NUTRITION SCREENING SURVEYS IN HOSPITALS IN THE UK, 2007-2011

A report based on the amalgamated data from the four Nutrition Screening Week surveys undertaken by BAPEN in 2007, 2008, 2010 and 2011

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BAPEN

Putting patients at the centre of good nutritional care

The British Association for Parenteral and Enteral Nutrition (BAPEN)

BAPEN is a multi-professional association and registered charity established in 1992. Its membership is drawn from doctors, dietitians, nurses, patients, pharmacists and from the health policy, industry, public health and research sectors.

- BAPEN works to achieve its mission by raising awareness of the prevalence and impact of malnutrition, raising standards in nutritional care and developing appropriate pathways to prevent malnutrition.

- BAPEN researches and publishes the evidence on malnutrition, and provides tools, guidance, educational resources and events for all health and care professionals to support the implementation of nutritional care across all settings and according to individual need.

- BAPEN works in partnership with its membership, its core specialist groups and external stakeholders to embed excellent nutritional care into the policy, processes and practices of all health and care settings.

- The Nutrition Screening Week Surveys have been conducted as part of the activities of the Malnutrition Action Group, a standing committee of BAPEN

For membership details, contact the BAPEN office or log on to the BAPEN website www.bapen.org.uk

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Key Points

- In this report, amalgamated data from hospitals in the UK that participated in the four Nutrition Screening Week Surveys (NSWs) undertaken between 2007 and 2011 revealed that overall, 'malnutrition' (medium + high risk according to 'MUST') affected 29% of adults on admission to hospital. Most of those affected were at high risk.

- The prevalence of 'malnutrition' varied significantly between seasons being highest in the winter (34%) and lowest in the spring (25%). The prevalence also varied between the nations of the UK being highest in England (30%) and lowest in Scotland (24%).

- During the five year period there was evidence of improvements in awareness of 'malnutrition', in nutritional screening practice and in the organisation of nutrition support services. There were significant increases in the proportion of hospitals with a nutrition screening policy, those undertaking audit of nutritional screening and recording patients' weights and heights on admission.

- There was an increased awareness of weighing scale standards over the period between the last two surveys when this question was asked.

- There was little improvement in the proportion of hospitals with access to a Nutrition Support Team, which was available in about 2/3 of centres in 2011.

- The 'Malnutrition Universal Screening Tool' ('MUST') was the most commonly used screening tool being used by 82% of centres by 2011.

- There were marked differences between certain characteristics of adults admitted to hospital and the general population of the UK. The mean age of adults admitted to hospital during the five year period was around 15 years higher, while the mean BMI slightly lower than the general population. More people admitted to hospital were underweight (<20 kg/m^2) or severely obese (≥40 kg/m^2) than in the general population.

- Nutritional screening was linked to care plans in almost all hospitals in all 4 surveys, with no significant improvement over time. In contrast, there were significant improvements in the inclusion of nutritional information in the discharge communication over the survey period.

- Much of the 'malnutrition' present on admission to hospital originates in the community. Consistent and integrated strategies to detect, prevent and treat malnutrition should exist within and between care settings.

Executive Summary

1. Between 2007 and 2011 four Nutrition Screening Week Surveys (NSW) of UK hospitals, care homes and mental health units were undertaken, each in a different season of the year. The surveys aimed to establish the prevalence of 'malnutrition' in the different care settings, to document current screening practice and problems that needed addressing and to provide feedback to local centres so their results could be benchmarked against those of the UK as a whole. The current report, which is based on the amalgamated data from UK hospitals that participated in the 4 surveys, provides new information on the trends in nutritional care over time, on the potential effect of seasonality on the prevalence of 'malnutrition' and on the way in which the anthropometry and age distribution of patients admitted to hospitals differ from those of the general population.

2. The four NSW surveys involved a total of 661 hospital centres (130-185 per survey) and 34,699 patients (6,068-9,567 per survey). The majority of data were provided from England and to a progressively smaller extent from Scotland, Wales and Northern Ireland. To overcome difficulties associated with non-responses to certain questions the data were subjected to three types of sensitivity analysis: one in which all the non-respondents were placed in one of two alternative categories, such as 'yes' and 'no'; another in which they were all placed in the other category; and the third in which all were placed in the two categories in the same proportion as the respondents.

3. The results suggest that over the five year period in which the NSW surveys were carried out there were improvements in awareness about 'malnutrition', nutritional screening and in the operational infrastructure of nutrition support services. The following are examples of statistically significant improvements: presence of a nutrition screening policy, which increased from 79-82% (the range indicates the variability associated with the three types of sensitivity analyses used) to 99% of hospitals; undertaking audit on nutritional screening, which increased from 75-85% to 98-99% of hospitals and the percentage of patients known to have been screened on admission, which increased from 67-78% to 86-95%. There was also a significant improvement in reported recording of weight on admission, which increased from 49-50% to 57-67%, and that of height, which increased from 28-34% to 61-65%, and awareness of weighing scale standards during the 15 month period between the last two NSW surveys when the question was asked. The reasons for the improvements are probably multiple, involving a combination of governmental and non-governmental initiatives.

4. Not all items were found to improve during the course of the surveys. For example access to a nutritional support team changed little and non-significantly, from 51-59% to 60-62%. There is therefore room for improvement in such items, as well as further improvement in some of the items for which progress has already been reported.

5. The 'Malnutrition Universal Screening Tool' ('MUST') was found to be the most commonly used screening tool, being used in 82% of hospitals surveyed in 2011. It allows the use of consistent criteria to detect malnutrition risk, for the purposes of identification of the need for and monitoring of nutritional care within and between care settings, as well as for audit.

6. The overall changes in practice in the UK do not necessarily reflect those in individual countries, which are presented separately in country-specific reports.

7. The mean age of those admitted to hospital was 64.5 ± 19.3 years, some 15 years higher than that of the general adult population of the UK. The mean BMI of those admitted to hospital was 26.4 kg/m^2, which was found to be about one BMI unit less than that of the general population. The BMI distribution was wider than that of the general population, and was associated with a greater proportion of both underweight people (<20 kg/m^2 and <18.5 kg/m^2) and severe obesity (≥40 kg/m^2). Patients at both ends of the BMI distribution need to be identified and directed towards appropriate management pathways.

8. The distribution of BMI according to the age of those admitted to hospital by and large paralleled that of the general population in that both increased curvilinearly with age, reached a maximum between 40-60 years and decreased thereafter. However, the peak occurred at a younger age and and then declined after the fifth decade was more rapid in those admitted to hospital than the general population, so that the discrepancy between the two curves became progressively greater in older subjects. The underweight (BMI <20 kg/m^2)-age distribution curve generally followed the reverse pattern: the proportion of underweight was lowest at 40-60 years and higher in both younger and older aged groups. At all age bands the proportion of underweight patients admitted to hospital was greater than that of the general population (in which the proportion was about 5% or less at all decades above the third decade) and several times higher in each decade from 60-70 years and over.

9. The prevalence of 'malnutrition' (medium + high risk according to 'MUST' criteria) on admission to hospitals was found to vary significantly between seasons being 28% in autumn and summer, 34% in winter, and 25% in spring. The variation was greater in older (≥65 years) than younger adults (<65 years). The reasons for this variation is unclear but they may relate to the effects of weather, such as those associated with the particularly cold and icy winter of the NSW 2010 survey, which may have predisposed to certain diseases, such as respiratory infections. It may also have altered behaviour, such as less inclination to shop for food, especially in icy conditions, and spending relatively more money on fuel, in order to keep warm, than on food (the fuel-food controversy). It may also be related to non-random selection of hospital centres.

10. The overall mean prevalence of 'malnutrition' in patients admitted to UK hospitals was 29% but it varied with country, being highest in England (30%) and lowest in Scotland (24%) (30% and 25% respectively when equal weighting was applied to each NSW survey when all four surveys were amalgamated). The distribution of 'malnutrition' generally mirrored that of BMI being lowest in those age 40-60 years and higher in those who were older and younger. The prevalence of 'malnutrition' was higher in women than men, especially in the older age groups and in those aged ≥65 years (33%) than<65 years (25%).

11. Overall, 11% of patients had a BMI of <20 kg/m^2, 10% had recently (within last 3-6 months) lost at least 5% body weight and 13% had a score for the effect of acute disease.

12. 'Malnutrition' was widely distributed between type of hospital (acute hospitals, 29%; community hospitals, 29%), number of hospital beds (<1000 bed, 29%; ≥1000 beds, 32%), type of admission (emergency, 33%; elective 21%), source of admission (home, 27%; other hospital 35%; other ward, 32%; and care home 50%); type of ward (oncology (38%), care of the elderly (37%), medical (33%), surgical (26%) and orthopaedic (17%)),and diagnostic category (ranging from 20% in musculoskeletal and cardiovascular diseases to 43% in gastrointestinal disease and 36% in respiratory disease). It was higher in patients with cancer (39%) than in those without (28%). This wide distribution of a common condition emphasises that 'malnutrition' should be of concern to every type of hospital, type of ward, and medical discipline.

13. Country specific reports (England, Wales, Scotland, and Northern Ireland) are available for comparison with the UK data.

Introduction

The four Nutrition Screening Week (NSW) surveys [1-4], undertaken in the UK between 2007 and 2011, have provided data for benchmarking local results against those of the UK as a whole. Analysis and communication of local results to the participating centres have contributed to the audit process. The surveys have also helped establish the burden of 'malnutrition' in hospitals, care homes and mental health units, which has been linked to care planning and an assessment of the cost of 'malnutrition' [5]. They have also increased awareness about 'malnutrition', which continues to be under-detected and under-treated. However, following amalgamation of the data from all four NSW surveys it is now possible to address trends over time and the effect of seasonality on the prevalence of 'malnutrition' not only from a UK prospective but also for the individual nations of the UK, which have become devolved since 1999, developing their own systems of healthcare in the process [6; 7].

This report, which is based on amalgamated data from the four NSW surveys, aimed to address several issues. Firstly, it aimed to examine trends over time, particularly in relation to the prevalence of 'malnutrition' and the organisational infrastructure for providing nutritional care in various care setting. The results of each NSW survey have been reported separately, which makes it difficult to assess trends, especially since the proportion of answers to specific questions varied between surveys. In order to undertake trend analysis using the data from the four surveys, it is necessary to merge them and undertake a sensitivity or uncertainty analysis, taking into account the confounding effects of the variables for which no values are assigned to them (non-responses). Over time, the cumulative sample size has increased substantially with each additional survey, which means that many issues can be addressed with more confidence than before, not only for the UK as a whole but also within the four devolved nations (England, Wales, Scotland and Northern Ireland).

Secondly, the surveys aimed to examine the effect of seasonality on prevalence of 'malnutrition'. Since this was a specific pre-planned aim, each individual survey was undertaken in a different season. To examine the potential role of seasonality, it is again necessary to merge the data from the four surveys and take into account confounding variables such as age, sex, type of hospital ward etc..

Thirdly, the surveys aimed to address specific issues, such as the status of nutritional support services and the prevalence of 'malnutrition' in different countries within the UK. The four published NSW reports have provided no results for the individual nations apart from the overall prevalence of 'malnutrition'. Since the participating nations have become devolved and have developed their own health and social care systems, there is a need to provide more specific information that could be more relevant to them. In doing so, any demonstrable differences between countries or demonstrable trends over time within the same countries could be relevant to the examination of the effects of existing policies as well as the development of future policies in nutritional care. To contextualise some of the features of the NSW surveys, a comparison of the anthropometry and age distribution was made against representative data from Health Surveys of general populations and population census data of the same countries. In some cases 'raw' data from three or four Health Surveys of each country were merged to provide a more representative picture of the population of that country during the period in which the NSW surveys were carried out. Furthermore, Health Surveys from more than one country were merged (e.g. England, Scotland and Wales (Great Britain)) to provide a more representative population dataset within the UK during the period in which the NSW surveys were carried out. Unfortunately, corresponding Health Survey data for Northern Ireland could not be identified.

Finally, it is necessary to briefly clarify the organisation of the NSW publication series. Separate reports are planned for the UK, England, Scotland, Wales and Northern Ireland focussing on data for hospitals, care homes and mental health units. The present one, which is part of the new series, deals with UK hospitals, although in examining some of its components it draws on some information which illustrates similarities and differences between the individual countries. All the reports of the present series and previous NSW reports can be obtained from BAPEN (www.bapen.org.uk).

General Features of the Survey

The table below shows the general features of the Nutrition Screening Week Surveys (NSW) which were undertaken in different seasons of the year. They involved a total of 661 hospitals and 34,699 patients, who were screened within 3 days of admission to hospital. Participating centres were not randomly selected but recruited via organisational networks, adverts in newsletters and websites.

Table 1. General features of the four Nutrition Screening Week Surveys†

Survey number	Year of survey	Date of survey	Season†	Number of hospitals	Number of subjects††
1	2007	27-29 September	Autumn	175	9,567
2	2008	1-3 July	Summer	130	6,068
3	2010	12-14 January	Winter	185	9,932
4	2011	5-7 April	Spring	171	9,132
Total				661	34,699

† The surveys were undertaken at 0.75 (autumn), 0.50 (summer), 0.04 (winter) and 0.26 (spring) of the way through the year
†† Not all questions completed on all subjects)

The first part of each survey involved gathering information about the hospital (Form 1a) and the second part about the patients (Form 2a). The forms used in individual surveys can be found in the previous reports [1-4] but the ones used in the last survey are included in Appendix 1. The forms differed slightly from year to year, mainly by the inclusion of a few more questions in the more recent surveys. For example, only the last two surveys included questions on the types of screening tool used by hospitals, educational and training methods used for nutritional screening and awareness of standards for weighing scales.

Risk of malnutrition was assessed using 'Malnutrition Universal Screening Tool' ('MUST') criteria [8], and 'medium + high risk' is referred to as 'malnutrition'.

Results from the four surveys were amalgamated into one database in order to establish the mean results over the four surveys, trends over time, and seasonal variation. Statistical analyses were carried out using the Statistical Package for the Social Sciences (SPSS Chicago, USA (versions 19). A P value (P value <0.05 was considered to be significant) is used to indicate statistical differences between groups or years, and P (trend) to indicate linear trends over time (see Appendix 2 (Glossary of statistical terms)).

A proportion of centres responded to certain questions with 'don't know' (DK) or 'no answer' (NA), which were amalgamated as 'don't know/no answer' ('DK/NA'). However, the proportion of 'DK/NA' responses varied from year to year creating difficulties in assessing trends over time or differences between seasons. Therefore the following three types of sensitivity analysis were carried out in which different proportions of the DK/NA group was assigned to the two alternative categories involved in the trend:

a) all the hospitals in the 'DK/NA' category were assigned to one of the two alternative categories (e.g. those responding 'yes')

b) all the DK/NA were assigned to the other alternative category (e.g. those responding 'no')

c) all the DK/NA responses were assigned to the two alternative categories in the same proportions as those reported for that question.

The first two sensitivity analyses involve extreme assumptions. However, if the results of these two analyses as well as that of the third are consistent in showing significant trends or differences in the same direction, it would indicate substantial confidence in the conclusions. If the results from these analyses were inconsistent showing different trends, it would suggest less confidence in establishing a definitive conclusion.

