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BAPEN
Putting patients at the centre of good nutritional care

The cost of malnutrition in England and potential cost savings from nutritional interventions (short version)

A report on the cost of disease-related malnutrition in England and a budget impact analysis of implementing the NICE clinical guidelines/quality standard on nutritional support in adults

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NHS
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National Institute for Health Research Southampton Biomedical Research Centre

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Health Research

The mission of the National Institute for Health Research Southampton Biomedical Research Centre (BRC) is to make a substantial contribution to the improvement of health through improving nutritional aspects of health promotion, prevention and treatment of ill-health. To achieve this mission the objectives are to:

- Establish a world-leading quality-assured framework within which a reliable nutritional diagnosis can be made for individuals, groups and populations;
- Develop a secure evidence base for nutritional interventions that promote health, prevent ill-health and treat disease, based upon stratified characterisation of risk, diagnosis and care, and which facilitates the achievement of appropriate nutrition competencies in the health workforce;
- Promote collaborations with clinical, academic and industry partners locally, nationally and internationally to further translational research in nutrition;
- Enable the City of Southampton to become a model for integrated, cross-sectoral nutritional well-being for the promotion of health, the prevention of ill-health and the treatment of disease across the primary, secondary, tertiary and quaternary sectors, based on stratified need.

British Association for Parenteral and Enteral Nutrition

BAPEN
Putting patients at the centre of good nutritional care

The British association for Parenteral and Enteral Nutrition (BAPEN) is a charitable association that raises awareness of malnutrition and works to advance the nutritional care of patients and those at risk from malnutrition in the wider community. Its membership is drawn from doctors, dietitians, nurses, patients, pharmacists and 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 social care professionals to support the implementation of nutritional care across all care 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 economic report resulted from collaboration between the Malnutrition Action Group, a standing committee of BAPEN, and the National Institute for Health Research Southampton Biomedical Research Centre.

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Key points

- Malnutrition is a common clinical and public health problem, affecting all ages and all care settings.
- The cost of malnutrition in England was estimated to be £19.6 billion per year, or more than 15% of the total public expenditure on health and social care. About half of this is expenditure is due to older people (>65 years), and the other half to younger adults and children.
- Interventions with nutritional support (to implement the NICE clinical guidelines/quality standard), including oral nutrition supplements (ONS), enteral tube feeding (ETF) and parenteral nutrition (PN) in hospital and community settings, were found to lead to greater net cost savings than those reported by NICE. The savings were even greater when the prevalence of malnutrition was high, when hospital admission rates were high, and when the gap between current care and desirable nutritional care was high.

Background

This is a short version of a detailed economic report[1] on the cost of malnutrition in England and a budget impact analysis on the effects of treating malnutrition according to the NICE clinical guidelines/quality standard. The document begins by outlining the burden of malnutrition and the need for concerted action to combat it.

Malnutrition is common problem

Malnutrition is a common clinical and public health problem in England, which is found in all care settings, all disease categories, and individuals of all ages. Using the Malnutrition Universal Screening Tool (MUST) for adults[2] in England it is estimated to affect about:

- 30% of adults on admission to hospital[3-7] and about 34% of those in hospital wards
- 35% of adults admitted to care homes in the previous 6 months and about 35 % of those resident in care homes[3-6, 8]
- 18% of adults on admission to mental health units[3-6]
- 15% or more of adults attending hospital outpatients[9-11]
- 12–14% of adults in sheltered housing[12-14]
- 10% of adults visiting their general practitioner (GP)[1, 15]
- 5% of the adult population of England[1, 16].

With an aging population the problem is expected to increase further since the prevalence of malnutrition increases with age.

The prevalence of malnutrition in children is also substantial, and varies with care settings and the method by which it is identified. Estimates suggest that the prevalence generally ranges from about 5% to 15% among those accessing healthcare services in routine practice in hospital and community settings[1].

Malnutrition predisposes to disease and adversely affects its outcome

Since malnutrition can detrimentally affect the function of all tissues within the body, it can predispose to a variety of diseases and adversely affect their clinical outcomes. Some examples are shown in Table 1, but the overall consequences can be summarised as follows:

- Adverse effects on mortality, morbidity (including increased complications after accidental and elective surgical injury) and quality of life
- Delayed recovery from illness (prolonged length of hospital stay and delayed rehabilitation)
- Impaired body function detrimentally affecting well-being and activities of daily living, some of which are shown in Table 2.

Evidence indicates that prevention and treatment of malnutrition can reduce or abolish many of its detrimental clinical and functional consequences.

