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Impact of a dietitian in general practice: Care of the frail and malnourished

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DIETITIAN AS FIRST CONTACT PRACTITIONER

Caring for malnourished and frail elderly



1

75% OF PATIENTS TRIAGED AT RISK OF MALNUTRITION



2

FOR 94% OF PATIENTS DIETITIAN ACTED AS FIRST CONTACT PRACTITIONER



3

DIETITIAN IMPROVED FRAILTY & MALNUTRITION SCORES



4

WEIGHT, BMI AND HANDGRIP ALL IMPROVED



5

92% PATIENTS ACHIEVED DIETARY GOALS



6

PROJECTED £15K COST SAVINGS

Title page

Impact of a dietitian in general practice: Care of the frail and malnourished

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Conflicts of interest

Mary Hickson and Avril Collinson are members of the BDA. Jenny Child has no conflicts of interest to declare.

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Authorship

All authors contributed to the conception and design of the study, MH & AC completed the analysis and interpretation of the data, MH wrote the initial draft the paper. All authors critically reviewed its content and have approved the final version submitted for publication.

Ethics

Ethical approval was granted by the Faculty of Health Research Ethics and Integrity Committee, University of Plymouth [18/19-1098] and permission obtained from Primary Care Network involved for the project to be undertaken.

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Study Highlights

- 75% of older underweight patients in the GP practice triaged at risk of malnutrition indicating a need for dietetic intervention
- The dietitian acted as the First Contact Practitioner for 94% of the patients seen (they had no other current input from the GP team)
- The dietetic intervention improved frailty and nutritional status scores
- The mean weight, BMI and handgrip strength also improved after dietetic intervention
- 92% of patients seen by the dietitian achieved their agreed dietary goals
- Cost saving were projected to be over £15K for one year from the optimised use of oral nutritional supplements alone

Infographic caption

There is an increased demand in primary healthcare and dietitians are ideal professionals to lead the management of patients with malnutrition and frailty. The evaluation of a model of dietetic care within a primary care network showed that the model was feasible, and allowed the dietitian to work as a first contact practitioner, reducing the GP workload. The dietitian delivered improved patient outcomes, cost savings and patients' were satisfied with the service.

Impact of a dietitian in general practice: Care of the frail and malnourished

Abstract

Background:

There is an increased demand in primary healthcare but General Practitioner (GP) numbers are declining, creating significant challenges. Dietitians are ideal professionals to lead the treatment of patients with conditions that are amenable to dietary manipulation, including the management of malnutrition and frailty.

To evaluate the benefits of a model of care in which a dietitian, working as a first contact practitioner, within a general practice, provided care to patients at risk of malnutrition and frailty, in order to reduce GP workload, improve patient care and make cost savings.

Methodology:

A service evaluation with a dietitian employed 6 hours per week for 6 months. The practice database was screened for patients aged ≥ 65 yrs and electronic Frailty Index 0.26-0.36 or $BMI < 19 \text{ kg/m}^2$. These patients were triaged by the dietitian and those at risk of malnutrition offered consultations. Patients prescribed oral nutritional supplements (ONS) and not under dietetic management were also seen.

Results:

Approximately 1200 patients met the screening criteria; 189 (16%) patients were triaged by the dietitian. Most (75%) were at risk of malnutrition and 63 of these were seen. Improvements in strength, frailty and nutrition status were observed, and changes to ONS prescriptions in 27 patients equated to annual cost savings of £15,379. Patient satisfaction was high.

Principal conclusions:

Dietitians, acting as first contact practitioners, can deliver significant improvements in care for older people at risk of malnutrition and frailty as part of the practice multi-disciplinary team. Cost savings for ONS were made and other potential cost saving were evident.

250/250 words

Key words

General Practice; Primary care; Dietetics; Frailty; Malnutrition; workforce

Introduction

The organisation and delivery of healthcare is affected by demographic shifts occurring in society, such as an ageing population, an increase in long-term conditions, changes in the ethnic diversity of society, as well as health inequalities and limited funding.⁽¹⁾ These demographic changes have led to an increased healthcare demand at the same time as GP numbers are declining, resulting in significant challenges within the primary care sector.⁽²⁾ Several policy documents have proposed solutions. The NHS Long Term Plan places primary care at the centre; looking at doing things differently through a new service model, taking more action on preventative measures, and improving care quality and outcomes for major conditions⁽³⁾. The General Practice Forward View⁽⁴⁾ advises making better use of the wider primary care workforce to reduce demand on GP time. The Primary Care Workforce Commission⁽⁵⁾ describes a vision in which a new 'expert generalist' healthcare professional role will emerge, with the competencies to manage significant parts of the primary care workload.

