

## Invited commentary

### How much undernutrition is there in hospitals?

Many studies over the last 30 years have emphasised the importance of disease-related undernutrition in hospitalised patients (Bistran *et al.* 1974; Hill *et al.* 1977; McWhirter & Pennington, 1994; Corish *et al.* 2000; Kelly *et al.* 2000). This is largely because undernutrition adversely affects clinical outcome, and well-being, and is responsible for a disproportionately large consumption of health service resources (Consumer's Association, 1999). Although the deleterious consequences of undernutrition, which include increased morbidity, delayed recovery from illness and increased length of hospital stay are generally accepted (Lennard-Jones, 1992; Elia, 1993; Green, 1999), there is still controversy about the exact incidence of undernutrition in the hospital setting. One of the major reasons for this controversy is that there is no universal agreement about the definition of undernutrition. Since various workers have used different criteria to screen for the presence of undernutrition, it is not surprising that the reported magnitude of the problem has also been highly variable both in hospitals (10–60%) (McWhirter & Pennington, 1994; Naber *et al.* 1997; Strain *et al.* 1999; Vlaming *et al.* 1999; Watson, 1999; Weekes, 1999; Corish *et al.* 2000; Kelly *et al.* 2000) and in nursing homes (10–80%) (Kerstetter *et al.* 1992). However, it is also feasible that there are major variations in the incidence of undernutrition in different hospitals in Republic of Ireland and the UK.

Corish *et al.* (2000) have recently screened for the presence of undernutrition in patients admitted to two teaching hospitals in Dublin, Republic of Ireland. They used the same criteria as those employed by another group of investigators, who published their results from Dundee, Scotland, UK 6 years earlier (McWhirter & Pennington, 1994). This was to ensure more reliable comparisons of the incidence of malnutrition between the two geographic locations. In both studies, patients were classified as 'undernourished' if they had a BMI < 20 kg/m<sup>2</sup> and a triceps skinfold thickness or mid-arm muscle circumference < 15th percentile (Bishop *et al.* 1981). The incidence of undernutrition in newly admitted patients in Dublin was reported to be more than three-fold lower (11%) (Corish *et al.* 2000) than in Dundee (40%) (McWhirter & Pennington, 1994). What could be responsible for this striking difference? Although a simple answer cannot be provided, several possibilities are worth exploring.

One possibility is that the population in Dublin is leaner than in Dundee. However, it is unlikely that this was the main reason for the differences between studies, because the data available from national surveys of Republic of Ireland (Lee & Cunningham, 1990), Scotland (The Scottish Office, 1995) and England (Office of Population Census and Survey, 1994), suggest that the proportion of these populations with

a BMI < 20 kg/m<sup>2</sup> is similar. Furthermore, a recent study in Glasgow (Kelly *et al.* 2000), which is less than 100 miles (160 km) from Dundee, reported that 18% of patients admitted to hospital had a BMI < 20 kg/m<sup>2</sup> (compared to 37.4% in the Dundee study (McWhirter & Pennington, 1994)).

Another possibility relates to the characteristics of patients and the criteria for admission to hospital. Amongst the patient characteristics that could have differed between studies are age (the average age of the group of patients admitted to the Dundee hospital was not documented, but in Dublin 40% of patients were over 65 years) and the diagnostic case-mix (which was generally similar between the two studies). The criteria for admission to hospital might vary depending on the local resources, including the number of hospital beds relative to the population served, the extent to which hospitals act as primary, secondary and tertiary referral centres, and the degree to which private healthcare schemes and community services operate in different regions. Furthermore, there could also be more than one acute hospital in each region so that malnourished patients with more severe or more prolonged disease are directed into one hospital in preference to the other. If that was the case, then comparisons between single hospitals in different regions could be misleading. Specifically, Corish *et al.* (2000) recruited every third patient admitted to a large hospital and every tenth patient admitted to a smaller hospital in Dublin to ensure proportional representation, whereas in the study in Dundee, only patients admitted to the main hospital of the region were recruited.

Yet another possibility concerns methodological differences between the two studies. For example, which arm was used for anthropometric measurements (not reported in either study)? Was the presence or absence of oedema taken into account, which could confound measurements of weight, anthropometry and calculations of BMI (Corish *et al.* 2000) (excluded patients with gross fluid retention but it is unclear whether such patients were excluded in the Dundee study)? Were surrogate measures used, and if so, was their use validated in the patient group? In the study by Corish *et al.* (2000) 17% of patients did not have their height measured (*n* 95 patients) and 9% (*n* 50) were not weighed and so surrogate measures were used. However, in the study in Dundee the number of patients who did not have their weight or height measured, and the proportion in whom surrogate measures were used instead, was not recorded. Furthermore, it is unclear if the measurement of knee height, which was used to estimate height in both centres, was undertaken using the equipment and procedure employed by Chumlea *et al.* (1985). Neither study appeared to have validated their measurement of knee height against the

height of a patient group and the equations of Chumlea *et al.* (1985) have only been validated in elderly Americans (aged between 60–90 years). There are two other methodological issues that are a little perplexing. The first is that the number of patients with a BMI < 20 kg/m<sup>2</sup> was found to be less than the number of patients classified as undernourished in the study of McWhirter & Pennington (1994) but greater in the study of Corish *et al.* (2000). This suggests that there may have been some differences in the criteria used to classify patients as undernourished. The second issue is that both studies stated that they used the 15th percentile for arm anthropometry (triceps skinfold thickness and mid-upper arm muscle circumference) as a cut-off for defining 'undernutrition', based on the reference values from Bishop *et al.* (1981). However, Bishop *et al.* (1981) reported the 5th, 10th and 25th percentiles but not the 15th. Consequently, it is uncertain if the studies in Dublin and Dundee used the same methods to estimate this 15th percentile.