Table 1 Mechanisms by which malnutrition predisposes to certain clinical problems and delays their resolution*

Morbidity	Mechanism
General infection	Loss of immune tissue and function, reducing the ability of the body to fight infection
Chest infection	Loss of respiratory muscle mass and function, reducing cough pressure and expectoration of mucus/mucus plugs and infected material
Skin infections	Thin friable skin, which can be breached easily, allowing microbes to enter through the skin
Respiratory failure (and delayed weaning from ventilators)	Loss of respiratory muscle strength and early fatigue, predisposing to respiratory failure in those with poor respiratory reserve
Hypothermia	Loss of insulation (subcutaneous fat) and impaired thermoregulation (central effect)
Deep vein thrombosis and embolism	Inactivity and immobility, partly due to loss of muscle mass and function, and partly due to behavioural effects (loss of energy if associated with disease-related malnutrition), predisposes to thromboembolism
Pressure ulcers	Loss of skin and subcutaneous fat, resulting in greater pressure over bony protuberances, and reduced activity or immobility (see above)
Wound complications	Weaker wounds (less collagen deposition) more likely to burst and become infected (see also ‘General infections’ and ‘Skin infections’)
Psychological effects: tendency to depression, hypochondriasis, anxiety, loss of libido, and impaired mother-child interactions	Central effects in the brain, which can develop in the absence of disease, and which can be reversed by re-feeding
Infertility	Irregular or absence (in the presence of severe malnutrition) of menstrual cycles and reduced sperm in men; loss of libido

* Largely based on references[16-18] (it is worth noting that disease can also predispose to malnutrition.

Table 2 Some common problems experienced by individuals with malnutrition

Problem	Mechanism
Falls	Muscle weakness and/or poor coordination
Problems with shopping, cooking and eating	Muscle weakness and/or poor coordination
Reduced ability to work and support others	Loss of energy, reduced strength, and fatigability
Self-neglect	Weakness, inability to self-care, and psychological disturbances induced by malnutrition
Dependency on others	Reduced ability to self-care
Impaired social function including mother-child bonding	Feeling of weakness, fatigue, generally unwell, and other central effects of malnutrition, including introversion

Malnutrition increases healthcare use

Since malnutrition affects about 1 in 20 subjects of the general population, and a greater proportion of subjects utilising healthcare (about 1 in 3 in care homes and hospitals and about 1 in 10 among those visiting their GP; see above), malnourished people have a disproportionately high healthcare requirements[1].

Research has shown that malnutrition increases:

- Hospital admissions, length of hospital stay, as well as hospital readmission following discharge from hospital
- Risk of becoming dependent on others and becoming a permanent resident in care homes, especially those with nursing care
- GP visits and prescriptions.

Prevention and treatment of malnutrition is expected to reduce healthcare use and associated expenditure.

The economic report[1] produced jointly by the British Association for parenteral and Enteral Nutrition (BAPEN) and the National Institute for Health Research Southampton Biomedical Research Centre (NIHR Southampton BRC) addressed two issues in two separate sections. The first examined the economic burden of malnutrition in England and the second the potential cost savings associated with fuller implementation of the NICE clinical guidelines/quality standard on nutritional support in adults in hospital and community settings.

Part A The cost of malnutrition in England in 2011–12

The cost of health and social care

The total public expenditure on health and social care in England in 2011–12 amounted to £127.5 billion (Figure 1). Of the total healthcare expenditure of £101.6 billion, £90.6 billion was purchased.

It was estimated that:

- The cost of healthcare was about four times greater than that of social care
- The cost of secondary health care was more than three times greater than primary care
- About 16% of the total expenditure on health and social care was considered to involve children and the remainder approximately equally split between older and younger adults.

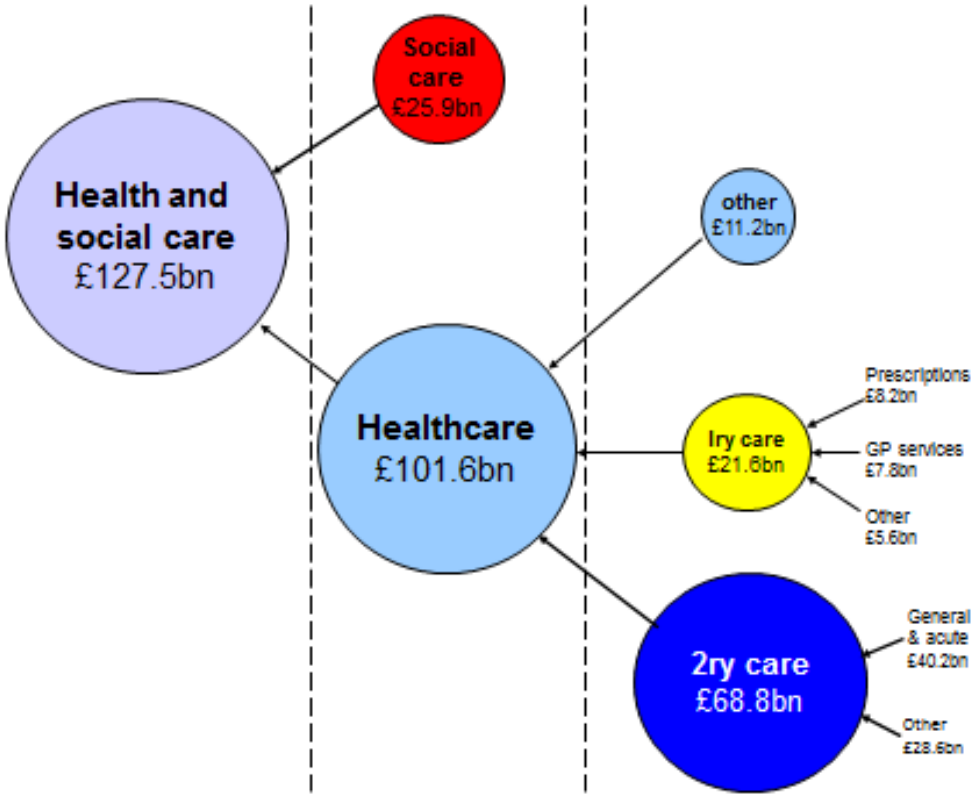

Figure 1 Budget for health and social care in England in 2011–12[1]. The budgets for primary and secondary care relate to purchased care (1ry = primary care; 2ry = secondary care).