The traditional model for dietetic work in primary care is through outreach clinics and education programmes, delivered by dietitians working in community or acute settings, or delivering dietetic clinics within GP surgeries taking referrals from GPs. There is now a need to explore new models of dietetic care to find effective and efficient modes of practice in the primary care setting. Dietitians are ideal professionals to lead the treatment of patients with conditions that are amenable to dietary manipulation, such as diabetes mellitus, cardiovascular disease, over- and under-weight, food allergies, chronic obstructive pulmonary disease, gastrointestinal, renal and liver conditions, as well as help support the management of mental health conditions and frailty. This project focused on the management of frailty and malnutrition; an area that is often not given priority⁽⁶⁾.

Frailty is associated with older age and chronic disease and increases the risk of falls, disability, hospitalisation and mortality⁽⁷⁾. Therefore, there is a need to ensure early identification and treatment to help minimise decline into frailty and reduce its impact. This is an expanding area of work because the UK population is ageing⁽⁸⁾; a nationally representative sample of middle-aged and young-old adults (37-73yrs) showed 3% were severely frail and 38% were pre-frail⁽⁹⁾. These rates are known to be higher in older age groups; one sample showing 65% of 90+yr olds at risk of frailty⁽¹⁰⁾. In 2017 the GP contract for England introduced a new requirement to identify, and appropriately manage, all patients aged over 64 years with moderate or severe frailty⁽¹¹⁾. It was recommended that the electronic Frailty Index (eFI) is used to help identify those at risk, in combination with clinical judgement⁽¹²⁾. The requirement for clinical judgement is important and requires anyone identified as frail using the eFI to be assessed further.

Frailty and malnutrition are distinct conditions, although they often occur together, each exacerbating the other. For example, an episode of illness can result in appetite loss and reduced food intake, resulting in weight loss and malnutrition. This involves loss of fat and lean tissue resulting in weakness and affecting activities of daily living; thus triggering a decline into the spectrum of frailty. Frailty, like malnutrition, is not a binary condition but exists on a spectrum of severity. It can be measured using clinical descriptors or as an accumulation of deficits (symptoms and diseases) which increase the likelihood of adverse outcomes. Estimates of the prevalence of malnutrition or risk of malnutrition in a frail community dwelling population vary between 51%⁽¹³⁾ to 66%⁽¹⁴⁾, and the prevalence of frailty in an at risk or malnourished community dwelling population are between 10%⁽¹⁴⁾ to 46%⁽¹³⁾. The variation is likely due to the populations studied, but indicate that there is significant overlap between the syndromes, and screening for both will ensure targeted appropriate care. Dietitians clearly have the skills to treat malnutrition. Since the evidence suggests that a combination of muscle strength training and protein supplementation is the most effective

intervention to delay or reverse frailty⁽¹⁵⁾, dietitians also have a role in the prevention and treatment of frailty.

The evidence for models of dietetic care for managing malnutrition within primary care settings are scarce, nevertheless what is available is encouraging to support of the effective working of dietitians in the area of malnutrition. A scoping review (unpublished, Hickson) found only eight articles relating to malnutrition in older adults. There were two RCTs^(16; 17) providing conflicting evidence. Endevelt *et al*⁽¹⁶⁾ tested dietitian-led case management (n=35) against physician-led (n=33) and untreated (usual care) (n=59) for 6 months. Results showed that dietitian-led care improved cognitive function, depression, and dietary intake, but not number of diagnoses, prescribed medications or physical function. The short follow-up in this study was a noted limitation, but the data supports the possibility that dietitians can produce improved outcomes over usual care or physician-led care⁽¹⁶⁾. Schilp *et al*⁽¹⁷⁾ compared dietetic treatment (n=72) to no treatment (n=74), with an emphasis on goal-setting and motivational interviewing techniques. In contrast to Endevelt *et al*, at 6 months Schilp *et al* found no improvements in weight, physical function, or food intake, consequently they concluded this was not a cost effective intervention⁽¹⁸⁾. Again, the follow-up was short and could potentially explain the lack of effect, as could the different criteria used to identify malnutrition risk. Neither of these studies targeted frailty.