To compare the anthropometry and age distribution of patients participating in the NSW surveys with those of the general population, raw data from 11 national surveys were obtained from the national archive centre at Essex University: four from England (Health Surveys for England 2007, 2008, 2009 and 2010; see reference [9] for reports); four from Wales (Welsh Health Surveys 2007, 2008, 2009 and 2010; see reference [10] for report; and three from Scotland (Health Surveys for Scotland 2008, 2009 and 2010; see reference [11] for reports). These overlapped temporally with the NSW surveys. Health Surveys for Northern Ireland could not be identified and nor could a Health Survey for Scotland for 2007. A secondary analysis of these surveys was undertaken using only adult data (≥ 18 years). In the case of the Welsh Health Surveys, which reported the age of the subjects in 5 year age bands, only those aged ≥20 years were used. When the results for two or more countries were involved in comparisons between the general population (Health Surveys) and patients admitted to hospitals (NSW surveys), the data from each country were weighted (for each type of survey separately) to establish proportional representation of the population (see Appendix 2 (Glossary of statistical terms) for weighting procedures) using the mid-2010 population estimates provided by the Office of National Statistics as reference [12].

Hospital and Subject Characteristics

Hospital Characteristics

In the section that follows, the raw results are shown in a table, which is followed by another table that summarises the results of sensitivity analyses, whenever appropriate.

Policies, audit, and access to dietetic service and nutrition support team

Presence of a nutrition steering committee

Table 2. Distribution of hospitals according to presence of nutrition steering committee

	2007	2008	2010	2011	Total	Total (adj)
		%	%	%	%	%
Yes	-	71	73	84	56	76
No	-	19	16	13	12	16
DK/NA	-	10	11	2	32	8
Total	-	100	100	99*	100	100
Number of Hospitals		*130*	*185*	*171*	*486*	*486*
P value†		*<0.001*				
		0.013 (adj)				

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
*Results do not add up to 100% due to rounding up of the component values to the nearest 1%
† Chi squared test

The question regarding presence of a nutrition steering committee was included in the last three surveys only.

Table 3. Sensitivity analyses of hospitals according to presence of nutrition steering committee

Type of sensitivity analysis*	% 'yes'				P value	
	2007	2008	2010	2011	P†	P(trend)†
Model a	-	81	84	87	0.399	0.176
Model b	-	71	73	84	0.010	0.005
Model c	-	78	82	86	0.229	0.088

* In model a) all DK/NA assigned to 'yes'
   In model b) all DK/NA assigned to 'no'
   In model c) all DK/NA assigned to 'yes' and 'no' in the same proportion as respondents
† Chi squared (P) and Chi squared for trend (P (trend))

The sensitivity analyses for years 2008, 2010 and 2011 involved two categories only ('yes' (presence of a nutrition steering committee) and 'no' (absence of a nutrition steering committee)). Whilst the data suggest that during consecutive surveys there was a trend towards a greater proportion of hospitals having a nutrition steering committee, this may have been due to a greater response rate in the 2011 than in the two earlier surveys. Whilst all three types of sensitivity analysis indicated a trend towards an increase in the proportion of hospitals with a nutrition steering committee, the changes were significant only with one type of sensitivity analysis (when all the DK/NA responses were assigned to the 'no' category). The overall results are suggestive of improvements over time, but they are by no means definitive.

Presence of a nutrition screening policy

Table 4. Distribution of hospitals according to presence of nutrition screening policy

	2007	2008	2010	2011	Total	Total (adj)
	%	%	%	%	%	%
Yes	76	82	87	99	86	86
No	18	11	11	1	10	10
DK/NA	6	7	3	1	4	4
Total	100	100	101*	101*	100	100
Number of Hospitals	*175*	*130*	*185*	*171*	*661*	*661*
P value†	*<0.001*					
	<0.001 (adj)					

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
† Chi squared test

Table 5. Sensitivity analyses of hospitals according to presence of nutrition screening policy

Type of sensitivity analysis*	% 'yes'				P value	
	2007	2008	2010	2011	P†	P(trend)†
Model a	82	89	89	99	<0.001	<0.001
Model b	76	82	86	99	<0.001	<0.001
Model c	81	88	89	99	<0.001	<0.001

* In model a) all DK/NA assigned to 'yes'
  In model b) all DK/NA assigned to 'no'
  In model c) all DK/NA assigned to 'yes' and 'no' in the same proportion as respondents
† Chi squared (P) and Chi squared for trend (P (trend))

Sensitivity analyses involved two categories only ('yes' (presence of a nutrition screening policy) and 'no' (absence of a nutrition screening policy)). The results indicate a progressive and significant increase in the proportion of hospitals reporting that they have a nutrition screening policy.

Audit of nutritional screening

Table 6. Distribution of hospitals according to audit of nutritional screening

	2007	2008	2010	2011	Total	Total (adj)
	%	%	%	%	%	%
Yes	75	71	83	98	83	82
No	14	15	10	1	9	10
DK/NA	11	14	7	1	8	8
Total	100	100	100	100	100	100
Number of Hospitals	*175*	*130*	*185*	*171*	*661*	*661*
P value†	*<0.001*					
	<0.001 (adj)					

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
† Chi squared test

Table 7. Sensitivity analyses: of hospitals according to audit of nutritional screening

Type of sensitivity analysis*	% 'yes'				P value	
	2007	2008	2010	2011	P†	P(trend)†
Model a	86	85	90	99	<0.001	<0.001
Model b	75	71	83	98	<0.001	<0.001
Model c	85	82	90	99	<0.001	<0.001

* In model a) all DK/NA assigned to 'yes'
  In model b) all DK/NA assigned to 'no'
  In model c) all DK/NA assigned to 'yes' and 'no' in the same proportion as respondents
† Chi squared (P) and Chi squared for trend (P (trend))

Sensitivity analyses involved two categories only ('yes' (audit on nutritional screening) and 'no' (no audit on nutritional screening)). The overall results indicate a significant increase in the proportion of hospitals reporting that they audit nutritional screening practice.

Frequency of nutrition screening audit

Table 8. Distribution of hospitals according to frequency of nutrition screening audit

	2007	2008	2010	2011	Total	Total (adj)
		%	%	%	%	%
Every year	-	57	63	88	70	69
Every 2 years	-	12	13	5	10	10
Every 3 or more years	-	9	7	0	5	6
DK/NA	-	22	17	7	15	15
Total	-	100	100	100	100	100
Number of Hospitals	-	*130*	*185*	*171*	*486*	*486*
P value†	*<0.001*					
	<0.001 (adj)					

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
† Chi squared test

The question on frequency of audit of nutritional screening was included in the last three surveys only.

Table 9. Sensitivity analyses of hospitals according to frequency of nutrition screening audit

Type of sensitivity analysis*	% auditing every year				P value	
	2007	2008	2010	2011	P†	P(trend)†
Model a	-	79	80	95	<0.001	<0.001
Model b	-	57	63	88	<0.001	<0.001
Model c	-	73	76	94	<0.001	<0.001

* In model a) all DK/NA assigned to 'yes' (auditing every year)
  In model b) all DK/NA assigned to 'no' (not auditing every year)
  In model c) all DK/NA assigned to 'yes' and 'no' in the same proportion as respondents
† Chi squared (P) and Chi squared for trend (P (trend))

Sensitivity analyses involved two categories only ('every year' (audit undertaken (at least) once a year) and 'not every year' (less frequently than once a year')). This indicated a highly significant and progressive increase in the proportion of hospitals undertaking audit of nutritional screening every year (i.e. a progressive decrease in the proportion undertaking audit less frequently than once a year).

Access to dietetic services

Table 10. Distribution of hospitals according to access to dietetic services

	2007	2008	2010	2011	Total	Total (adj)
	%	%	%	%	%	%
Yes	99	100	99	100	100	100
No	1	0	1	0	<1	<1
DK/NA	1	0	0	0	<1	<1
Total	101*	100	100	100	100	100
Number of Hospitals	*175*	*130*	*185*	*171*	*661*	*661*
P value†	*0.614*					
	0.542 (adj)					

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
*Results do not add up to 100% due to rounding up of the component values to the nearest 1%
† Chi squared test

Access to nutrition support team

Table 11. Distribution of hospitals according to access to nutrition support team

	2007	2008	2010	2011	Total	Total (adj)
	%	%	%	%	%	%
Yes	51	52	56	60	55	55
No	41	42	40	38	40	40
DK/NA	8	6	4	2	5	5
Total	100	100	100	100	100	100
Number of Hospitals	*175*	*130*	*185*	*171*	*661*	*661*
P value†	*0.236*					
	0.269 (adj)					

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
† Chi squared test

Table 12. Sensitivity analyses of hospitals according to access to nutrition support team

Type of sensitivity analysis*	% yes				P value	
	2007	2008	2010	2011	P†	P(trend)†
Model a	59	59	60	62	0.933	0.597
Model b	51	52	56	60	0.410	0.097
Model c	56	55	58	61	0.731	0.314

* In model a) = all DK/NA assigned to 'yes'
  In model b) = all DK/NA assigned to 'no'
  In model c) = all DK/NA assigned to 'yes' and 'no' in the same proportion as respondents
† Chi squared and Chi squared for trend (P (trend))

Sensitivity analyses involved two categories only ('yes' (access to nutrition support team) and 'no' (no access to nutrition support team)). This indicated small non-significant changes in the proportion of hospitals with access to a nutrition support team.

Nutritional screening and communication of nutrition information

Proportion of reporters who knew the percentage of patients screened on admission to hospital

Table 13. Proportion of reporters who knew the percentage of patients screened

	2007	2008	2010	2011	Total	Total (adj)
	%	%	%	%	%	%
Yes	67	70	72	86	74	74
No	22	15	19	5	15	15
DK/NA	11	15	9	9	11	11
Total	100	100	100	100	100	100
Number of Hospitals	*175*	*130*	*185*	*171*	*661*	*661*
P value†	*<0.001*					
	<0.001 (adj)					

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
† Chi squared test

Table 14. Sensitivity analyses of hospitals according to reporters who knew the proportion of patients screened on admission to hospital

Type of sensitivity analysis*	% with known proportion				P value	
	2007	2008	2010	2011	P†	P(trend)†
Model a	78	86	80	95	<0.001	<0.001
Model b	67	70	72	86	<0.001	<0.001
Model c	75	83	79	94	<0.001	<0.001

* In model a) all DK/NA assigned to 'yes' (known proportion screened)
  In model b) all DK/NA assigned to 'no'; (unknown proportion screened)
  In model c) = all DK/NA assigned to 'yes' and 'no' in the same proportion as respondents
† Chi squared (P) and Chi squared for trend (P (trend))

Sensitivity analyses involved two categories only ('yes' (reporters knew the proportion screened on admission to hospital) and 'no' (reporters did not know the proportion of patients screened on admission to hospital)). This indicated a significant trend towards an increase in the proportion of hospital respondents who knew the proportion of patients screened on admission to hospital.

Proportion of patients screened

Table 15. Proportion of patients screened

	2007	2008	2010	2011	Total	Total (adj)
	%	%	%	%	%	%
0-25%	6	5	6	1	4	4
26-50%	7	5	6	6	6	6
51-75%	16	22	17	15	17	17
76-100%	42	38	46	68	50	49
DK/NA	29	31	24	11	23	23
Total	100	101*	99*	101*	100	99*
Number of Hospitals	*175*	*130*	*185*	*171*	*661*	*661*
P value†	*<0.001*					
	<0.001 (adj)					

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
*Results do not add up to 100% due to rounding up of the component values to the nearest 1%
† Chi squared test

Table 16. Sensitivity analyses of hospitals according to proportion of patients screened

Type of sensitivity analysis*	% screening 76-100%				P value	
	2007	2008	2010	2011	P†	P(trend)†
Model a	71	69	70	79	0.184	0.138
Model b	42	38	47	68	<0.001	<0.001
Model c	59	55	61	77	<0.001	0.001

* In model a) all DK/NA assigned to 'yes' (screening 76-100%)
  In model b) all DK/NA assigned to 'no' (not screening 76-100%)
  In model c) all DK/NA assigned to 'yes' and 'no' in the same proportion as respondents
† Chi squared (P) and Chi squared for trend (P (trend))

Sensitivity analyses involved two categories only (hospitals screening 76-100% of patients and those screening 75% or less of patients). To do these analyses hospitals that screened 1-25%, 26-50% and 51-75% were first amalgamated into one group for comparison with the group that screened 76-100%. The sensitivity analyses suggested a general trend towards an increase in the proportion of hospitals that reported screening of 76-100% of patients on admission, but with the uncertainty associated with 'DK/NA', the proportion of which fluctuated from year to year (11-31% of the total) significant trends were observed in only two of the three sensitivity analyses.

Considering only the responses from the hospitals that said they knew the proportion of patients screened on admission (N=486; 74% of total number of hospitals), there was a significant increase in the proportion screening 76-100% of patients over the period of the four surveys (60%, 55%, 61% and 78%, in consecutive surveys; P (linear trend) <0.001). In the original 2007 survey a lower figure was reported in error.

Recording of weight and height on admission
Recording of weight on admission

Table 17. Recording of weight on admission

	2007	2008	2010	2011	Total	Total (adj)
	%	%	%	%	%	%
Yes, on all wards	49	52	52	67	55	55
Yes, on some wards	44	40	44	28	39	39
No	6	2	3	2	4	3
DK/NA	2	6	1	2	2	3
Total	101*	100	100	99*	100	100
Number of Hospitals	*175*	*130*	*185*	*171*	*661*	*661*
P value†		*<0.001*				
		<0.001 (adj)				

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
*Results do not add up to 100% due to rounding up of the component values to the nearest 1%
† Chi squared test

The proportion of hospitals recording weight on all wards and some wards was over 90% in all surveys with the majority recording weight on all wards. The proportion recording weight on all wards appeared to rise in the 2011 survey

Table 18. Sensitivity analyses of hospitals according to recording of weight on admission

Type of sensitivity analysis*	% recording of weight on all wards				P value	
	2007	2008	2010	2011	P†	P(trend)†
Model a	50	58	52	57	0.001	0.002
Model b	49	52	52	67	0.002	0.001
Model c	49	55	52	69	0.001	0.001

* In model a) all DK/NA assigned to 'yes' (recording weight on all wards)
  In model b) all DK/NA assigned to 'no' (not recording weight on all wards)
  In model c) all DK/NA assigned to 'yes' and 'no' in the same proportion as respondents
† Chi squared (P) and Chi squared for trend (P (trend))

Sensitivity analyses involved two categories only (recording of weight on all wards and recording of weight on some wards + no wards). Those hospitals recording weight on some wards were first amalgamated with those that did not record weight on their wards to form one group that could be compared with the hospitals that recorded weight on all wards. The sensitivity analyses indicated that with consecutive surveys there was a significant trend towards an increase in the proportion of hospitals that recorded weight on all wards.