The cost of malnutrition

- Public expenditure on malnutrition was estimated to be £19.6 billion in England in 2011–12, or more than 15% of the total expenditure on health and social care. The cost was calculated from the proportion of healthcare activity due to malnutrition and the cost for this activity, which in some cases was uplifted to take into account additional known effects of malnutrition, such as prolongation of length of hospital stay.
- Most of the cost of malnutrition was due to healthcare (78%) rather than social care (22%).

- Older adults accounted for a little more than half of the total cost of malnutrition in health and social care, and children and younger adults together for a little less than half (Figure 2).

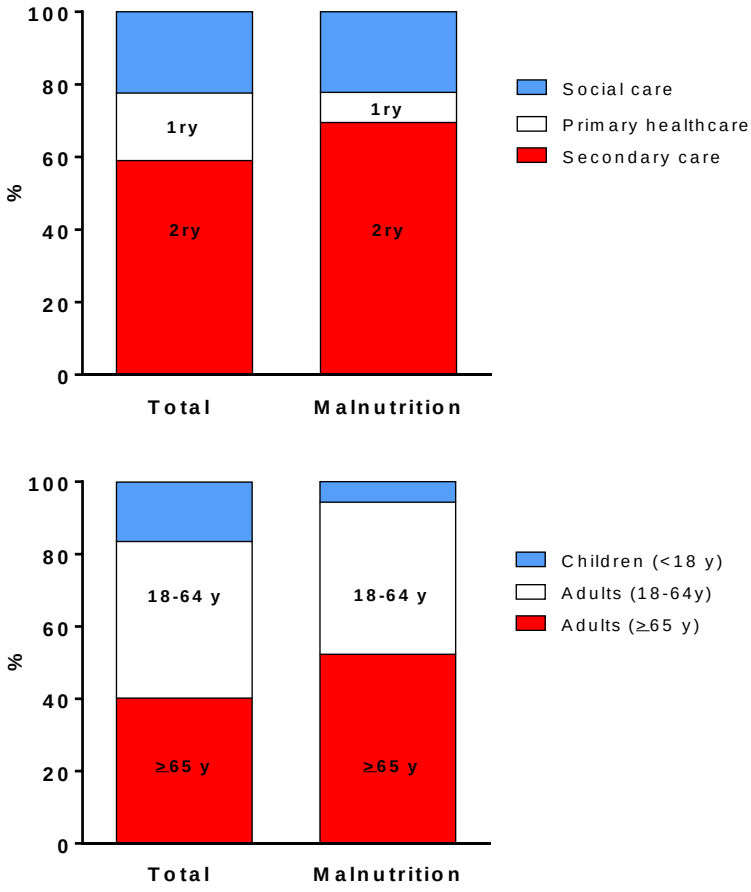

Figure 2 The distribution of total public health and social care expenditure in England (£127.5 billion) and in the subgroup of individuals with malnutrition (£19.6 billion) according to type of care *(upper graph)* and age category *(lower graph)* (base case analysis) (1ry = primary care; 2ry = secondary care)[1].

- The healthcare cost of malnutrition was dominated by secondary care rather than primary care and to a greater extent than that for the general population.
- The annual cost per subject with malnutrition or risk of malnutrition ('malnutrition') (£7408 per subject per year) was three to four times greater than that for a non-malnourished subject (£2155 per subject per year) (Figure 3).
- The incremental cost of treating a malnourished subject was two to three times greater than that for a non-malnourished subject (Figure 3).
- Although most of the cost of malnutrition was due to secondary care, predominantly in the hospital setting, a new analysis indicates that only 2% of malnourished subjects were found in hospital at a given point in time (Figure 4). This is because a mere 136,332 hospital beds were occupied in in England in 2011 (127,832 publicly funded and ~8500 privately funded), only a proportion of which were occupied by malnourished subjects. Most malnutrition is harboured in the community followed by care homes, which have several times more occupied beds than hospitals. However, the expensive hospital environment has a high turnover of patients (more than 10 million inpatient admissions and more than 40 million outpatient attendances per year), which explains the high contribution of hospitals to overall costs. The hospital setting offers an excellent opportunity to identify malnutrition and to start treatment there, which can be continued in the community if necessary.