Other evidence (service evaluation, case note review and audit data) shows dietitians are able to ensure prescribed nutritional products (e.g. oral nutritional supplements) are used appropriately and safely, thus potentially treatment is more effective⁽¹⁹⁻²¹⁾. One case note review shows significant improvements in weight, proportion of people at risk of malnutrition and healthcare use at 6 weeks, 3 and 6 months after the dietitian intervened⁽²²⁾, suggesting clinical and cost benefits. A before and after study indicates that dietitians could improve dietary habits and knowledge, and the intake of selected nutrients⁽²³⁾, but did not indicate how these changes influenced clinical or cost outcomes. This indicates that there is a role for dietitians in primary care, although it does not provide certainty regarding how effective (in terms of clinical outcomes or cost) such a role may be. The body of evidence is limited and contradictory and so further evaluation of dietitians in roles targeting malnutrition and frailty in primary care are essential.

This project aimed to evaluate the benefits of a model of care in which a dietitian worked within a general practice to provide appropriate care to patients at risk of malnutrition and/or frailty, in order to reduce GP workload, improve patient care and make cost savings.

Methods

Design

This was a service evaluation project, evaluating the benefits of a dietitian working as a first contact practitioner to help manage frailty and malnutrition in a health centre in Cornwall over a six-month period. A first contact practitioner is a registered health professional who is the first point of contact for patients, providing new expertise and increased capacity to general practice and providing patients with faster access to the right care. In this context the dietitian was identifying those at risk of frailty and malnutrition, contacting them directly and intervening where appropriate. A dietitian was employed for this project 0.16wte (6hrs/wk) for a 6 month period.

Location

The primary care network in Cornwall provides a full range of primary care medical services to a network population of over 36,000. They aspire to expand their range of services and specialist clinics, therefore volunteered to host this project.

Process

The practice database (SystemOne, TPP, Leeds, UK) was searched to retrieve patients aged over 65 years with either a moderate electronic frailty index score (eFI 0.26-0.36)⁽²⁴⁾ or a low body mass index (BMI<19kg/m²). The eFI score ranges between 0-1, where scores closer to 1 indicate a higher risk of frailty and hence greater vulnerability to adverse outcomes. The eFI uses existing electronic health record data to measure frailty on the basis of the accumulation of 36 deficits comprising around 2,000 Read codes (Read codes are a coded thesaurus of clinical terms). Any patient in a care home was excluded. The list of retrieved patients were contacted by the dietitian over the telephone and triaged using the Patients Association Nutrition Checklist, a nutrition screening tool validated against MUST⁽²⁵⁾. If the patient was at risk of malnutrition they were either offered nutritional advice over the telephone, or invited to a dietetic clinic appointment.

The dietitian also took direct referrals of any patients ≥65 years at risk of frailty and malnutrition from GPs and other health staff, or from the integration team when assessing patients' discharged from hospital. Patients ≥65 years who were prescribed oral nutritional supplements and were not currently under dietetic management were also offered dietetic consultations.

Data collection

Number, type and time of dietetic consultations, including where the dietitian acted as a first contact practitioner, were recorded. Each patient's nutritional risk, frailty score, weight, grip strength, mid upper arm circumference (MUAC), and ONS use were also recorded. Frailty was measured with the Rockwood clinical frailty scale⁽²⁶⁾, which predicts mortality or the need for an institution. It provides a clinical description of frailty as opposed to the cumulative deficit score used by the eFI. It is recommended for individual assessment of frailty, whereas the eFI is used to screen populations. It is a 7-point scale exploring physical, psychological and social domains of frailty to provide a global score ranging from 1 (very fit) to 7 (severely frail). Weight was self-reported or measured by the dietitian where possible. Grip strength was assessed using a dynamometer (Takei Scientific Instruments Co., Ltd, Tokyo, Japan); the patient was seated with their elbow bent at 90°, palm up, they grasped the dynamometer and squeezed with maximal effort. The best of three tries on each hand was recorded. MUAC was measured using a tape measure positioned around the mid-point of the upper arm ensuring a snug but not compressed fit.