Recording of height on admission

Table 19. Recording of height on admission

	2007	2008	2010	2011	Total	Total (adj)
	%	%	%	%	%	%
Yes, on all wards	28	42	36	60	41	42
Yes, on some wards	38	32	40	26	34	34
No	29	16	22	11	20	19
DK/NA	6	10	2	3	5	5
Total	101*	100	100	100	100	100
Number of Hospitals	*175*	*130*	*185*	*171*	*661*	*661*
P value†	<0.001 <0.001 (adj)					

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
*Results do not add up to 100% due to rounding up of the component values to the nearest 1%
† Chi squared test

The proportion of hospitals recording height on all wards was less than those recording weight on all wards, but the proportion appeared to increase over the period of the four surveys.

Table 20. Sensitivity analyses of hospitals according to recording of height

Type of sensitivity analysis*	% recording of height on all wards				P value	
	2007	2008	2010	2011	P†	P(trend)†
Model a	34	52	38	63	<0.001	<0.001
Model b	28	42	36	60	<0.001	<0.001
Model c	30	46	37	61	<0.001	<0.001

* In model a) all DK/NA assigned to 'yes' (recording height on all wards)
  In model b) all DK/NA assigned to 'no' (not recording height on all wards)
  In model c) all DK/NA assigned to 'yes' and 'no' in the same proportion as respondents
† Chi squared (P) and Chi squared for trend (P (trend))

Sensitivity analyses involved two categories only (recording of height on all wards and recording of height on some wards + no wards). Those hospitals that reported recording height on some wards were first amalgamated with those that said they did not record height on their wards to form one group that could be compared with the hospitals that recorded height on all wards. The sensitivity analysis indicated that with consecutive surveys there was a significant trend towards an increase in the proportion of hospitals that recorded height on all wards.

Awareness of weighing scale standards

Table 21. Proportion aware of weighing scale standards

	2007	2008	2010	2011	Total	Total (adj)
			%	%	%	%
Yes	-	-	52	68	60	60
No	-	-	29	8	19	19
DK/NA	-	-	19	23	21	21
Total	-	-	100	99*	100	100
Number of Hospitals	-	-	*185*	*171*	*356*	*356*
P value†	<0.001					
	<0.001 (adj)					

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
*Results do not add up to 100% due to rounding up of the component values to the nearest 1%
† Chi squared test

A question on awareness of standards on weighing scales was introduced in the 2010 survey and was also used in the 2011 survey.

Table 22. Sensitivity analyses of hospitals according to proportion aware of weighing scale standards

Type of sensitivity analysis*	% aware of standards				P value	
	2007	2008	2010	2011	P†	P(trend)†
Model a	-	-	71	92	<0.001	-
Model b	-	-	52	68	<0.001	-
Model c	-	-	64	91	<0.001	-

* In model a) all DK/NA assigned to 'yes' (aware of standards)
  In model b) all DK/NA assigned to 'no' (not aware of standards)
  In model c) all DK/NA assigned to 'yes' and 'no' in the same proportion as respondents
† Chi squared (P) and Chi squared for trend (P (trend))

The sensitivity analyses involved only two groups ('aware of the weighing scale standards' and 'not aware of weighing scale standards). The results suggest participants in the 2011 survey were more aware of weighing standards than those in the 2010 survey.

Linking screening results to a care plan

Table 23. Linking screening results to a care plan

	2007	2008	2010	2011	Total	Total (adj)
		%	%	%	%	%
Yes	-	92	92	97	94	94
No	-	8	4	1	4	4
DK/NA	-	0	3	2	2	2
Total	-	100	99*	100	100	100
Number of Hospitals	-	*130*	*185*	*171*	*486*	*486*
P value†	*0.017*					
	0.017 (adj)					

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
*Results do not add up to 100% due to rounding up of the component values to the nearest 1%
† Chi squared test

A question on linking screening results to a care plan was included in the last three surveys only.

Table 24. Sensitivity analyses of hospitals according to linking screening results to a care plan

Type of sensitivity analysis*	% linking screening results to a care plan				P value	
	2007	2008	2010	2011	P†	P(trend)†
Model a	-	92	96	99	0.007	0.002
Model b	-	92	92	97	0.065	0.040
Model c	-	92	96	99	0.007	0.002

* In model a) all DK/NA assigned to 'yes' (linking results to a care plan)
  In model b) all DK/NA assigned to 'no' (not linking results to a care plan)
  In model c) all DK/NA assigned to 'yes' and 'no' in the same proportion as respondents
† Chi squared (P) and Chi squared for trend (P (trend))

The sensitivity analyses involved two categories only ('linking results to a care plan' and 'not linking results to a care plan).The results suggested trends towards improved practice, with almost all hospitals linking the screening results to a care plan in 2011.

Communication on discharge

Table 25. Nutrition information included in discharge communication

	2007	2008	2010	2011	Total	Total (adj)
		%	%	%	%	%
Always	-	13	15	18	15	15
Usually	-	38	32	52	41	41
Sometimes	-	39	43	26	36	36
Never	-	2	3	1	2	2
DK/NA	-	8	7	3	6	6
Total	-	100	100	100	100	100
Number of Hospitals	-	*130*	*185*	*171*	*486*	*486*
P value†		*0.006*				
		0.016 (adj)				

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
† Chi squared test

A question on inclusion of nutrition information in discharge communication was used in the last three surveys only.

Table 26. Sensitivity analyses of hospitals according to nutrition information included in discharge communication

Type of sensitivity analysis*	% 'always +usually' communicating nutrition information at discharge				P value	
	2007	2008	2010	2011	P†	P(trend)†
Model a	-	58	55	73	0.001	0.005
Model b	-	51	48	70	<0.001	<0.001
Model c	-	55	51	72	<0.001	0.002

* In model a) all DK/NA assigned to 'yes' (always + usually communicating nutrition information at discharge)
  In model b) all DK/NA assigned to 'no' (sometimes + never communicating nutrition information at discharge)
  In model c) all DK/NA assigned to 'yes' and 'no' in the same proportion as respondents
† Chi squared (P) and Chi squared for trend (P (trend))

Using information from three surveys sensitivity analyses were carried out with two groups only ('always+ usually including nutrition information in discharge communication' and 'sometimes + never including nutrition information in discharge communication'). The results suggested significant improvements due to the large change in the latest survey.

Type of screening tool used

Table 27. Type of screening tool used

	2007	2008	2010	2011	Total	Total (adj)
			%	%	%	%
'MUST'	-	-	69	80	74	74
'MUST'+ local tool	-	-	2	1	1	1
'MUST' + other tool	-	-	2	<1	1	1
NRS	-	-	3	2	3	3
'MUST'+NRS	-	-	0	<1	<1	<1
NRS + other tool	-	-	<1	0	<1	<0
NRS + local tool	-	-	0	2	1	1
Other tool	-	-	5	2	4	4
Local tool	-	-	17	7	12	12
Local +other	-	-	0	<1	<1	<1
Local+ other+ NRS	-	-	0	<1	<1	<1
No tool	-	-	<1	0	<1	<1
No answer	-	-	2	3	2	2
Total	-	-	100	100	98*	98*
Number of Hospitals	-	-	*185*	*171*	*356*	*356*

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
'MUST' = The 'Malnutrition Universal Screening Tool'; NRS = Nutrition Risk Score2002
*Results do not add up to 100% due to rounding up of the component values to the nearest 1%.

The type of screening tools used in hospitals was assessed only in the 2010 and 2011 surveys. In both surveys the 'Malnutrition Universal Screening Tool' ('MUST') was the most commonly used tool. In 2010 'MUST' was reported to be used in 73% of all hospitals (69% as the only tool) and 82% in the 2011 (80% as the only tool). The second most commonly used tools were local screening tools.

Training of staff in nutritional screening

Table 28. Method of training staff in nutritional screening

	2007	2008	2010	2011	Total	Total (adj)
			%	%	%	%
Workbook	-	-	0	0	0	0
Lecture/workshop	-	-	54	53	53	53
Lecture/workshop + workbook	-	-	5	1	3	3
E-learning	-	-	2	0	1	1
E-learning + lecture/workshop	-	-	6	8	7	7
E-learning + workbook	-	-	0	1	<1	<1
E-learning + lecture/workshop + workbook	-	-	0	1	<1	1
Other	-	-	9	16	12	12
Other + lecture/workshop	-	-	16	19	17	17
Other + e-learning + lecture/workshop	-	-	<1	1	1	1
Other + workbook + lecture/workshop	-	-	2	1	1	1
No training	-	-	6	1	4	4
No answer	-	-	3	1	1	1
Total	-	-	103*	103*	100	101*
Number of Hospitals	-	-	*185*	*171*	*356*	*356*

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
*Results do not add up to 100% due to rounding up of the component values to the nearest 1%

A question on methods used to train staff on nutritional screening was introduced in the 2010 survey and was also used in the 2011 survey.

More than 90% of hospitals reported training their staff in nutritional screening, which most commonly involved a combination of lectures and workshops. E-learning was used in only a minority (~10%) of hospitals.

Subject Characteristics
Gender

Table 29. Patients according to gender

| | Number | | | | | | % | | | | | |
	2007	2008	2010	2011	Total	Total(adj)	2007	2008	2010	2011	Total	Total(adj)
Male	4546	2929	4500	4234	16209	16262	48	48	45	46	47	47
Female	5017	3129	5412	4868	18426	18374	52	52	54	53	53	53
NA	4	10	20	30	64	63	<1	<1	<1	<1	<1	<1
	9567	*6068*	*9932*	*9132*	*34699*	*34699*	100*	100*	99*	99*	100*	100*

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
NA = No answer
* Results rounded to nearest whole number.

Age

Table 30. Patients according to age (years) and gender

| | Number | | | | | |
	2007	2008	2010	2011	Total	Total(adj)
Male						
Mean ± sd	62.6 ± 18.4	63.1 ± 18.7	65.1 ± 18.1	64.7 ± 18.1	63.9 ±18.3	63.9 ±18.3
Median (IQ)	65.5 (51-77)	66.0 (50-78)	68.0 (54-79)	67.0 (54-79)	67.0 (52-78)	67.0 (52-78)
N	*4546*	*2929*	*4500*	*4234*	*16209*	*16209*
Female						
Mean ± sd	64.5 ± 20.1	64.6 ± 20.1	66.3 ± 19.9	64.6 ± 20.6	65.1 ± 20.1	65.1 ± 20.2
Median (IQ)	69.0 (50-81)	69.0 (50-81)	71.0 (52-83)	69.0 (50-82)	69.0 (51-82)	69.0 (51-82)
N	*5017*	*3129*	*5412*	*4868*	*18426*	*18426*
Male + female						
Mean ± sd	63.6 ± 19.3	63.9 ± 19.4	65.8 ± 19.1	64.6 ± 19.5	64.5 ± 19.3	64.5 ± 19.4
Median (IQ)	67.0 (50-79)	68.0 (50-79)	69.5 (53-81)	68.0 (51-80)	68.0 (51-80)	68.0 (51-80)
N	*9567*	*6068*	*9932*	*9132*	*34699†*	*34699†*

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
IQ= Interquartile range
† Includes 64 (63 for Total (adj)) patients whose sex was not specified

The mean age was 64.5 (sd ± 19.3) years and median age was 68.0 (IQ 51-80) years. Figure 1 shows that the age distribution is skewed to the left.
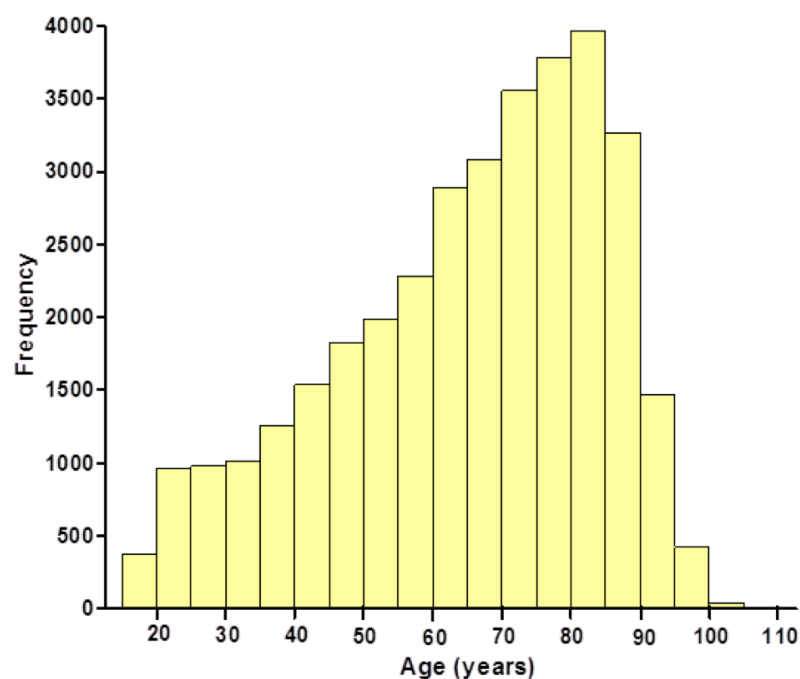
Figure 1. Histogram of the age distribution of adult patients (≥18 years) participating in the four NSW surveys. The frequency refers to the number of subjects in each 5 year age band (individual bar).

Body mass index

Table 31. Body Mass Index (BMI) (kg/m^2)

	2007	2008	2010	2011	Total	Total(adj)
Mean ± sd	26.2 ± 6.3	26.4 ± 5.3	26.3 ± 6.3	26.7 ± 6.7	26.4 ± 6.4	26.4 ± 6.4
Median (IQ)	25.4 (22.1-29.4)	25.7 (22.2-25.7)	25.4 (22.0-29.7)	25.8 (22.3-30.0)	25.6 (22.1-29.7)	25.6 (22.1-29.7)
N	7707	4637	7865	7527	27736	27736

Total (adj) = equal weighting for each year (equivalent to equal sample size each year
IQ= Interquartile range

The mean BMI was 26.4 (sd ± 6.4) kg/m^2 and the median BMI was 25.6 (IQ 22.1-29.7) kg/m^2. Figure 2 shows that the BMI distribution is skewed to the right.
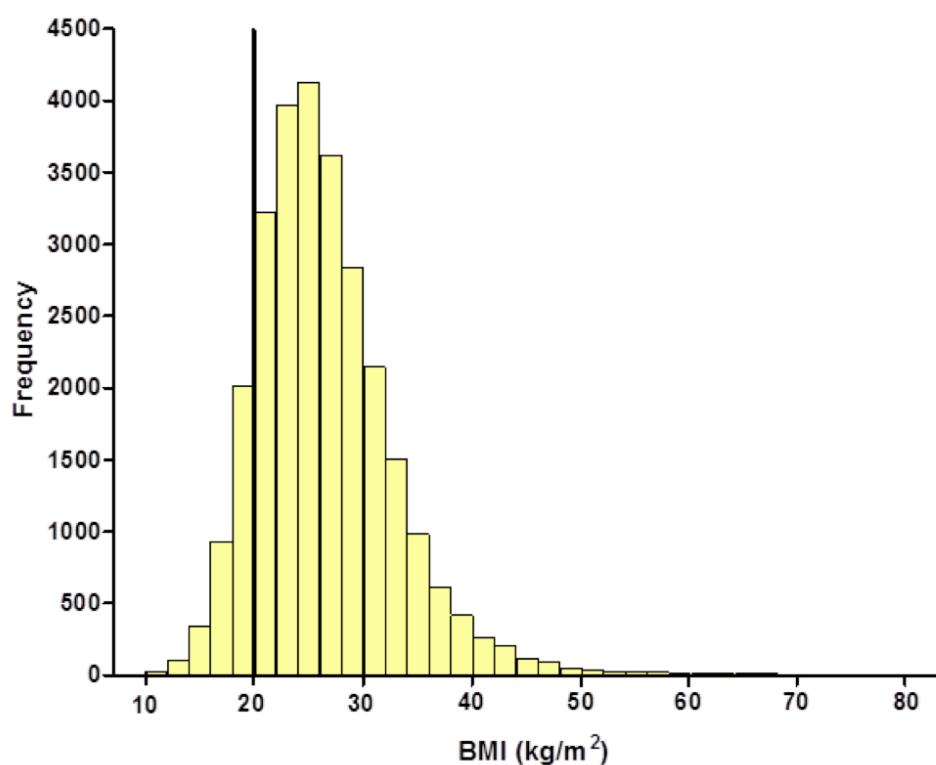
Figure 2. Histogram of the BMI distribution of adult patients (≥18 years) participating in the four NSW surveys. The frequency refers to the number of subjects in each 2 kg/m² BMI band (individual bar). The bold vertical line corresponds to a BMI of 20 kg/m².