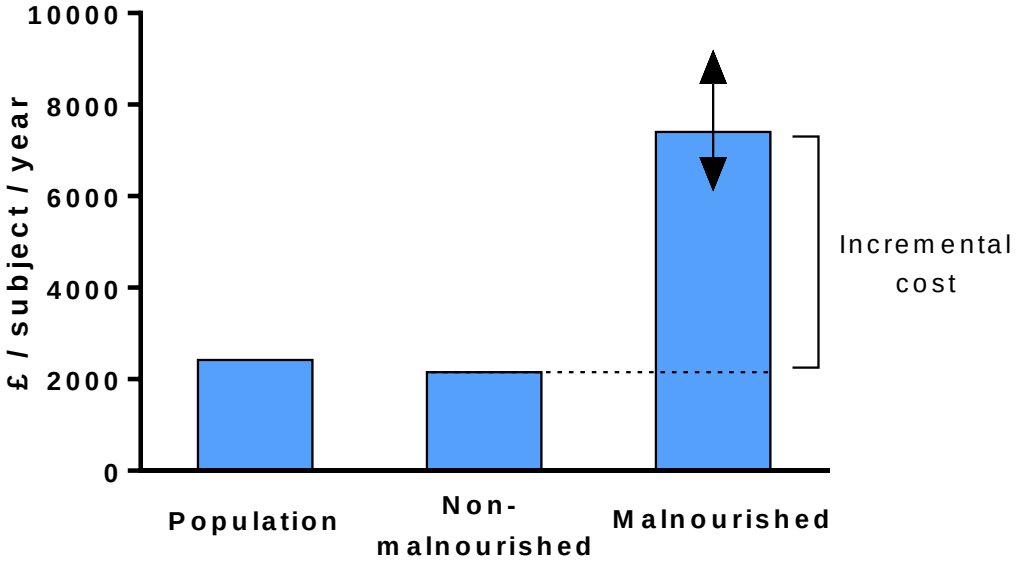

Figure 3 Public expenditure on health and social care per subject in the general population, per subject without malnutrition and per subject with malnutrition (medium + high risk according to MUST)[1]. The top of the bars represent the values calculated assuming that 5% of the population is malnourished or at risk of malnutrition. The tip of the upper arrow head above the bar for the malnourished represents the value calculated assuming that 4% of the population is malnourished and the tip of the lower arrowhead assuming that 6% of the population is malnourished. No arrowheads are shown for the non-malnourished because the base case value was affected by only about ± 1%.

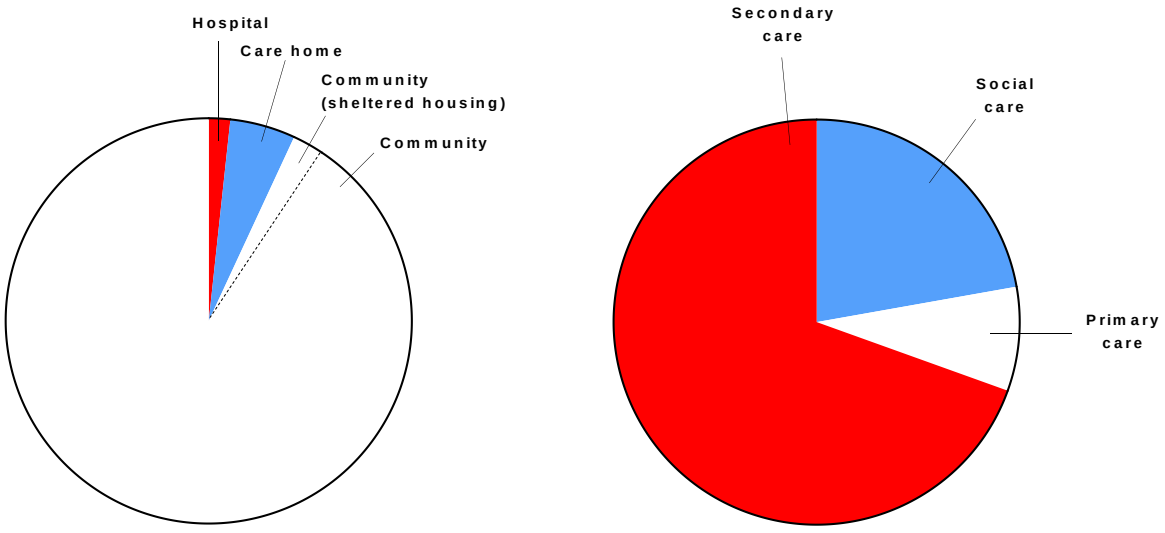

Figure 4 The estimated distribution of malnutrition (medium + high risk using MUST) at a given point in time by care setting *(left chart)*[1]. The estimated distribution of costs between primary care (mainly community), secondary care (mainly acute hospitals), and social care (mainly care homes and community) *(right chart)*[1].

Conclusion

1. Malnutrition is not only a major clinical and public health problem but also a major economic problem, with an estimated cost of £19.6 billion in England in 2011–12. Small fractional cost savings would therefore produce large absolute net savings.

2. Since malnutrition affects individuals of all ages, campaigns to combat it should not be restricted to older malnourished people, despite their accounting for about half of the total expenditure on malnutrition in the health and social care sectors.

3. Efforts to prevent of malnutrition and to treat it early could potentially have major effects in reducing both the clinical and economic burden of malnutrition.