Acting as a first contact practitioner was defined as the dietitian being the only person involved in the patient's management at the point in time when the dietitian triaged the patient. This meant that the patient had not been referred by another health professional. In this role the dietitian took responsibility for managing these complex patients, developing integrated and tailored treatment plans in partnership with the patient, and reducing the need for pharmacological interventions⁽²⁷⁾.

Analysis

Percentages are used to characterise the sample. Changes in frailty and nutritional status are examined using the sign test, which shows the direction of change within a scale. Anthropometric data were tested for normality and examined using either Wilcoxon signed rank test or paired t-test as appropriate for the data distribution.

Ethics

Ethical approval was granted by [removed for blind peer review] and permission obtained from Primary Care Network involved for the project to be undertaken.

Results

Approximately 1200 patients met the screening criteria. A total of 189 (16%) patients were triaged by the dietitian; 162 from the database search using eFI & BMI, and 27 identified with a prescription of ONS but not under dietetic monitoring. Of these 25% (47/189) were not at risk of malnutrition, but 75% (142/189) were at risk; 44% (63/142) of these were provided with a dietetic consultation and follow-up as necessary (46% (29/63) telephone, 54% (34) face to face). Of those not seen 8% (15/142) were considered at risk but declined the dietetic consultation, 2% (4/142) did not attend their appointments, 1% (2/142) were admitted to hospital and 30% (58/142) were not able to have an appointment booked within the timeframe of the project. The dietitian acted as a first contact practitioner for 94% (59/63) of these patients. Two patients were previously seen by a practice nurse and two by a GP.

The patients' characteristics are shown in table 1. The patients were spread evenly throughout the five year age categories and many had multiple long-term conditions. Two thirds of patients were deemed at risk of frailty according to the eFI and more than half were under weight, with the median BMI less than 19kg/m².

Frailty status

The Rockwood clinical frailty scale⁽²⁶⁾ indicated that patients' seen by the dietitian ranged from 'apparently vulnerable' to 'severely frail' before the dietetic intervention (see table 2).

After the dietetic intervention there was a significant shift towards a less severe frailty category; frailty score reduced=8 patients; score increased=0; no change=50 (exact significance, 2-tailed; p=0.008). This shows that, in the short time the patients were treated and monitored, some improved their frailty status.

Nutritional status

Malnutrition risk was assessed using the Patients' Association Nutrition checklist (<https://www.patients-association.org.uk/patients-association-nutrition-checklist-toolkit>). One point was scored for each affirmative response to questions in section B (0-10), indicating a potential issue that may increase nutritional risk. A Sign test was used to assess the changes in these scores before and after the intervention. The number of affirmative responses decreased in 21 patients; number increased=4; no change=33. This indicated a statistically significant improvement after the dietitian's intervention (exact significance, 2-tailed; p=0.001).

Anthropometric measures

Table 3 presents anthropometric measures pre- and post-dietetic intervention. Weight, BMI, hand grip, and MUAC were all improved even within the short time frame of this project. A reduction in mortality risk has been found for every 1kg increase in handgrip strength⁽²⁸⁾ and both right and left hand mean difference in grip strength were found to have exceeded this (table 3), suggesting an improved clinical outcome and lower mortality risk after the dietetic consultations. The change in MUAC, although statistically significant (i.e. a true increase rather than by chance alone), it is not clinically significant, representing only a 1% increase in the value. Similarly, BMI (+0.3kg/m²) and weight (+1.7kg) both showed increases, which were statistically significant and had a medium effect size, but were not clinically significant. However, it is notable that only three patients lost weight, while 31 gained. Due to the time restrictions of this six-month project, only short term outcome measures were captured, therefore data on the longer-term implications of this dietetic intervention are not available.

Dietary aims

The dietitian discussed the patient's current diet and agreed suitable patient-centred dietary aims with the patient; these are shown in supplementary information. Of the 63 patients, 48 agreed two dietary aims and 15 one dietary aim. 76% (48/63) fully achieved their dietary aims and 16% (10/63) partially achieved them. Only 8% (5/63) patients did not achieve their dietary aims and the reasons were; one patient died, one patient had dementia, one patient was at end of life and two patients' medical conditions deteriorated.