Table 32. BMI categories

	2007	2008	2010	2011	Total	Total(adj)
kg/m²	%	%	%	%	%	%
<18.5	7	6	7	6	7	6
<20.0	12	11	13	12	12	12
20.0-24.9	35	34	35	32	34	34
≥25.0	52	55	53	59	55	55
≥30.0	22	23	24	25	24	24
N	7707	4637	7865	752 7	27736	27736

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)

Comparison of age and BMI distribution of adults admitted to hospital with the general population

Age distribution

There were marked differences between the age distributions of adults admitted to hospitals and the general population in England plus Scotland combined are shown in the figure below. The mean age of those admitted to hospital is greater than that of the general population (64.5 ± 19.3 years v 47.8 ± 18.8 years; median (IQ range), 68 (51-80) years v 46 (32-62) years) and their distributions are skewed in opposite directions.
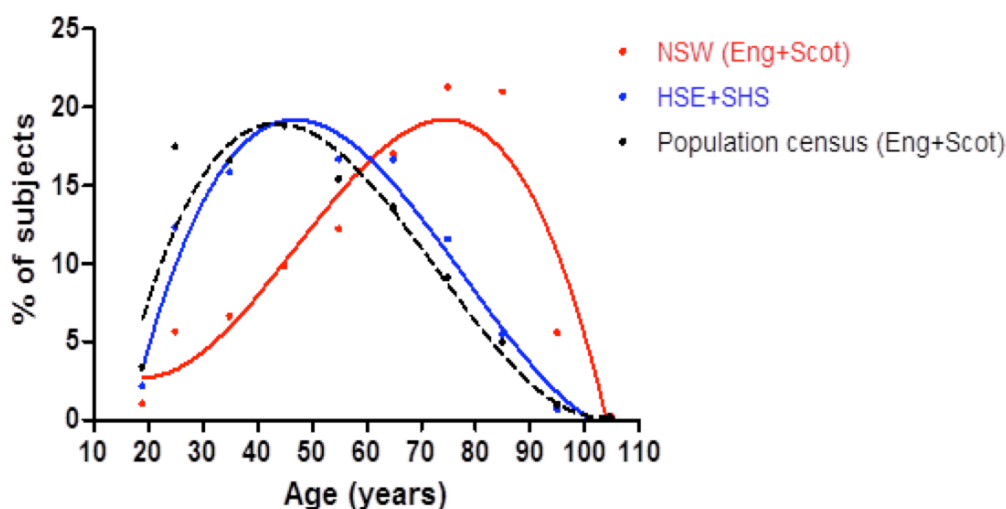

Figure 3. A comparison of the age distribution of adult subjects (≥18 years) admitted to hospital (NSW (Eng + Scot); red line) with that of the general population according to a population census of England and Scotland combined (black dotted line) and Health Surveys for England (HSE) and Scottish Health Survey (SHS) combined (blue line). The data from the four Health Surveys for England (2007, 2008, 2009 and 2010) were amalgamated with each other and with the three Scottish Health Surveys (2008, 2009 and 2010) (total N = 54,945). The data of patients admitted to English and Scottish hospitals (NSW surveys 2007, 2008, 2010 and 2011; total N = 29,999) were also amalgamated before analysis (Elia unpublished). In combining datasets for England and Scotland weighting factors were applied to establish proportional representation of the population according to the mid-2010 census, as reported by the Office of National Statistics [12]. Each data point represents the proportion of adult subjects (≥18 years) within 10 year age bands starting from 10 years (first data point is for subjects aged 18 and 19 years only). The curves were constructed using third order polynomials.

The age distribution of the general adult population participating in the Health Surveys for England and Scotland approximated to that of the overall adult population according to mid-2010 census for the same two countries [12]. Since Wales and Northern Ireland in combination accounted for only 7.6% of the adult population of the UK in mid-2010 their inclusion would be expected to make little difference to the distribution curves. For example, addition of the data from the Welsh Health Surveys to those from England plus Scotland (10-69 years) made only 0 - <0.01% difference to the values of the individual 10 year age bands of the general population. Addition of NSW data from Wales to those of England plus Scotland only made 0 - 0.22% difference to the values. Unlike the population census survey, the Health Surveys for England, the Scottish Health Surveys and the Welsh Health Surveys, provided information on a variety of nutritionally relevant variables, including body mass index which is considered next.

BMI distribution

The BMI and its distribution in patients admitted to hospitals (England, Wales and Scotland) differed from that of the general population of the same countries in several ways:

1. The mean BMI of adults (≥18 years) admitted to hospital was lower than that of the general population by 1 BMI unit (26.4 v 27.4 kg/m^2 (P <0.001)) and remained lower after adjustment for age and sex (26.2 v 27.6 kg/m^2 (P < 0.001)).

2. The variation in BMI was found to be greater for hospital admissions than for the general population. There was significantly greater standard deviation (P <0.001) (26.4 ± 6.4 (sd) v 27.4 ± 5.3 (sd) kg/m^2) and a broader distribution as shown on the graph below. There was a highly significant difference between the two BMI distribution curves (P <0.001; 2 sample Kolgomorov-Sminov test).
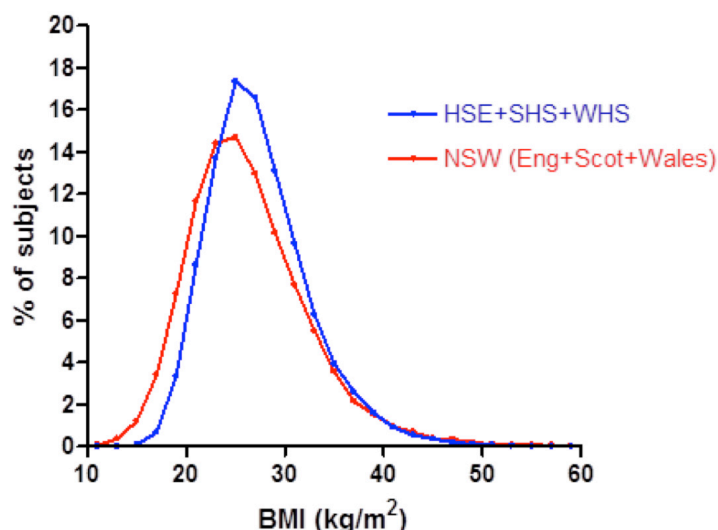

Figure 4. A comparison of the BMI distribution of adult subjects (≥18years) admitted to hospital (NSW (Eng + Scot + Wales); red line) with that of the general population (HSE + SHS + WHS; blue line). The data for the general population are based on an amalgamation of results from four Health Surveys for England (HSE 2007, 2008, 2009 and 2010); N = 30,238) three Scottish Health Surveys (SHS 2008, 2009, 1010; N = 17,397) and four Welsh Health Surveys (WHS 2007, 2008, 2009, 2010; N = 51,563) (total N = 99,162; only those involving adults ≥ 20 years were used from these datasets, which were presented according to 5 year age bands) (Elia unpublished). The data for admissions to hospital are based on an amalgamation of results from the four Nutrition Screening Week Surveys involving hospitals in England, Scotland and Wales (NSW surveys 2007, 2008, 2010 and 2011; N = 26,430) (Elia unpublished). Data from each country were weighted to ensure proportional representation of the adult population of Great Britain (based on the mid-2010 census data provided by the Office of National Statistics [12]). Each data point represents the proportion of adult subjects in 2kg/m^2 bands.

3. In the general population the BMI increased during young adult life and reached its maximum at about 65 years and declined slowly thereafter. In subjects admitted to hospital the peak BMI was reached earlier and declined more steeply with advancing age. The data in Figure 5 are for England and Scotland only. It did not include data from Wales because the Welsh Health Surveys only provided data in 5 year age bands up to 74 years and the rest was classified into a single age band labelled as 75 years and over. In addition, adults aged 18 and 19 years old could not be distinguished from children aged 15 years and over. However, since Wales accounts for a small proportion of the adult population of Great Britain (5%), it has little overall effect. Indeed, the addition of data from Wales (weighted for population size) over the range of 20-70 years was found to have negligible effect on the mean BMI of each age band (0 - <0.07 kg/m^2 for both the NSW survey and the Health Surveys - on a graph the new points were found to overlap with the existing points for England plus Scotland and be indistinguishable from each other, therefore not included.
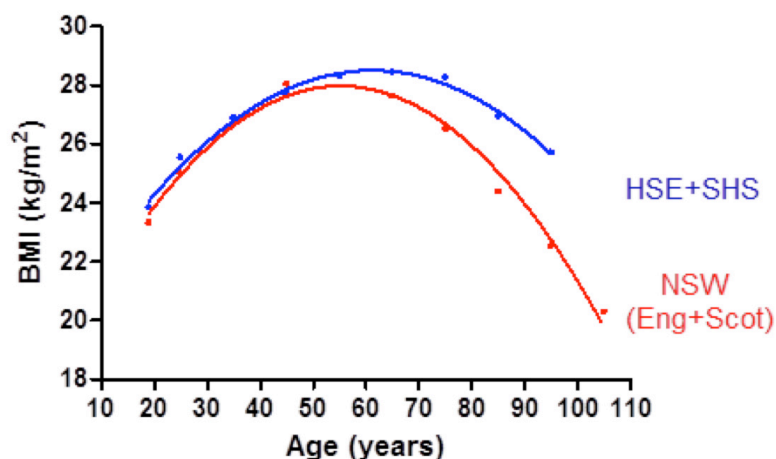
Figure 5. The effect of age on the BMI distribution of subjects admitted to hospital (NSW (Eng + Scot); red line) and the general population (HSE + SHS; blue line). The data for the general population are based on an amalgamation of results from four Health Surveys for England (HSE) (2007, 2008, 2009 and 2010); N = 28,917) and the Scottish Health Surveys (SHS) (2008, 2009 and 2010; N = 17,361) (total N = 46,278). The data for admissions to hospital are based on an amalgamation of results from the four Nutrition Screening Week Surveys involving hospitals in England and Scotland (NSW surveys 2007, 2008, 2010 and 2011; N = 24,043) (Elia unpublished). Both datasets are weighted to ensure proportional representation of the adult population of the countries involved (based on the mid-2010 data provided by the Office of National Statistics). Each data point represents the mean results of adult subjects in 10 year age bands (the age band 10-19 only includes adults aged 18 and 19 years).

4. The proportion of underweight (BMI <20/kg/m2) individuals admitted to hospitals was greater than in the general population at all ages but the differences were most marked in the older age groups (see Figure 6). The proportion of grossly obese individuals (BMI ≥40kg/m2) admitted to hospital was also greater than that in the general population at all ages but the differences were most marked in the age groups 35-65 years.
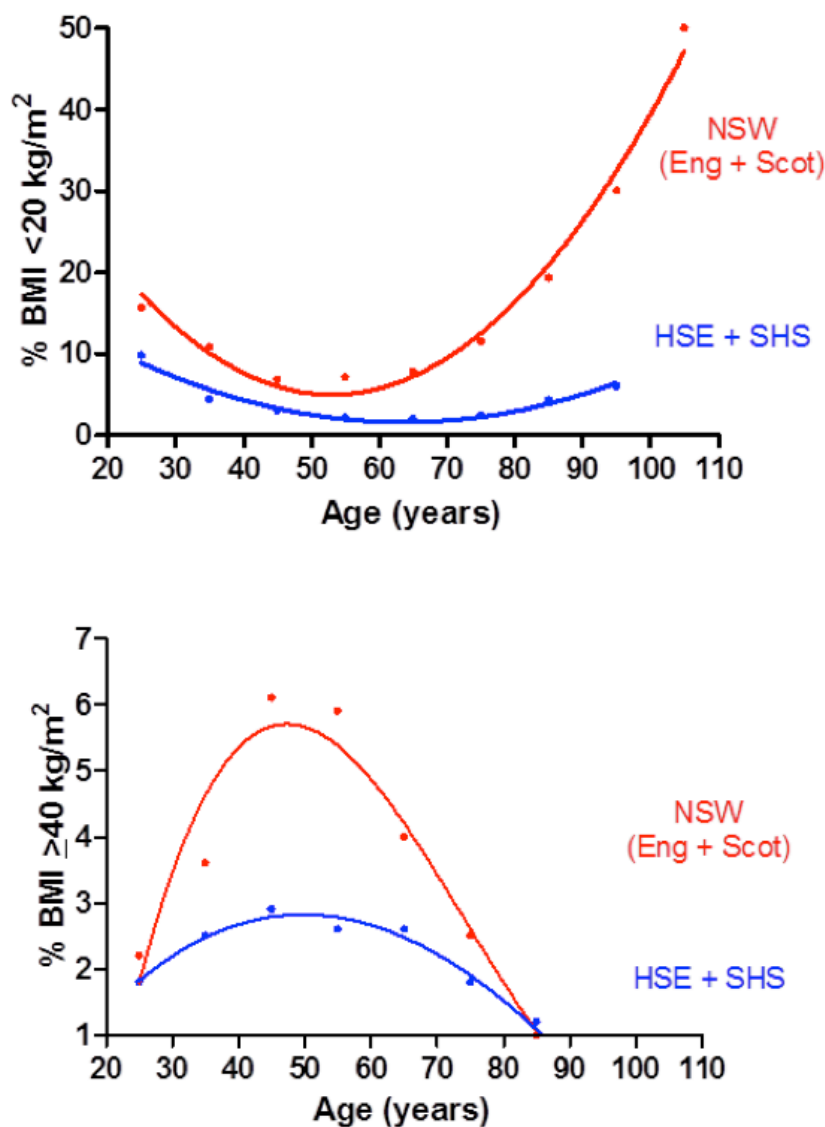
Figure 6. *Upper*: A comparison of the effect of age on the proportion of subjects with a BMI <20 kg/m² admitted to hospital (NSW (Eng + Scot); red line) and those in the general population (England (HSE) and Scotland (SHS) only; (blue line)). *Lower*: A comparison of the effect of age on the proportion of subjects with a BMI ≥40 kg/m² admitted to hospital (NSW (Eng + Scot); red line) and the general population (England (HSE) and Scotland (SHS) only; (blue line)) based on the sources indicated in the legend to the previous figure (Elia unpublished). Each point represents the proportion for 10 year age bands (10-100 years), with the lowest band (10-19 years) involving only subjects aged 18 and 19 years. The curves were drawn using second order polynomials (upper graph) and third order polynomials (lower graph).