Part B Budget (cost) impact analysis involving implementation of the NICE clinical guidelines (CG32)/ quality standard (QS24)

Background

NICE produced two costing reports with a budget impact analysis which examined the effects of treating malnutrition in adults: one in 2006 which accompanies the NICE clinical guidelines on nutritional support in adults (CG32)[19], and the other in 2012 to accompany the quality standard on nutritional support in adults (QS24)[20]. Both indicated that a change in the current pathway of nutritional care to one incorporating the NICE clinical guidelines/quality standard would produce an overall net cost saving, while improving the quality of care. Nutritional support in adults was ranked as the third highest among a wide range of other cost saving interventions associated with implementation of NICE guidelines/standards. In this report, the NICE costing template has been updated, rationalised and modified in many ways, using evidence-based information when appropriate. It also used expert opinion about current clinical practice and multidisciplinary nutritional care. Uncertainties were explored using a series of sensitivity analyses.

Methodology

- The basic model involved three steps (Figure 5): calculating the extra cost necessary to change the current pathway of nutritional care to one (the proposed pathway) that incorporates the NICE clinical guidelines/quality standard (NICE CG/QS); calculating the cost saving associated with implementing the proposed pathway; and calculating the overall budget impact (net cost saving) as the difference between the two.

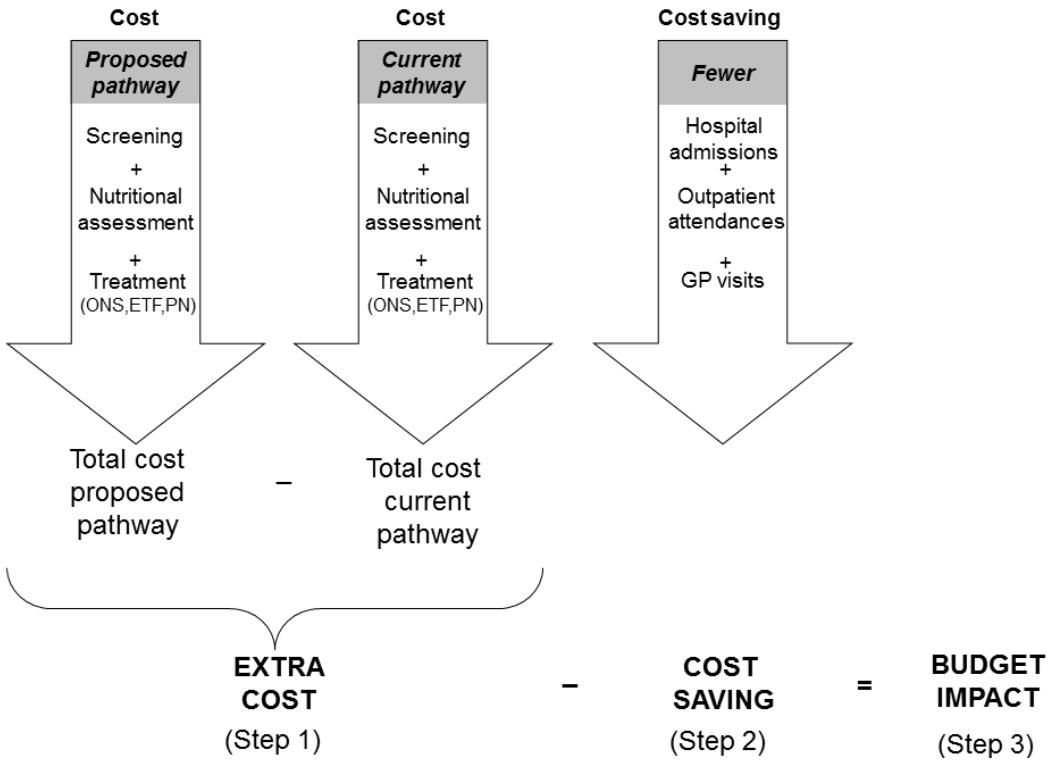

Figure 5 Flow diagram illustrating the basic model involving both hospital and community settings.

- Use was made of information from the Health and Social Care Information Centre (specifically requested for this project), the Nutrition Screening Surveys, various publications on malnutrition, particularly those using the 'Malnutrition Universal Screening Tool' ('MUST'), and systematic reviews with meta-analyses.
- Since the NICE CG/QS involved screening, assessment and treatment in hospital and community (plus care home) settings, the calculations involved all these settings (Table 3).

Table 3 Matrix of component costs associated with the current and proposed pathways

	Hospital inpatients	Hospital outpatients (new attendances)	Community (new GP registrations)	Community (care home and own home)
Screening	Screening hospital inpatients	Screening hospital outpatients	Screening GP practice	†
Assessment	Assessment hospital inpatients	Assessment hospital outpatients	Assessment GP practice	Assessment community
Treatment: ONS	ONS hospital inpatients	ONS+ hospital outpatients	ONS	ONS community
ETF	ETF hospital inpatients		*	ETF community
PN	PN hospital inpatients	*	*	PN community

ONS = oral nutrition supplements; ETF = enteral tube feeding; PN = parenteral nutrition; GP = general practitioner
† Since screening in care homes is not funded by the NHS (it is financed by the social care services) it is not considered
+ Although the patients are living in the community these ONS costs are paid by the hospital. If ONS are to be continued they are paid from the GP practice (primary care) budget
* Any ETF or PN already taking place in patients registering with their GP is included in the last column (community-home enteral tube feeding or home parenteral nutrition)