The papers of Corish *et al.* (2000) and McWhirter & Pennington (1994) provide an opportunity to make three comments about the criteria for defining undernutrition. First, in our view, anthropometric cut-off values should not be used as a 'diagnostic label' of undernutrition but rather to classify an individual's risk of undernutrition (e.g. high, moderate, low risk). This is in accordance with the view held by the World Health Organization (1995). For example, some healthy subjects have a BMI < 20 (especially young adults) and function perfectly well. Second, anthropometric criteria alone suggest a chronic protein–energy deficiency status. However, a patient showing substantial recent weight loss (e.g. > 10% weight loss in 3–6 months) is at risk of developing protein–energy malnutrition and showing impaired bodily functions, even though the anthropometric cut-off values may not have been reached. Third, the reference standards for anthropometry require regular review. Unlike BMI, which remains a fixed criterion, percentile values can show substantial change over time. For example, the reference values provided by Bishop *et al.* (1981) for arm anthropometry were established in the USA about 30 years ago. The well-known secular trends in obesity since that period mean that these reference values may no longer apply. The choice of the 15th percentile cut-off for use as

part of the screening tool to classify patients as undernourished, as in the Dublin and Dundee studies, appears to be arbitrary, and perhaps inappropriately high (since 15% of the reference population falls below this cut-off). However, it is important to use the same criteria to make comparisons of the incidence of undernutrition at two or more different locations.

One of the most widely-recorded measurements in studies of undernutrition is BMI. Table 1 summarises the proportion of patients with a BMI < 20 kg/m<sup>2</sup> (designated 'underweight' by the Office of Population Census and Survey (1994)), admitted to various hospitals in the UK and Republic of Ireland. The table not only highlights the spectrum of results that exist, but also shows that the results from the Dublin and Dundee studies are at the two extremes. The table also implies that the results are not necessarily representative of hospitals in general, since all of the studies were undertaken in teaching hospitals which, in the UK and Republic of Ireland, are out-numbered by non-teaching hospitals. Furthermore, these studies investigated admissions to specific wards only and none of them involved admissions to gynaecology, rheumatology, mental health and other speciality wards. None of the trials indicated in the table investigated the incidence of undernutrition in paediatric patients, although a study in Glasgow suggested that about 15% of children admitted to hospital were considered undernourished by anthropometric criteria (Hendrikse *et al.* 1997).

We are forced to conclude that we still have an incomplete picture of the incidence and geographic distribution of undernutrition in hospitals in the UK and Republic of Ireland. Routine measurement and recording of weight and height on admission to hospital would help make the picture more complete. However, it is clear that disease-related undernutrition remains a significant clinical problem in hospitals. Other work also suggests that undernutrition is an important problem in hospital out-patients, nursing homes and in the community, where it is frequently unrecognised and under-treated. The studies of Corish *et al.* (2000) and McWhirter & Pennington (1994) have made important observations in highlighting that not only does undernutrition continue to be an important problem in hospitalised patients, but also that

**Table 1.** Comparison of recent studies documenting the incidence of patients with a BMI < 20 kg/m<sup>2</sup> admitted to UK and Irish hospitals

Study	Location and type of hospital	No. of patients	Type of patients	Patients with BMI < 20 kg/m <sup>2</sup> (%)
Corish <i>et al.</i> 2000	Dublin (teaching hospitals)	569	General medical, surgical, respiratory, care of the elderly and orthopaedic	13.5
McWhirter <i>et al.</i> 1994	Dundee (teaching hospital)	500	General medical, surgical, respiratory, care of the elderly and orthopaedic	37.4
Kelly <i>et al.</i> 2000	Glasgow (teaching hospital)	219	Acute medical and surgical	18
Strain <i>et al.</i> 1999	Manchester (teaching hospital)	326	General medical, surgical and orthopaedic	≥ 24*
Vlaming <i>et al.</i> 1999	London (teaching hospital)	423	General medical, surgical and orthopaedic (< 65 years only)	15 (men) 18 (women)
Watson <i>et al.</i> 1999	London (teaching hospital)	65	Care of the elderly	29.3
Weeks <i>et al.</i> 1999	London (teaching hospital)	186	General medical	22
M Elia†	Cambridge (teaching hospital)	57	General medical and surgical	21
J Tharakan <i>et al.</i> ‡	Cambridge (teaching hospital)	100	Care of the elderly	21

\* Additional anthropometric criteria were used in this calculation.

† M Elia, unpublished results.

‡ J Tharakan, RJ Stratton and M Elia, unpublished results.

patients become more malnourished than they were at admission by the time of discharge from hospital. Ultimately, the identification of patients who are undernourished or at risk of undernutrition is worthless if effective interventions to improve nutritional status are not instigated, e.g. with appropriate dietary manipulation, oral nutritional supplements, enteral tube feeding and parenteral nutrition (Elia, 1990, 1993; Consumer's Association, 1999; Green, 1999; Stratton & Elia, 1999).

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