Diagnostic categories

Table 33. Proportion of patients according to diagnostic categories

	2007	2008	2010	2011	Total	Total (adj)
	%	%	%	%	%	%
Musculoskeletal	17	16	16	15	16	16
Gastrointestinal (GI)	18	16	15	14	15	16
Cardiovascular (CVD)	13	14	12	13	13	13
Respiratory	11	11	14	12	12	12
Genito/Renal	7	8	8	9	8	8
Neurological (CNS)	6	5	6	7	6	6
Other	26	26	26	26	26	26
>1 category	0	0	0	<1	<1	<1
Don't know	2	4	3	3	3	3
No answer	1	0	2	1	1	1
Total	101*	100	102*	100	100	101*
N	*9479*	*6068*	*9785*	*9132*	*34464*	*34464*

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
*Results do not add up to 100% due to rounding up of the component values to the nearest 1%

Prevalence of 'Malnutrition'

'Malnutrition' according to risk category, season and country

'Malnutrition' risk categories

Table 34. 'Malnutrition' according to risk category (medium + high risk)

Malnutrition risk	2007	2008	2010	2011	Total	Total (adj)
	%	%	%	%	%	%
Low	72.3	71.8	65.8	75.0	70.9	71.2
Medium	5.9	6.0	13.7	7.3	8.6	8.2
High	21.8	22.2	20.6	17.7	20.5	20.6
Medium + High	27.7	28.2	34.2	25.0	29.1	28.8
N	*9338*	*5089*	*9669*	*7541*	*31637*	*31637*

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
The proportion of 'malnourished' subjects (medium + high risk) differed significantly between survey years (P <0.001; Chi squared test)

Overall, a BMI of <20 kg/m^2 was present in 11% of patients, weight loss ≥5% in 10% of patients and an acute disease effect in 13% of patients.

'Malnutrition' according to seasons

The overall results in the UK differed significantly between surveys (seasons) (P <0.001 using binary logistic regression). Although the results of the two surveys in 2007(autumn) and 2008 (summer) were not significantly different from each other there were differences with the other two surveys when 2010 (winter) showed the highest prevalence and 2011 (spring) the lowest prevalence. The unadjusted (raw) results are shown below as odds ratios (OR) using the first survey in 2007 (autumn) as the reference survey (OR for this year = 1.000).

Table 35. Seasonal variation in the prevalence of 'malnutrition'

Season (survey)	Unadjusted results		Adjusted results†	
	OR (95% CI)	P value	OR (95% CI)	P value
Autumn (survey 1)*	1.000		1.000	
Summer (survey 2)	1.028 (0.953, 1.109)	0.476	1.012 (0.931, 1.099)	0.795
Winter (survey 3)	1.361 (1.279, 1.447)	<0.001	1.268 (1.183, 1.359)	<0.001
Spring (survey 4)	0.872 (0.815, 0.935)	<0.001	0.842 (0.781, 0.907)	<0.001

OR = odds ratio (analysis undertaken using binary logistic regression with season as categorical variable)
† adjusted for age (3 categories; <40 years 40-59 years, ≥60 years), sex, ward type, source of admission, diagnostic category, hospital type, bed numbers (2 categories; <1000, ≥1000) (all variables were used as categorical variables).
*referent

Adjustment for confounding variables (see footnote to Table 35) did not abolish the significant seasonal variation.

The variation was greater in older (≥65 years) than younger subjects (<65 years) and in those admitted as an emergency than electively (see Figure 7).
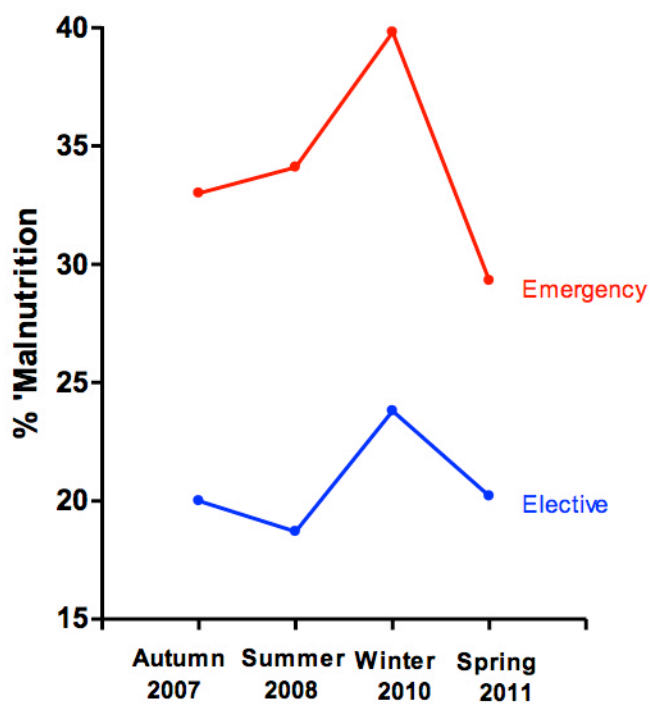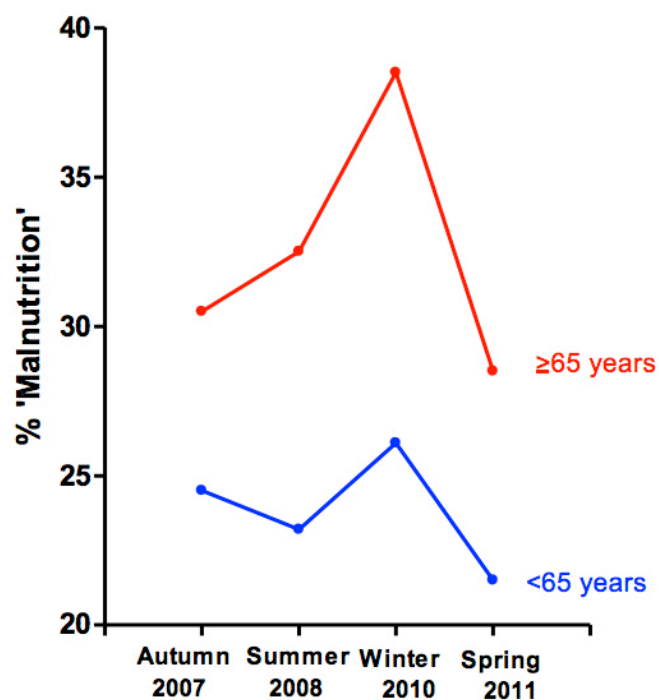
Figure 7. Seasonal variation in the prevalence of 'malnutrition' according to age category (<65 years and ≥65 years) (*Upper*) and type of admission (emergency and elective) (*Lower*).

'Malnutrition' according to country

Table 36. 'Malnutrition' in the UK according to country

	2007	2008	2010	2011	N	Total	Total (adj)
	%	%	%	%		%	%
England	29	28	35	26	23631	30	30
Wales	26	40	33	22	2687	28	30
Scotland	23	29	27	21	3640	24	25
Northern Ireland	25	15	38	-	1588	29	26
No answer	†	20	-	-	91	20	20
Mean (UK) ††	28	28	34	25	31637	29	29
N	*9336*	*5000*	*9669*	*7541*	*31637*	*31637*	*31637*
P value†††	*0.004*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
† No result given as there were only 2 subjects with no country assigned
†† There was a significant difference in prevalence between the four surveys (P < 0.001)
Overall, 75% patients at risk were admitted to hospitals in England, 8% to hospitals in Wales, 12% to hospitals in Scotland, 5% to hospitals in Northern Ireland and<1% to hospitals where the country was uncertain.
††† Chi squared test

The overall mean results in each country ranged from 24-30% (un-weighted mean 25-30%) with values in England and Wales being higher than in Scotland. In Northern Ireland there was large variability in prevalence between surveys which was associated with small sample size, ranging from 948 in the first survey to 298 in the second survey.

'Malnutrition' according to type of hospital, operational infrastructure, type of hospital admission and source of admission

'Malnutrition' according to type of hospital

Table 37. 'Malnutrition' according to type of hospital

	2007	2008	2010	2011	N	Total	Total (adj)
	%	%	%	%		%	%
Acute	27	28	34	26	26768	29	29
Community	29	37	34	23	2084	29	29
Acute/Community	-	-	-	26	107	26	26
DK/NA	29	18	27	17	2678	25	25
Total	28	28	34	25	31637	29	29
N	*9338*	*5089*	*9669*	*7541*	*31637*	*31637*	*31637*
P value†	*0.474*	*0.004*	*0.626*	*<0.001*		*<0.001*	*<0.001*

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
† Chi squared test
Overall, patients in acute hospitals accounted for 85% of all the 'MUST' results, those from community hospitals for 7%, those from a combination of acute and community hospital for <1% and unknown 7%.

The overall prevalence of 'malnutrition' in acute hospitals was the same as in community hospitals (29%) although in 2011 the prevalence was higher in acute hospitals and in 2007 and 2008 higher in community hospitals. The overall significant difference relates to the lower values in the DK/NA category and also the lower values in the small number of subjects in the Acute and Community hospitals.

'Malnutrition' according to number of hospital beds

Table 38. 'Malnutrition' according to number of hospital beds

	2007	2008	2010	2011	N	Total	Total (adj)
	%	%	%	%		%	%
<1000 beds	26	28	35	25	22068	29	28
≥1000 beds	38	29	31	31	4863	32	33
DK/NA	28	28	32	21	4706	27	27
Total	28	28	34	25	31637	29	29
N	*9338*	*5089*	*9669*	*7541*	*31637*	*31637*	*31637*
P value†	*<0.001*	*0.723*	*0.002*	*<0.001*		*<0.001*	*<0.001*

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't= equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
Overall, 70% patients were admitted to hospitals with less than 1000 beds, 15% to those with at least 1000 beds and 15% to hospitals where the bed numbers were uncertain.
† Chi squared test

Although the proportion of 'malnourished' patients varied according to number of beds (<1000 and ≥1000 beds), it was sometimes higher and sometimes lower in hospitals with ≥1000 compared to those with <1000 beds, depending on the survey year (or season).

Table 39. Sensitivity analyses of 'malnutrition' by number of hospital beds

Type of sensitivity analysis*	% 'malnourished'				P (season)†	P (beds)†
	2007	2008	2010	2011		
Model a: <1000 beds	27	28	35	24	<0.001	<0.001
≥1000beds	38	29	32	31		
Model b: <1000 beds	26	28	35	25	<0.001	0.144
≥1000 beds	31	29	32	26		
Model c: <1000 beds	27	28	35	24	<0.001	0.004
≥1000 beds	35	29	32	30		

*In model a) the results in the DK/NA category were assigned to hospitals with <1000 beds
 In model b) the results in the DK/NA category were assigned to hospitals with ≥1000 beds
 In model c) the results in the DK/NA category were assigned to the two hospital bed categories in the same proportions as originally reported
† Analysis undertaken using binary logistic regression with 'season' and 'beds' as categorical variables

Sensitivity analyses involved only two categories (<1000 and ≥1000 beds).The prevalence of 'malnutrition' tended to be greater in hospitals with ≥1000 beds than <1000 beds during all seasons with the exception of winter (2010).

Although there were significant difference in the prevalence of 'malnutrition' between survey years (seasons) there were no consistent results in the prevalence of 'malnutrition' according to number of beds, when sensitivity analysis was applied.

'Malnutrition' according to type of admission

Table 40. 'Malnutrition' according to type of admission

	2007	2008	2010	2011	N	Total	Total (adj)
	%	%	%	%		%	%
Elective	20	19	24	20	10235	21	20
Emergency	32	34	39	27	20752	33	33
DK/NA	21	28	34	31	650	29	28
N	*9338*	*5089*	*9669*	*7541*	*31637*	*31637*	*31637*
P value†	*<0.001*	*<0.001*	*<0.001*	*<0.001*		*<0.001*	*<0.001*

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
Overall, 32% were elective admissions, 66% emergency admissions and 2% not known.
† Chi squared test

Table 41. Sensitivity analyses of malnutrition according to type of admission

Type of sensitivity analysis*	% 'malnourished'				P (year)†	P (type of admission)†
	2007	2008	2010	2011		
Model a: Elective	20	19	25	21		
Emergency	32	33	39	33	<0.001	<0.001
Model b: Elective	20	19	24	19		
Emergency	32	34	39	28	<0.001	<0.001
Model c: Elective	20	19	24	20		
Emergency	32	34	39	27	<0.001	<0.001

*In model a) the results in the DK/NA category were assigned to elective admissions
 In model b) the results in the DK/NA category were assigned to emergency admissions
 In model c) the results in the DK/NA category were assigned to selective and emergency admissions in the same   proportions as originally reported
† Analysis undertaken using binary logistic regression with the 'season' and ''type of admission' as categorical variables

Sensitivity analysis involved only two categories (elective and emergency). In all the seasons the prevalence of 'malnutrition' was higher in patients admitted as an emergency than those admitted electively which is confirmed by a highly significant effect in the sensitivity analyses. Those admitted as an emergency were older than those admitted electively (66 ± 20 years v 61 ± 18 years).

'Malnutrition' according to source of admission

Table 42. 'Malnutrition' according to source of admission

	2007	2008	2010	2011	N	Total	Total (adj)
	%	%	%	%		%	%
Home	26	26	31	23	23361	27	27
Other hospital	31	34	41	33	2281	35	35
Other ward	32	32	38	26	4787	32	32
Care home	43	52	59	41	1034	50	50
DK/NA	28	35	29	24	174	28	28
N	*9338*	*5089*	*9669*	*7541*	*31637*	*31637*	*31637*
P value†	*<0.001*	*<0.001*	*<0.001*	*<0.001*		*<0.001*	*<0.001*

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
Overall, 74% were admitted from their own homes, 7% from another hospital, 15% from another ward, 3% from a care home and <1% from an uncertain setting (DK/NA).
† Chi squared test

The prevalence of 'malnutrition' during all seasons was lowest in those admitted from their own homes, which accounted for the greatest proportion of admissions, and highest from those admitted from care homes, which accounted for the smallest proportion of admission. This consistent pattern and the statistical significance associated with it were not affected by the presence of a small proportion of admissions (0.5%) which came from an unknown setting. In comparison with those admitted from their own home, who had an overall prevalence of 'malnutrition' of 27%, those from other known care settings had a mean prevalence of 36% (P <0.001).

'Malnutrition' according to nutrition screening policy

Table 43. 'Malnutrition' according to nutrition screening policy

	2007	2008	2010	2011	N	Total	Total (adj)
	%	%	%	%		%	%
Yes	28	29	34	26	25459	30	29
No	24	30	32	22	2629	27	28
DK/NA	29	21	34	17	3549	27	26
N	*9338*	*5089*	*9669*	*7541*	*31637*	*31637*	*31637*
P value†	*0.004*	*0.012*	*0.301*	*<0.001*		*<0.001*	*0.001*

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
Overall, 80% of patients were admitted to hospitals with a screening policy, 8% to hospitals without a screening policy and 11% to hospitals where it was uncertain if there was a screening policy.
† Chi squared test

The data suggested the prevalence of 'malnutrition' was higher in patients admitted to hospitals with a nutrition screening policy than those admitted to hospitals without a nutrition screening policy, but a substantial proportion of respondents did not know or did not answer the question.