Findings

- The results of five models involving nutritional support in ~85% of subjects with high risk of malnutrition according to MUST are shown in Table 4. In all cases there was a net cost saving ranging from £63,192,501 to £81,870,330.
- The net cost saving established with these five models are also shown in Figure 6, with the results expressed per 100,000 of the general population (£119,000 to £154,000 per 100,000 of the general population) (as in the NICE documents), which approximates to the population served by a parliamentary constituency. In the full report the results are also expressed per 250,000 of the population, which approximates to the population served by a clinical commissioning group (CCG). Figure 6 also shows two other results: first, it illustrates the additional cost saving associated with treatment of 85% of subjects with medium + high risk of malnutrition according to MUST in comparison with the earlier models in which nutritional support was provided only to those with high risk of malnutrition (total cost saving £325,000 to £432,000 per 100,000 of the general population); second, it illustrates the effect of treating the extra subjects with medium risk of malnutrition entirely with oral nutritional supplements (ONS), in comparison with a combination of ONS and other forms of oral nutritional support. There is a particular need to strengthen the evidence base for oral (non-ONS) nutritional support.
- A breakdown of the costs associated with treating more malnourished subjects is shown in Figure 7 using one of the models (model 5). Nutritional screening contributed more costs than assessment and more costs than individual treatments with parenteral nutrition, enteral nutrition and oral nutrition supplements in all care settings.
- Nutritional interventions were found to not only produce a net cost saving (rather than a net cost) but also to an extent that is greater than that reported by NICE. Although the difference is due to the use of different models relying on a variety of different assumptions, one of the important distinctions is that the present work involved more malnourished subjects than the NICE models.

Table 4 A summary of the budget impact analysis (treatment of 80–90% of those at high risk of malnutrition)

Analysis (model)	Treatment and setting	Cost	Cost saving	Budget impact (net saving)
1	ONS: hospital (IP + OP†) community (GP +CH)	£38,613,913	£101,806,414	£63,192,501
2	Oral*: hospital (IP + OP†)	£19,167,133	£101,037,463	£81,870,330
3	Oral*: hospital (IP +OP†) community (GP + CH)	£38,613,913	£115,527,927	£76,914,014
4	Oral*: hospital (IP + OP†) community (GP + CH) ETF + PN: hospital IP††	£49,735,973	£126,649,987	£76,914,014
5	Oral*: hospital (IP + OP†) community (GP + CH) ETF + PN: hospital (IP††) community (GP + CH)	£61,165,437	£126,649,987	£65,484,550

ETF = enteral tube feeding; PN = parenteral nutrition; IP = inpatients; OP = outpatients; GP = general practitioner; CH = care home

*Oral = ONS + other oral treatment following and including the costs of screening and assessment (e.g. dietary counselling, diet modification or fortification). It was assumed that oral (non-ONS) nutritional support was half as effective as ONS. The main report provides the background to this assumption and provides the results of a range of sensitivity analyses.

† assumes that outpatient activity is cost neutral, with the extra costs being balanced by the savings so that the budget impact remains unaltered (this assumption is varied in the sensitivity analysis)

†† assumes that the cost of ETF and PN for IP is cost neutral, with the extra costs being balanced by the extra savings so that the budget impact remains unaltered (this assumption is varied in the sensitivity analysis)

- There is a clear need to spend extra money to undertake more screening and more assessment, and to provide more nutritional support (Figure 7) to reduce the extent to which malnutrition is undetected and untreated. However, the interventions were found to produce savings that overshadow the costs, ultimately producing a net cost saving (Table 4; Figures 6 and 7). These occurred despite the presence of disease, which may show little or no response to nutritional support.
- The models involved only a portion of the entire population of malnourished adults. They included only a minority of adults attending GP surgeries and outpatient clinics and only a fraction of the resident care home population. This is mainly because the NICE models and the new model used for the present analysis examined the effects of applying the NICE clinical guidelines/quality standard, which targeted only new GP registrations, new outpatient attendances, and new admissions to care homes. In addition, the results only considered the NHS costs. It is therefore likely that in reality, efforts to improve identification and treatment of malnutrition in every social care and health setting would result in even greater overall costs saving whilst improving clinical outcomes and the quality of health services.
- Care should be taken not to extrapolate the results uncritically to other countries or to local economies within England since they may differ substantially in their practice. For example, in the models used in this report (and also the 2012 NICE costing report) it was assumed that 65% of relevant hospital admissions were already screened (current practice), leaving relatively little room for further increments in the proposed pathway of care. Sensitivity analyses not only showed that the net cost savings are likely to be greater when the care gap (between current practice and desirable high quality care) is large rather than small, but also when the prevalence of malnutrition is higher, and when hospital admission rates are higher.