Table 44. Sensitivity analyses of 'malnutrition' by nutrition screening policy

Type of sensitivity analysis*		% 'malnourished'				P (year)†	P (screening policy)†
		2007	2008	2010	2011		
Model a:	Yes	28	28	34	25	<0.001	0.007
	No	24	30	32	22		
Model b:	Yes	28	29	34	26	<0.001	0.001
	No	27	27	33	18		
Model c:	Yes	28	28	34	25	<0.001	0.013
	No	25	29	32	21		

*In model a) the results in the DK/NA category of patients were assigned to hospitals with a screening policy
  In model b) the results in the DK/NA category of patients were assigned to hospitals with no screening policy
  In model c) the results in the DK/NA category were assigned to hospitals with and without a screening policy in the same proportions as originally reported
† Analysis undertaken using binary logistic regression with 'season' and presence of nutrition screening policy' (Yes/No) as categorical variables

Sensitivity analyses involved only two categories (patients admitted to hospitals with a screening policy (Yes) and without a screening policy (No)). In general 'malnutrition' was more common in hospitals with a nutrition screening policy than in those without (although this was not the case in 2008 when models a) and c) were used).

'Malnutrition' according to proportion of patients screened

Table 45. 'Malnutrition' according to proportion of patients screened

	2007	2008	2010	2011	N	Total	Total (adj)
	%	%	%	%		%	%
0-25%	31	22	47	33	1515	35	33
26-50%	25	32	38	25	2726	31	31
51-75%	26	32	36	25	6861	30	30
76-100%	27	32	29	25	8683	27	27
DK/NA	28	25	34	24	11852	29	28
N	*9338*	*5089*	*9669*	*7541*	*31637*	*31637*	*31637*
P value†	*0.011*	*<0.001*	*<0.001*	*0.721*		*<0.001*	*<0.001*

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
Overall, 5% patients were admitted to hospitals in which 0-25% of patients were screened, 9% in which 26-50% were screened, 22% in which 51-75% were screened, 27% in which 76-100% were screened and 37% to hospitals that did not know the proportion screened or did not answer the question.
† Chi squared test

The first three categories were merged into one category (≤75%) for comparison with the last category 76-100%) and for the sensitivity analyses, which follow.

Table 46. 'Malnutrition' according to hospitals screening <75% and 76-100% of patients

	2007	2008	2010	2011	N	Total	Total (adj)
	%	%	%	%		%	%
≤75%	27	28	38	25	11102	31	31
76-100%	26	32	29	25	8683	27	28
DK/NA	29	25	34	24	11852	29	28
N	*9338*	*5089*	*9669*	*7541*	*31637*	*31637*	*31637*
P value†	*0.081*	*<0.001*	*<0.001*	*0.374*		*<0.001*	*<0.001*

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
† Chi squared test

Table 47. Sensitivity analyses of 'malnutrition' by proportion of patients screened

Type of sensitivity analysis*	% 'malnourished'				P (year)†	P (proportion screened)†
	2007	2008	2010	2011		
Model a: ≤75% screened	28	27	36	25		
76-100% screened	26	32	28	25	<0.001	<0.001
Model b: ≤75% screened	27	30	38	25		
76-100% screened	28	27	32	25	<0.001	<0.001
Model c: ≤75% screened	28	28	37	25		
76-100% screened	28	29	30	25	<0.001	<0.001

*In model a) the results in the DK/NA category of patients were assigned to hospitals screening ≤75% patients
 In model b) the results in the DK/NA category of patients were assigned to hospitals screening 76-100% patients
 In model c) the results in the DK/NA category were assigned to hospitals screening the same proportions as originally reported
† Analysis undertaken using binary logistic regression with 'season' and proportion of patients screened (≤75% />75%) as categorical variables

Sensitivity analyses involved only two categories (≤75% screened and 76-100% screened). Despite differences in results in the proportion screened (≤75% and 76-100 %) between years there were no consistent trends that were common to all three models.

'Malnutrition' according to type of ward

Table 48. 'Malnutrition' according to type of ward

	2007	2008	2010	2011	N	Total	Total (adj)
	%	%	%	%		%	%
Care of the elderly	34	41	42	34	3224	37	37
Oncology	41	42	36	34	1418	38	38
Medical	31	31	40	26	10725	33	32
Surgical	27	23	30	24	8811	26	26
Orthopaedic	15	19	20	16	3716	17	17
Other	-	27	34	23	2286	28	28
>1 ward type	-	-	-	23	44	23	23
DK/NA	23	27	25	25	1413	24	24
N	*9338*	*5089*	*9669*	*7541*	*31637*	*31637*	*31637*
P value†	*<0.001*	*<0.001*	*<0.001*	*<0.001*		*<0.001*	*<0.001*

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
Overall, 10% patients were in Care of the Elderly wards, 4% in Oncology wards, 34% in Medical wards, 28% in Surgical wards, 12% in Orthopaedic wards, 7% in other types of wards, <1% in more than 1 type of ward and 4% where type of ward was uncertain.
† Chi squared test

There were significant differences in the prevalence of 'malnutrition' between wards, those in elderly care and oncology wards being consistently higher than the average, and those in orthopaedic wards consistently lower than the average.

The overall prevalence of 'malnutrition' according to type of ward is shown in Figure 8 below.
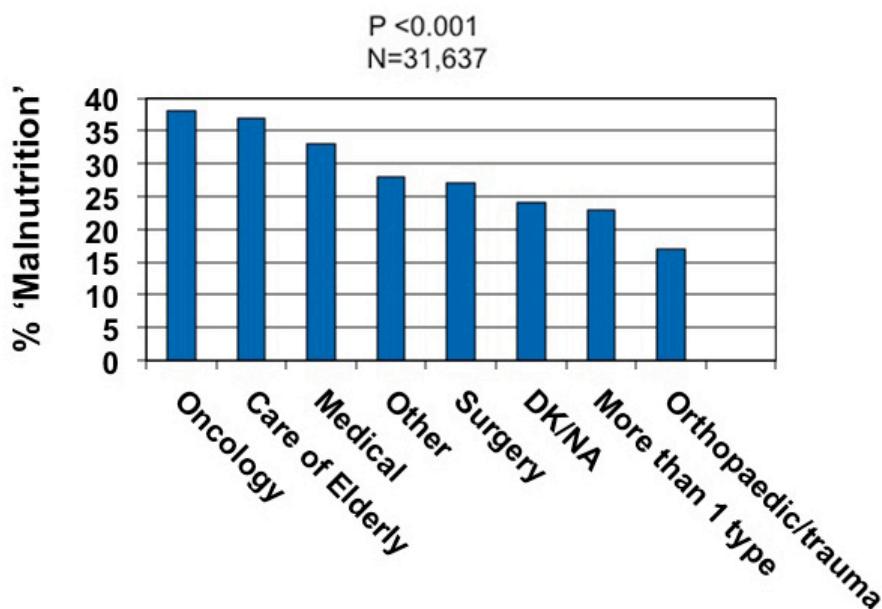
Figure 8. 'Malnutrition' according to type of ward

'Malnutrition' according to subject characteristics

'Malnutrition' according to gender

Table 49. 'Malnutrition' according to gender

	2007	2008	2010	2011	N	Total	Total (adj)
	%	%	%	%		%	%
Male	26	26	32	22	14874	27	26
Female	29	30	36	28	16707	31	31
N	*9335*	*5080*	*9649*	*7517*	*31581*	*31581*	*31581*
P value†	*<0.001*	*<0.001*	*<0.001*	*<0.001*		*<0.001*	*<0.001*

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
† Chi squared test

There was a consistently higher prevalence of 'malnutrition' in women than men by 3-6% (mean 4%). The difference was more marked in those aged ≥65 (29% v 36%; P <0.001) than <65 years (23% v 25%; P = 0.017). The overall difference remained significantly higher after controlling for season, age (3 categories <40 years, 40-59 years, ≥60 years), sex, ward type, source of admission, diagnostic category, hospital type, bed numbers (2 categories; <1000, ≥1000) (all variables were used as categorical variables).

'Malnutrition' according to age

Table 50. 'Malnutrition' according to age categories

	2007	2008	2010	2011	N	Total	Total (adj)
Age (Years)	%	%	%	%		%	%
18-19	28	48	44	26	343	35	37
20-29	27	26	31	26	1774	28	28
30-39	27	20	27	23	2096	25	24
40-49	24	22	25	17	3119	22	22
50-59	22	21	30	21	3936	24	24
60-69	25	25	29	21	5522	25	25
70-79	28	29	33	24	6693	29	29
80-89	33	37	43	32	6495	37	36
90+	38	43	50	40	1659	44	43
N	*9338*	*6068*	*9669*	*7541*	*31637*	*31637*	*31637*
P	*<0.001*	*<0.001*	*<0.001*	*<0.001*		*<0.001*	*<0.001*

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
Overall, 1% patients were aged 18-19 years, 6% 20-29 years, 7% 30-39years, 10% 40-49 years, 12% 50-59 years, 17% 60-69 years, 21% 70-79 years, 21% 80-89 years and 5% 90 years and over

The overall prevalence of 'malnutrition' according to age categories is shown in Figure 9 below.
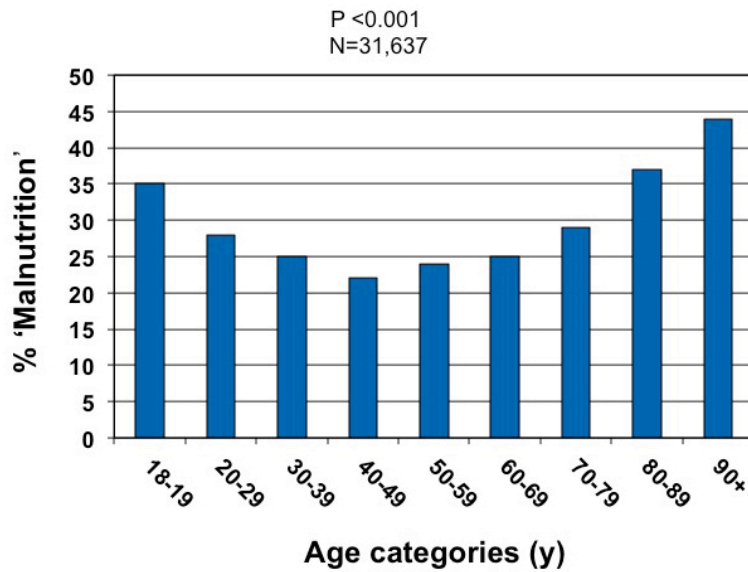

Figure 9. Distribution of 'malnutrition' according to age categories (all adults)

A graph of 'malnutrition' according to age by gender is shown below in Figure 10. The curvilinear relationship indicates that the lowest prevalence occurs at an age of about 40 years, with a substantial increase in both younger and older subjects. Underweight (BMI <20kg/m2), which contributes to 'MUST' categorisation, also shows a curvilinear relationship with age (see Figure 6).
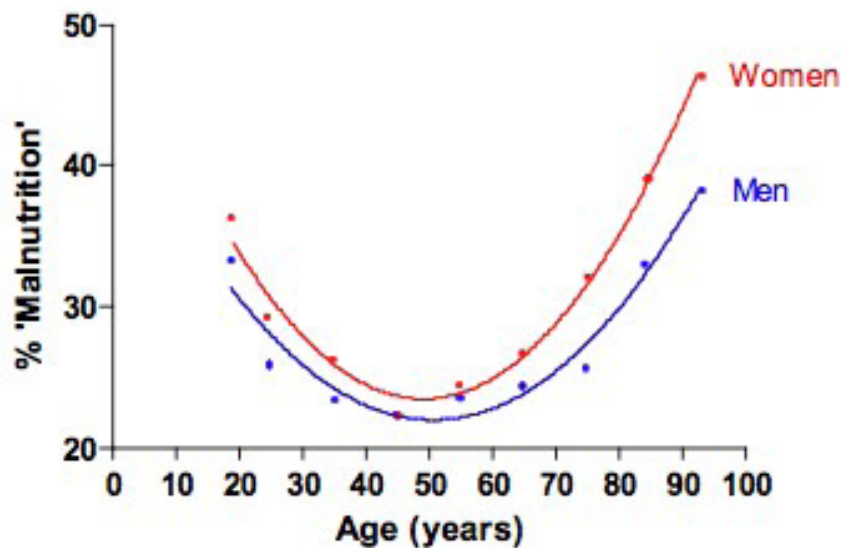

Figure 10. Distribution of 'malnutrition' in men (blue line) and women (red line) according to age. The points are the mean values within each decade (10-100 years), with the youngest age band (10-19 years) representing adults 18 and 19 years only and the oldest age band representing adults aged >90 years (mean age 92.8 years). The curves were drawn using second order polynomials.

Women had a higher prevalence of 'malnutrition' than men in all age groups and the difference between them widened from the fourth decade onwards.

Table 51. 'Malnutrition' according to age <65 years and ≥65 years

	2007	2008	2010	2011	N	Total	Total (adj)
	%	%	%	%		%	%
<65 years	24	23	28	21	14133	25	24
≥65 years	30	32	38	28	17504	33	32
N	9335	5080	9649	7517	31637	31637	31637
P value†	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
Adults <65 years accounted for 45% of the total population and those ≥65 years for 55% of the total population. This means that older people accounted for most of the 'malnutrition' (62%).
† Chi squared test

Overall the prevalence of 'malnutrition' was about 33% higher in those aged ≥65 years than those aged <65years. However, when 'malnutrition' was divided into 3 categories (<40 years, 40-59 years and ≥60 years, with a prevalence of 27%, 23% and 32% respectively) the reasons for the higher prevalence in younger and older adults was explored further. For example, the prevalence of 'malnutrition' within a variety of different diagnostic categories (e.g. respiratory, cardiovascular, genitourinary musculoskeletal categories, and the category labelled as 'other') was greater in those <40 years and ≥60years than in those in the intermediary age group. A similar pattern was observed when 'malnutrition' was examined according to medical and surgical wards, which accounted for 62% of admissions. Admissions to 'Care of the elderly wards' contributed to the high prevalence of 'malnutrition' in the elderly, but overall such admissions represented only 10% of the total number of admissions.

'Malnutrition' according to diagnostic category

Table 52. 'Malnutrition' according to diagnostic category

	2007	2008	2010	2011	N	Total	Total (adj)
	%	%	%	%		%	%
Neurological (CNS)	33	32	34	23	1798	31	30
Gastrointestinal(GI)	42	41	48	38	5023	43	42
Respiratory	32	38	42	31	3748	36	36
Cardiovascular (CVD)	21	20	23	16	4037	20	20
Genito/Renal	24	25	33	23	2511	27	26
Musculoskeletal	18	21	24	18	5103	20	20
Other	25	26	33	24	8315	27	27
>1 category	-	-	-	47	38	47	48
DK/NA	32	31	29	28	1064	34	33
N	9338	5089	9669	7541	31637	31637	31637
P value†	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
Overall, 6% patients screened had Neurological (CNS) diseases, 16% had Gastrointestinal (GI) diseases, 12% had respiratory diseases, 13% had Cardiovascular (CVD) disease, 8% had Genito/Renal disease, 16% had Musculoskeletal disease, 26% had other diagnoses. <1% had diagnoses listed in more than 1 category and in 3% the diagnosis was not known.
† Chi squared test

The prevalence of 'malnutrition' varied with diagnostic category. Patients with gastrointestinal disease had a consistently higher prevalence (43%) than the overall mean (29%) and musculoskeletal consistently lower prevalence (20%) than the overall mean.

The overall prevalence of 'malnutrition' according to diagnostic categories is shown in Figure 11 below
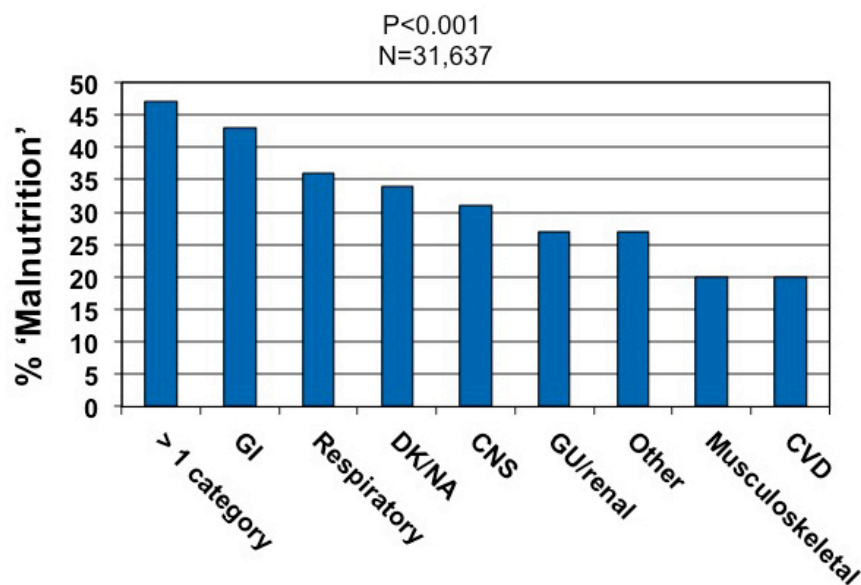

Figure 11. 'Malnutrition' according to diagnostic category

'Malnutrition' according to presence of cancer

Table 53. 'Malnutrition' according to presence of cancer

	2007	2008	2010	2011	N	Total	Total (adj)
	%	%	%	%		%	%
Yes	-	40	44	34	2957	39	39
No	-	26	32	23	18312	28	27
DK/NA	-	30	41	31	1030	35	34
N	-	*5089*	*9669*	*7541*	*22299*	*22299*	*22299*
P value†	-	*<0.001*	*<0.001*	*<0.001*		*<0.001*	*<0.001*

Total (adj) = equal weighting for each year (equivalent to equal sample size each year)
DK = Don't know, NA = No answer
Overall, 13% patients were reported to have cancer, 82% did not and in 5% it was not known or reported.
† Chi squared test

Table 54. Sensitivity analyses of 'malnutrition' according to presence of cancer

Type of sensitivity analysis*		% 'malnourished'				P (year)†	P (cancer)†
		2007	2008	2010	2011		
Model a:	With cancer	-	37	43	34	<0.001	<0.001
	Without cancer	-	26	32	23		
Model b:	With cancer	-	40	44	34	<0.001	<0.001
	Without cancer	-	27	33	23		
Model c:	With cancer	-	39	44	34	<0.001	<0.001
	Without cancer	-	27	33	23		

*In model a) the results in the DK/NA category were assigned to the with cancer category
  In model b) the results in the DK/NA category were assigned to the without cancer category
  In model c) the results in the DK/NA category were assigned to the with cancer and without cancer categories in the same proportions as originally reported
† Analysis undertaken using binary logistic regression with 'season' and presence of 'cancer/no cancer' as categorical variables

Sensitivity analysis involved only two categories (patients with a diagnosis cancer and those without). All three models used in the sensitivity analysis indicate that the prevalence of malnutrition is higher among those patients with a diagnosis of cancer than those without.

Comments

The four NSW surveys, undertaken between 2007 and 2011, aimed to establish the prevalence of 'malnutrition' in the different care settings in the UK, to document current screening practice and problems that needed addressing and to provide feedback to local centres so their results could be benchmarked against those of the UK as a whole. The amalgamated data from all four surveys provide new information on the trends in nutritional care over time, on the potential effect of seasonality on the prevalence of 'malnutrition' and on the way in which the anthropometry and age distribution of patients admitted to hospitals differ from that of the general population. The general comments that follow below refer to the amalgamated data for hospitals in the UK. Country-specific reports are available as well as this report for the UK as a whole [13-17].

Trends over time

The NSW surveys have provided valuable information about certain aspects of nutritional care in UK hospitals and the changes that have occurred over time. They suggest that during the course of the over the five year period in which the NSW surveys were carried out, there have been both clinically relevant and statistically significant improvements in awareness about malnutrition and in the operational infrastructure of nutritional support services. For example, there has been a reported increase in the proportion of hospitals with an established nutrition screening policy (from 79-82% (the range indicates the variability associated with the three types of sensitivity analyses; see below) to 99%), a reported increase in the proportion undertaking audit of nutritional screening (75-85% to 98-99%), and a reported increase in the proportion of patients known to have been screened on admission to hospital (67-78% to 86-95%). In addition, there has been improvement in the reported recording of weight (from 49-50% to 57-69%) and height (from 28-34% to 61-65%), and improved reported awareness about weighing scale standards even during the 15 month period between last two surveys (2010 and 2011). Furthermore, there has been a small but significant reported increase in the practice of linking screening results to a care plan in almost all patients and an improved communication on discharge from hospital (from 51-55% (2008) to 70-73% (2011)). However, inspection of the reports of individual countries will indicate that the changes have not been uniform across the four devolved nations. Their baseline status and the changes in status, particularly their infrastructure for dealing with 'malnutrition' have varied considerably. For example, Scotland appeared to have better baseline performance indicators such as recording height and weight on wards of patients admitted to hospitals and greater improvements over time (see report for Scotland report [15]). For some countries such as Northern Ireland, it is difficult to establish trends over time, partly because the hospitals in Northern Ireland did not participate in one of the four surveys, and in the other three surveys, the number of hospitals was small and variable between surveys.

Some uncertainty was associated with interpretation of the raw results because a variable proportion of hospitals did not report or did not know the answer to specific questions (0% to 30% of the questions on the general hospital questionnaire), making it difficult to analyse some of them statistically, especially when there were trends of a decreasing proportion of non-responses over time. For example, a low positive response to a question may reflect a high a non-response rate and vice versa. However, the conclusions made in the previous paragraph about the UK as a whole appear to be robust because the raw data yielded consistent results when subjected to three types of sensitivity analysis (one in which all the non-respondents were placed in one of two alternative categories, such as 'yes' and 'no'; another in which they were all placed in the other category; and the third in which all were placed in the two categories in the same proportion as the respondents). In the preceding paragraph, the range of results indicated for the first as well as the last survey reflect the extent which the three models vary from each other within each of the surveys. For a minority of questions there was less confidence in the trends because only one out of the three sensitivity analyses (e.g. the presence of a Nutrition Steering Committee) or two out of the three analyses (e.g. proportion of patients screened) proved to be significant, although the general direction of change over time was clear. However, none of the sensitivity analyses showed evidence of significant trends over time in the proportion of hospitals with a nutrition support team. With only about 60% of hospitals with a nutrition support team, and no recent trend for this to increase, there is room for substantial improvements in the future.

The reasons for the improved trends over time probably reflect the efforts by both governmental and non-governmental organisations. Various non-governmental organisations have championed implementation of appropriate nutritional care in clinical practice, BAPEN being one that has dedicated its activities to this end, ever since its formation in 1992. The government, especially the Departments of Health in the devolved nations, have responded positively to calls for action, and have facilitated behaviour change within the health and social care services. They have developed and implemented guidelines and standards, have helped increase awareness of the importance of malnutrition in clinical practice, encouraged education and training and increasingly inspected and regulated nutritional issues in hospitals (see reports of individual countries).

The differences between countries are considered further in the specific reports for these countries.

The gradual implementation of the 'MUST' within the UK, since its launch in 2003 has resulted in more than 82% of hospitals adopting it, according to the 2011 NSW survey, an increase from 73% since the 2010 survey. From the end of 2003, when 'MUST' was launched, it is estimated that its use increased to about 20-40% between 2004 and 2007, with substantial regional variation. The uptake of 'MUST' has been particularly high in hospitals that participated in Scotland and Northern Ireland (see specific reports for these countries). The implementation of 'MUST' has allowed the use of consistent criteria to detect malnutrition and consistent indicators to audit and monitor nutritional care within and between care settings. It is much more difficult to undertake meaningful audits when multiple, unvalidated or poorly validated screening tools are used within and between care settings. Education and training in the use of the 'MUST' framework has probably contributed to increased awareness of nutritional issues and improved audit results.

Seasonality and the prevalence of 'malnutrition'

The prevalence of 'malnutrition' on admission to hospitals varied significantly between seasons: 28% in autumn and summer, 34% in winter, and 25% in spring. The variation was found to be less pronounced when the values were adjusted for various confounding variables, such as age, sex, type of hospital and ward, and bed numbers, but nevertheless significant differences between seasons remained. It can be suggested that the higher prevalence in winter is related to a number of factors: greater social isolation in the cold weather which may result in reluctance of people to go out shopping or visit their GP to have their health problems attended to; more severe accidents on icy surfaces; more severe hypothermia, and more prolonged and severe chest infections. The well-known effects of malnutrition causing weakness, lethargy, impaired temperature regulation and immunosuppression could predispose to such problems during cold weather. Seasonal variations in poverty can also be proposed as explanations, especially in older people who probably have less income than younger adults and who may have to spend more money on fuel to keep warm and less on nourishing food and drink. Indeed, older people tend to be at the centre of the food-fuel controversy. The greater seasonal variation in the prevalence of 'malnutrition' in those ≥ 65 years (10.5% variation) than in those <65 years (6.7% variation) is consistent with this suggestion. The greater seasonal variation among patients admitted as an emergency than electively might also be expected since malnutrition predisposes to conditions such as accidental falls, infections, and hypothermia, and delays recovery from acute illness, compromising independent living. However, caution should be exercised in uncritically accepting the magnitude and statistical significance of these differences because the hospitals participating in the four surveys were not the same each year and they were not randomly selected and the results were not entirely consistent across all four devolved nations. In addition, the same season may produce different weather conditions in different years, such as those associated with mildly cold or bitterly cold winters. The 2010 NSW was carried out in a particularly cold winter with ice and snow (the winter of 2009/2010 was the coldest since the winter of 1978/1979), and it is possible that less cold winters could produce different effects.

Other issues

The NSW surveys suggest that the prevalence of 'malnutrition' across the four seasons is about 29%, with some variation between countries, ranging from 30% in England to 24% in Scotland. Explanations for the national differences are complex and need to take into account the different healthcare systems that operate in the devolved nations, the distribution of care between hospitals and the community, the number of beds per capita of population, which is greater for Scotland than England, as well as national differences in age, gender, BMI distribution and types of diseases that affect their populations. The NSW surveys in all the nations have re-emphasised the widespread nature of 'malnutrition'. They have also confirmed that the prevalence of 'malnutrition' varies according to many factors including the following: the source of admission (being higher in those admitted from care homes and other wards/hospitals than from the patients' own homes, probably because of more severe or prolonged disease in the former groups); the type of ward (being higher in care for the elderly and oncology wards than orthopaedic wards); disease category (being higher in gastrointestinal and respiratory diseases than musculoskeletal and cardiovascular diseases), and presence of cancer (being higher in those with cancer than those without).

 As expected, the population of adult patients admitted to participating hospitals was considerably older than that of the general adult population, by about 17 years when comparing mean values (65 v 48 years), and about 22 years (68 v 46 years) when comparing median values. Women outnumbered men (ratio 1.14:1.00), were slightly older than men (65.1v 63.9 years), and had a greater risk of 'malnutrition' in all surveys (overall mean 31% v 27%; P <0.001). However, the NSW surveys found that people <65 years accounted for almost half the adult population admitted to hospitals and almost 40% of those with malnutrition. This means that 'malnutrition' is not just a problem of the elderly, but also of younger individuals, who should not be overlooked particularly in national initiatives addressing 'malnutrition'.

Of particular interest is that the lowest prevalence of 'malnutrition' was found to occur in subjects aged 40-60 years. Above the age of about 50 years the prevalence of 'malnutrition' progressively increases into extreme old age, probably because the disease or combination of diseases and disabilities requiring hospital admission are more common in older people and are more likely to predispose to 'malnutrition' or vice versa. The reasons for the increased prevalence in adults <50 years is not entirely clear but several explanations can be proposed. For example, younger people admitted to hospital may suffer from different types of diseases with a higher prevalence of 'malnutrition' than those that affect 40-60 year old people. An alternative explanation is that compared to subjects in the intermediate age group (40-59 years) younger (<40 years) and older people (≥60 years) with 'malnutrition' have more severe conditions within the same disease category than those in the intermediary age group, which is consistent with the NSW data. Another explanation is that in the general population younger adults have a lower mean BMI than older adults (up to about 75 years of age) which means that a greater proportion of younger adults are likely to become underweight after a given weight loss than older adults. In addition, younger subjects who tend to have more functional capacity and reserve than older subjects may be able to manage at home in a more malnourished state than older people. In the NSW survey the prevalence of 'malnutrition' was assessed using 'MUST'. It is possible that different results may be established when malnutrition is assessed using other types of nutrition screening tools, especially those that incorporate age into their scoring systems. Age is not a feature of 'MUST' or of most other nutrition screening tools[18], although where included it can make a variable and sometimes pronounced contribution to the overall risk score in some tools. In addition, the curvilinear relationship between BMI and age among patients admitted to hospital broadly reflects that of the general population, although a lower BMI occurs among patients admitted to hospital particularly in the older age groups.

An interesting feature of the BMI distribution curve of patients admitted to hospital is that both tails were extended so that the proportion underweight (BMI <20kg/m^2 or <18.5 kg/m^2) and the proportion of grossly obese individuals (BMI ≥40kg/m^2) were greater than those of the general population. The increased morbidity associated with both underweight and grossly obese individuals makes them more likely to be admitted to hospitals. Therefore, both underweight and obese individuals pose important clinical problems, which should be recognised and directed towards appropriate management pathways. A nutrition screening procedure that identifies both malnutrition and obesity has obvious advantages over screening procedures that identify each of these separately.