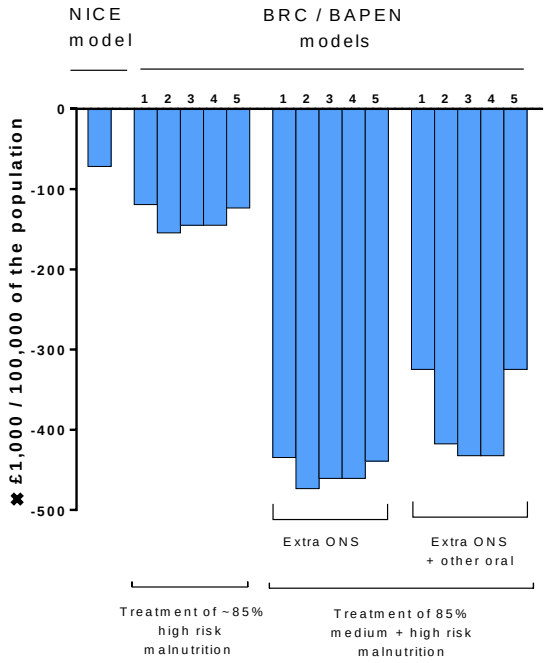

Figure 6 Net cost saving according to type of model, severity of malnutrition treated, and whether the extra treatment associated with medium-risk malnutrition involved ONS alone or ONS plus other forms of oral nutritional support. NICE = National Institute for Health and Care Excellence; BRC / BAPEN = National Institute for Health Research Southampton Biomedical Research Centre / British Association for Parenteral and Enteral Nutrition. The numbers at the top of the bars refer to the type of model used (1 = ONS in all settings; 2 = oral (ONS and non-ONS) in hospital inpatients and outpatients; 3 = oral (ONS and non-ONS) in hospital and community settings; 4 = as for 3 + enteral tube feeding and parenteral nutrition in hospital; 5 = as for 3 + enteral tube feeding and parenteral nutrition in hospital and community settings. 'Extra ONS' refers to the use of extra ONS to support subjects with medium risk of malnutrition (without dietetic referral) and 'Extra ONS + other oral' refers to the use of extra ONS plus other forms of nutritional support (with referral to a dietitian), using the proportions specified in the base case model.

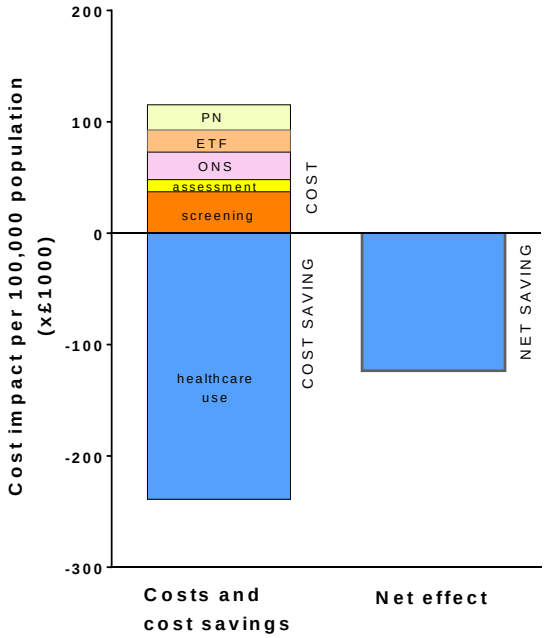

Figure 7 The costs, cost savings and budget impact (net effect) of providing nutritional support to ~85% of subjects with high risk of malnutrition (model 5). PN = parenteral nutrition, ETF = enteral tube feeding, ONS = oral nutritional supplements.

Conclusion

1. The economic budget impact analyses indicate that the use of nutritional support including ONS, EFT and PN ultimately save rather than cost money (£119,000 – £432,000 per 100,000 depending on the model used). It is necessary to make a commitment to invest money before the financial benefits can be reaped.

2. The economic benefits of interventions are greater when the prevalence of malnutrition is high, when hospital admission rates are high, and when the gap between current and high quality care is large.

3. Although sensitivity analyses indicate that the models used were generally robust, more evidence-based information is required to help refine them, especially on the clinical and economic effects of dietary advice and other forms of oral (non-ONS) nutritional support.

4. The analysis, which was based only on treatment of established malnutrition, involved only a small portion of the total population of malnourished subjects. Models to examine the effects of preventive measures and treatment of malnutrition more widely are required.

5. The burden of malnutrition should be tackled in an integrated and coordinated manner by multidisciplinary groups of health and social workers, including health planners, commissioners, clinicians, nurses, dietitians and pharmacists. The role of each should be clearly defined.

Glossary of terms

Assessment (nutritional assessment): Detailed, specific and in-depth evaluation of a subject's nutritional state undertaken by a professional with nutritional expertise. It is usually performed when there are serious nutritional problems and typically following nutritional screening.

Body mass index (BMI): Body mass index (weight (kg)/height^2 (m^2)) is a measure of weight status. The adjustment for height allows people to be categorised as underweight, desirable weight, overweight and obese.

Care home: A residential setting where residents access services, which may range from personal care and nursing care, to other special types of care such as palliative care or care for the elderly mentally ill. Individual care homes may provide one or more of these services. 'Residential care homes' are now often referred to as 'care homes' and 'nursing homes' as 'care homes with nursing'.

Clinical commissioning groups (CCGs): Groups of general practices with the responsibility for commissioning most health and care services for patients in England, as set out in the Health and Social Care Act 2012. CCGs are made up of doctors, nurses, dietitians, pharmacists and other professionals, who work in partnership with local authorities and local communities. They became legal entities in 2013 after the abolition of Primary Care Trusts (PCTs).

Dietary advice (dietary counselling): Advice provided by a qualified healthcare worker to modify the quantity, texture and/or proportions of food ingested.