Since the NSW surveys involved nutritional screening on admission to hospital, mainly of patients from their own homes, the data reflect problems that arose in the community. Policies aiming to prevent the problems from developing or to initiate treatment at an early stage need to focus on the community and to integrate services between care settings. Hospitals have a role to play in identifying malnutrition and communicating the results to the community so that treatment initiated for inpatients or outpatients can be continued in the community [19-21]. The NSW surveys suggest there is considerable room for further improvement in this respect, partly because discharge communication about 'malnutrition' was found to be patchily carried out and partly because there were only small changes reported over the five year period in which the surveys were undertaken. The NSW surveys also indicated that the proportion of underweight individuals admitted to hospital (BMI <20 kg/m^2) rises steeply above the age of 70 years, contrasting with the overall lack of rise in the general population. Preventing the development of underweight in free living individuals could have a substantial effect on reducing hospital admissions and costs.

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Appendix 1: Forms used in NSW11

(on the following pages)

Nutrition Screening Week NSW11

Hospitals

Sheet 1(a) for Hospitals	Information about your Hospital

Hospital Name ……………………………………. **Code Number** ……………

Location ☐ **England** ☐ **Scotland** ☐ **Wales** ☐ **N Ireland**

Please complete by putting an **X** in the appropriate boxes. Please use **black ink.**

1. What type of hospital?
    ☐ Acute ☐ Community

2. How many beds? Please state number …………………………

3. Do you have access to a Nutrition and Dietetic service? ☐ Yes ☐ No ☐ ?

4. Do you have access to a Nutrition Support team? ☐ Yes ☐ No ☐ ?

5. Does your hospital / Trust have a Nutrition Steering Committee? ☐ Yes ☐ No ☐ ?

6. Does your hospital / Trust have a Nutrition Screening policy? ☐ Yes ☐ No ☐ ?

7a. Do you know what % patients are screened on admission? ☐ Yes ☐ No ☐ ?

7b. If you have answered 'Yes' to 7a please indicate % of patients screened on admission:
    ☐ 0-25% ☐ 26-50% ☐ 51-75% ☐ 76-100%

8. Which nutrition screening tool(s) is/are routinely used in the hospital/Trust?
    ☐ 'MUST' ☐ MNA ☐ NRS ☐ Local tool ☐ No tool used ☐ No tool used
    ☐ Other (please specify) …………………………………………………

9. How are staff trained on nutritional screening? (please tick all that apply)
    ☐ Lecture /workshop ☐ Workbook ☐ No training provided ☐ e-learning
    ☐ Other (please specify) …………………………………………………

10. Are patients routinely weighed on admission?
    ☐ Yes on all wards ☐ On some wards ☐ No ☐ ?

11. Are you aware of any standards regarding the type of and maintenance
    requirements for weighing scales used in your Trust? ☐ Yes ☐ No ☐ ?

    If yes, please specify which standard you are aware of/following …………………………………………………

12. Is the height of patients routinely recorded?
    ☐ Yes on all wards ☐ On some wards ☐ No ☐ ?

13. Do you have a care plan for the management of patients identified as at risk of malnutrition / underweight?
    ☐ Yes ☐ No ☐ ?

14. Is nutrition information routinely included in discharge communications for those identified at risk of
    malnutrition / underweight?
    ☐ Always ☐ Usually ☐ Sometimes ☐ Never ☐ ?

15a. Is the practice of nutrition screening audited? ☐ Yes ☐ No ☐ ?

15b. If yes, how often? ☐ Every year ☐ Every 2 years ☐ Every 3 or more years ☐ ?

16a. Have you participated in previous Nutrition Screening Week Surveys? ☐ Yes ☐ No ☐ ?

16b. If yes, which ones? (please tick all that apply) ☐ 2007 ☐ 2008 ☐ 2010

Thank you

Hospital Sheet 2 (a) Patient / client data
To be collected within 72 hrs of admission

Nutrition Screening Week NSW11
BAPEN

Country Location: _____ (England, Scotland, Wales, N. Ireland, ROI)

Ward/location name: _____

Code Number: _____

Date: _____

Have the scales on your ward been calibrated within the last 12 months?   Yes ☐   No ☐   ? ☐

Patient Number	Age Yrs	Sex M/F	Type of ward * 1-5, 8	Where admitted from ** 1-4	Diagnostic category *** 1-8	Other current medical conditions Y/N	Is the diagnosis one of cancer? Y/N/DK	Oedema present? Y/N	Weight (kg) Actual	Weight (kg) Recalled	Weight (kg) N/A ****	Height (m) if not available calculate from Ulna length — Actual	Height (m) — Recalled	Height (m) — Calculated	Unintentional weight loss (past 3-6mths) Kg	Food intake over past 5 days — Normal	Food intake over past 5 days — Less than normal	Food intake over past 5 days — V Little or None	Likely food intake over next 5 days — Normal	Likely food intake over next 5 days — Less than normal	Likely food intake over next 5 days — V Little or None	Type of admission — Elective	Type of admission — Emergency

* **Type of Ward**
1. Medical, 2. Surgical, 3. Orthopaedic/trauma, 4. Care of the Elderly/Stroke, 5. Oncology, 8. Other (Please specify)

** **Where admitted from**
1. Home, 2. Other hospital, 3. Other ward, 4. Care Home.

*** **Diagnostic Category**
1. CNS, 2. GI Disease, 3. Respiratory Disease, 4. Cardio-vascular Disease, 5. Genito/ Renal Disease,
6. Musculoskeletal (including orthopaedic) conditions, 7. Other, 8. Not known

**** **Weight: when not available**
1. Underweight, 2. Normal weight , 3. Overweight

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Guidance Notes: Hospitals

Thank you for participating in Nutrition Screening Week 2011. The aim of this survey is to establish the prevalence of malnutrition risk in patients and clients admitted to hospitals, care homes and mental health units across the United Kingdom and Republic of Ireland (ROI) in the spring season, to complete and complement data already collected from previous screening weeks held in the summer (NSW08), autumn (NSW07) and winter (NSW10) and to provide additional information on nutritional care practice across the UK and ROI.

Preliminary results will be presented at the BAPEN Conference in Harrogate, 29 -30 November 2011. Additionally we will analyse and send you the results of your data to enable you to report the scale of the problem in your locality and to compare your data with the national picture. This is the final screening survey that will be carried out. Following the NSW11 results, the data from all 4 surveys will be compiled to produce the most comprehensive picture of prevalence of malnutrition in the UK and Ireland ever undertaken, which will also consider any seasonal variation in numbers. Participating in the Nutrition Screening Week will help demonstrate how you are striving to achieve nutritional standards and your commitment to meeting the nutritional needs of your residents or clients.

The survey is based on 2 questionnaires, a general questionnaire about your hospital and practice of nutritional screening (Sheet 1(a)) and a patient /client data collection sheet (Sheet 2 (a)). Please read the following guidance notes carefully before completing the forms.

Sheet 1(a):
Please answer on behalf of your hospital within your Trust. Please provide the information for the hospital as a whole, not a particular area / unit within it. If you wish to include more than 1 hospital within your Trust, please use a separate set of documentation for each hospital.

You will be issued with a code number for each hospital, please write it in the space on the form. Please document the name of your hospital clearly and tick in which country it lies. If you were allocated a code/s last year please use this code again this year.

If you don't know the answer to any question, please mark the box with a question mark beside it.

In the question regarding screening tools used in your hospital/trust, please tick all that apply if more than one tool is used. The tools are defined as follows:

'MUST': 'Malnutrition Universal Screening Tool'
MNA: Mini Nutritional Assessment
NRS: Nutrition Risk Score
Other: to be specified.

Sheet 2(a) Patient / Client data:
Please collect the required information on *all adult* patients admitted to medical, surgical, orthopaedic/ trauma, care of the elderly, stroke and oncology wards in your hospital between 00.01 hrs on 5th April and 23.59 hrs on 7th April 2011. The data should be collected **within 72 hours of the patient's admission to the ward**.

If you would like to collect data on patients admitted to other wards, you may do so, but please specify the type of ward in the space at the top of the sheet. Patients admitted via medical/surgical admissions units or A&E should also be included if their hospital stay is longer than 24hours.

If patients were screened on admission and the information required is already available and documented in the patients' notes, then this can be directly entered onto the data collection sheets. If not, please obtain and record the information within 72 hours of the patient's admission.

Patients admitted to these wards during the screening period who are under 18 years of age or already established on nutritional support (oral nutritional supplements, enteral tube feeding, PEG feeding or parenteral nutrition) ***are excluded from the study and therefore should not have data recorded***. Please add any such patients to the form, but simply insert across the row next to their number what method of nutritional support they are on, e.g. *'002 = [excluded – PEG feeding]'*

If a patient transfers from another ward, their data has not already been included on the previous ward and they are *within 72 hours of their admission to the hospital*, please include their data. If their admission has been longer than 72 hours or their data has already been included elsewhere, do not include them.

Code number: Please write the same code number inserted on Sheet 1(a) onto each copy of Sheet 2(a) that you use.

Ward/location: Please write the name or number of the ward in the space at the top of Sheet 2(a) using separate sheets for each ward included in the survey.

Have your scales been calibrated in the last 12 months?: Please enter yes, no or don't know.

Patient Number: Please number patients admitted to each ward sequentially 001, 002, 003 etc. Please do not include the patient's name.

Age: Please include patients who are 18years and over, giving the age of the patient in years only. There is no need to include number of months as well.

Type of ward: Please insert appropriate number (see key at the bottom of Sheet 2(a).)

Where admitted from: Again, please insert appropriate number from key.

Diagnostic category: Please indicate whether the patient has other relevant medical conditions or problems. A yes or no answer only is sufficient – no specific category information is required here.

Other medical conditions: Please indicate whether the patient has other relevant medical conditions or problems. A yes or no answer only is sufficient – no specific category information is required here.

Cancer?: Please indicate if the primary diagnosis or any other ongoing medical condition is one of cancer. A yes, no or don't know answer is sufficient.

Oedema present?: Please indicate whether the patient was or was not oedematous on admission. A yes or no answer only is sufficient.

Weight: Please state weight in kg in appropriate column indicating if weight was an actual measurement or a weight recalled by the patient or carer. If weight of patient is not available or obtainable, please assess weight status subjectively, i.e. does the patient look underweight, normal weight or overweight.

Height: Please state height in metres in appropriate column indicating if height was an actual measurement, a height recalled by the patient or carer or a value calculated from length of the ulna (see information on measurement of ulna and conversion table). If height (or surrogate measure) cannot be safely obtained e.g. confused, terminally ill, non-compliant patients, please enter N/A.

Recent unintentional weight loss: Please give amount of any weight lost unintentionally in the last 3-6mths.Please do not include any weight lost following use of diuretics. Please give value in kg (1kg = 2.2lbs). If recent weights are not available in the patient's notes please ask the patient / carer if they are aware of the amount of any recent weight loss. If patient /carer does not know how much weight has been lost, insert DK (Don't know).

Food intake, past and future: Please tick the relevant boxes. Please use your professional judgement as to the likely food intake over the next 5 days. Please note that the very little /no food box specifically means *a few mouthfuls of food at the most*, i.e. nothing or virtually nothing. There is no need to record actual food intake.

Type of admission to hospital: Please tick if admission was elective or an emergency.

Appendix 2: Glossary of Statistical Terms

Binary logistic regression

A type of regression analysis involving logarithmic transformations (the logistic or logit transformation of a proportion = log (proportion/1-proportion)) that is used when the outcome variable is binary (e.g. 'yes' or 'no'; 'malnutrition' or 'no malnutrition'). It provides results as odds ratios and it avoids potential problems that may arise when the proportion is modelled as a linear function of the prediction variables. Binary logistic regression can involve both continuous and categorical input (explanatory) variables: the overall result of the outcome variable can be said to have been adjusted for or controlled for the input variables.

Chi squared test and P values

A statistical test used to assess the independence of two variables in a contingency table, which is used to examine the observed and expected frequencies under independence. A statistically significant test, typically indicated by a probability (P value) of < 0.05, indicates that the result is significantly different from expected. The test does not assess trends (e.g. trends over time or trends associated with consecutive surveys; see next item).

Chi squared test for trend and P (trend) values

A statistical test applied to a Chi squared contingency table in which one of the variables has two categories (e.g. yes and no) and the other has more than two ordered categories (e.g. survey number to represent consecutive surveys over time). The test assesses whether there is a trend associated with the proportion of the first variable (e.g. proportion answering 'yes') in relation to the variable with ordered categories (e.g. a trend with consecutive surveys).

Mean and standard deviation (see also weighted mean and weighted standard deviation; Mean and Mean (adj))

The equations for the mean ($\bar{x}$) and standard deviation (sd) are:

$$\bar{x} = \frac{x_1 + x_2 \ldots + x_n}{N}$$

$$sd = \sqrt{\frac{\sum_{i=1}^{N} (x_i - \bar{x})^2}{N-1}}$$

where $x_1 + x_2 \ldots + x_n$ are the observations, N is the number of sample observations, and $\sum_{i=1}^{n} (x_i - \bar{x})^2$ represents the sum of the squared differences between the individual i observations and the mean ($\bar{x}$).

P value (P)

The probability of obtaining a given result, such as a difference, a correlation or a ratio, or more extreme result, assuming that for the particular result there is no difference, no correlation and that the ratio is 1.0.

Sensitivity (uncertainty) analysis

A sensitivity analysis is used to assess the variability in a result (outcome variable) when there is uncertainty about the values of an input variable (e.g. non-responses to a question). It quantifies how changes in the values of the input variable affect the outcome variable. If extreme values are assigned to the missing data of the input variable and there is little alteration in the results of the outcome variable, the sensitivity analysis can provide more confidence in the precision of the result.

Skewness (right or left skew)

A right or left skew indicates the tendency for a distribution to have a long tail (bunched up stretching to one or other side). If the tail is at the higher or upper end of the distribution, it is described as a right (or positive) skew. If the tail is at the lower end of the distribution it is described as a left (or negative) skew. When the mean is higher than the median, the distribution is likely to have a right skew (and if the mean is lower than the median, a left skew) although exceptions can occur, for example in multimodal distributions.

'Total' and 'Total adjusted' (Total (adj))

In this report the term 'Total' is used to indicate the mean and standard deviation of a series of observations. Surveys with larger sample sizes will contribute more to the result than those with smaller sample sizes. 'Total adjusted' (Total (adj) is used to indicate that the overall mean and standard deviation are calculated (see weighted mean and weighted standard deviation) assuming that all the individual surveys have equal weight (equivalent to equal sample size).

Weighted mean and weighted standard deviation

The equations for the weighted mean ($\bar{x}_w$) and weighted standard deviation (sd_w) are:

$$\bar{x}_w = \frac{w_1 x_1 + w_2 x_2 \ldots + w_n x_n}{N}$$

$$sd_w = \sqrt{\frac{\sum_{i=1}^{N} w_i (x_i - \bar{x}_w)^2}{\frac{(N'-1)\sum_{i=1}^{N} w_i}{N'}}}$$

where x_i ($x_1, x_2, \ldots x_n$) are the observations w_i are the weights and $\sum_{i=1}^{N} w_i (x_i - \bar{x}_w)^2$ represents the sum of the squared differences between the weighted individual i observations and the weighted mean ($\bar{x}_w$). N is the number of observations, N' is the number of non-zero weights and $\sum_{i=1}^{N} w_i (x_i - \bar{x}_w)^2$

is the sum of the squared differences between the weighted individual i observations and the weighted mean ($\bar{x}_w$).

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