Enteral tube feeding (ETF): Use of a tube to deliver a feed directly into the stomach or gut.

Home enteral tube feeding (HETF): Enteral tube feeding in the community setting.

Home parenteral nutrition (HPN): Parenteral nutrition in the community setting.

Malnutrition: A state of nutrition in which a deficiency of energy, protein and/or other nutrients causes measurable adverse effects on tissue/body form (body size, shape and composition) and function and on clinical outcomes (in this report malnutrition is not used to describe overweight/obesity). In this report malnutrition is generally identified with the Malnutrition Universal Screening Tool (MUST).

Malnutrition Universal Screening Tool (MUST): Nutrition screening tool to identify adults who are malnourished, at risk of malnutrition (undernutrition), or obese. It also includes management guidelines which can be used to develop a care plan. It can be used in hospitals, community and other care settings and by a range of workers. A person is considered to be at high risk of malnutrition if the body mass index (BMI) is <18.5 kg/m^2, has suffered unintentional weight loss >10% within the previous 3–6 months, or a combination of a BMI 18.5–20 kg/m^2 and unintentional weight loss of 5–10% body weight in the previous 3–6 months. In the acute hospital setting no intake or likely no intake for >5 days is also a criterion for high risk of malnutrition. Medium risk of malnutrition is identified by the presence of either a BMI 18.5–20 kg/m^2 or unintentional or weight loss of 5–10% of body weight in the previous 3–6 months.

Meta-analysis: Statistical procedure used to amalgamate the results of two or more independent studies to establish a single quantitative estimate of a treatment effect. The meta-analysis can involve a fixed-effect model that aims to establish a single quantitative common true effect size (i.e. the differences between studies are simply due to random error associated with each study). In contrast, a random-effects model assumes that study populations differ from each other in ways that could affect the treatment effect (i.e. the differences between studies are due both to random error and real differences in effect size). In the fixed-effect model, there is only one true effect size, whereas in the random-effects model there is a range of effect sizes, which means that the summary statistic represents the average of a distribution of values. Judgment is necessary to decide which studies to pool together in a single meta-analysis. Sometimes it is inappropriate or misleading to establish a summary statistic if the studies are intrinsically different (equivalent to mixing 'apples' and 'oranges').

Nutritional support: Provision of nutrients orally or by tube and/or intravenously (parenterally) with the aim of improving or maintaining a person intravenously (parenterally) and avoiding complications of an underlying disease).

Older adults: Subjects aged 65 years and over (see also Younger adults).

Oral nutrition support: Alterations in food and/or fluid intake with a view to increasing dietary intake or avoiding problems due to an underlying disease. The support may include the following: dietary advice on how to increase intake or exclude certain food items or constituents; fortification of food with nutrients; provision of snacks and oral nutritional supplements; changes in the texture of food and fluid; and change in the frequency and pattern of meal ingestion.

Operating costs: Ongoing costs (excludes capital costs).

Parenteral nutrition (PN): Nutrition provided intravenously, typically involving an infusion of amino acids, glucose, fat, vitamins, trace elements and electrolytes.

Prevalence: The number of people with a particular condition present within a population. It may be expressed as a percentage (per 100 of population) or per thousand or per million of population.

Primary care: Primary care is generally considered to be healthcare provided outside acute and mental health trusts, with the aim of meeting local care needs. It includes services provided by GPs, nurses, dietitians and pharmacists. Patients may initially contact their primary care practitioner(s) with their healthcare problems, but they may be referred to secondary care practitioners in hospital or mental health units for special investigation and treatment (see also Secondary care, which describes the grey area between primary and secondary care).

Randomised controlled trial (RCT): A study in which subjects allocated at random to intervention and control groups are followed-up to establish differences in outcome. The RCT may include more than one intervention and more than one control group, e.g. the control group could involve no treatment or routine care.

Screening (nutritional screening): A rapid, simple and general procedure used by nursing, medical or other staff, often at first contact with the patient, to detect subjects who have significant nutritional problems or risks of such problems, so that a clear plan of action can be implemented, e.g. simple dietary measures or referral for expert help.

Secondary care: Secondary care generally refers to healthcare provided by medical specialists and other health professionals, who generally do not have first contact with patients. However, it includes care in a hospital emergency department, where patients may be seen and treated directly by specialists without prior referral. Furthermore, some secondary care could operate outside the hospital setting and some primary care could operate within the hospital setting, e.g. primary care hospitals dedicated to rehabilitative and palliative care.

Sensitivity analysis: A statistical method in which the underlying assumptions are altered to test the robustness of the results and conclusions. It quantifies the extent to which changes in an input variable alters the value of an outcome variable. Uncertainty may arise from missing data and methodological imprecision. In one-way sensitivity analysis each parameter is varied individually, while other variables are kept constant. In two-way sensitivity analysis (the commonest type of multi-way sensitivity analysis) two parameters are varied simultaneously, while other variables are kept constant. Sensitivity analysis can also be used to establish relationships between input and output variables and to help make messages more understandable.

Systematic review: A critical objective appraisal of evidence, conducted according to explicit and reproducible methodology in order to reduce the risk of bias and random errors. A systematic review does not necessarily include a meta-analysis.

Younger adults: Subjects aged 18–64 years (see also Older adults).

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