Three patients were identified as being at risk of refeeding syndrome and were provided with nutritional support in line with NICE guidance⁽²⁹⁾.

Cost savings

This project was not designed to enable a formal economic analysis but it would be desirable for future evaluations to assess costs comprehensively. Nevertheless the data provided several examples of the impact the dietitian had on healthcare cost, patient safety and quality of care (see box 1).

Supplements were reviewed for 27 patients and eight of these had their ONS stopped entirely. Six patients' ONS were reduced in volume and nine were switched to a cheaper more suitable alternative, two were both reduced and switched, and only two were continued on the same prescription. Three of these patients had their prescribed vitamins stopped. These prescription changes for only 27 patients equated to projected total annual cost savings of £15,379. This equates 160% of the value of the dietitian's time in this project (6 hrs a week at Band 7 salary for 6 months; approximately £9540) (See supplementary information).

Patient satisfaction

Only 21 patients returned the satisfaction questionnaire, primarily due to lack of resource to post the questionnaire to patients who consulted by telephone. Of these 19 (90%) were fully completed and included in the analysis. All 19 patients rated their overall satisfaction of the service as excellent, stated that the dietitian treated them with dignity and respect, would recommend this service to family and friends, and universally reported that the dietitian acted using a patient-centred approach (see supplementary information).

Screening patients

We used eFI and/or low BMI to identify patients at risk of frailty who may benefit from the input of the dietitian. These criteria were used because the data is recorded routinely into the GP database and can be filtered for. Approximately a third of the patients retrieved were classified by the eFI as at low risk of frailty (see table 1). However, the assessment of nutritional risk, using the Patients Association Nutrition Checklist, showed that these low risk patients were at risk of malnutrition. This illustrates how the risk of malnutrition and frailty do not necessarily always go together, and stresses the importance of the dietitian's clinical assessment to identify patients both at risk of frailty and malnutrition.

Discussion

This service evaluation demonstrates a model of dietetic-led care in general practice which is reproducible and sustainable. In less than one day a week an experienced dietitian can make a difference to patient care, and make substantial cost savings. We have also demonstrated that dietitians can act as first contact practitioners in this specific area of care, frailty and malnutrition. This illustrates a principle that could be extended to other diagnostic groups with primary care. The data available suggests that dietitians can work with patients to improve clinical outcomes and that patients are highly satisfied with the service model. Some cost savings are possible through the

optimisation of prescribed supplements, and are sufficient in the first 6 months of working to offset the cost of the dietitian's salary.

The strategy to identify suitable patients, using routinely collected data; BMI and eFI, was successful, with 75% of selected patients being at risk of malnutrition on triage. As shown in previous research there is overlap between malnutrition and frailty, and dietitians can contribute to the treatment of both^(13; 14). The dietitian only triaged 16% of the patients identified by the database screening procedure, illustrating the size of the potential workload in this population group. This suggests that the inclusion of less specialised staff (e.g. healthcare assistants or dietetic assistants) under the supervision of the dietitian could make the model of care more efficient and practicable in the primary care setting. For example, healthcare assistants could be trained by the dietitian to undertake triage, complete basic screening (both malnutrition and frailty) and deliver initial nutritional advice (food first), referring more complex patients to the dietitian. The dietitian would then have more time for managing complex patients and leading further service developments for managing patients with frailty and malnutrition.

Data indicates that malnutrition affects 1 in 10 people in community dwelling older populations⁽³⁰⁾ and frailty prevalence increases from 3%⁽⁹⁾ in middle-age (40+yrs) to 65% in the very old (90+yrs)⁽¹⁰⁾. Therefore, there is likely a large cohort of at risk patients in need of dietetic intervention in most general practices, depending on the age profile of the population served. In this practice, of those triaged (189) 75% were found to be at risk, suggesting in a population of approximately 900 at risk patients (1200*75%). Research shows that people suffering with malnutrition have higher healthcare costs, as they tend to have greater use of services, longer hospital stays and worse clinical outcomes^(31; 32), thus, the possible costs savings shown in this project are supported by research evidence.

Importantly, our data indicate that patients' frailty status and nutritional status improved following consultation with the dietitian. Markers of health and strength (weight, BMI and hand grip strength) increased, and it is known that these are associated with overall improved clinical outcomes^(33; 34). Patients were able to meet individualised dietary aims with support from the dietitian, which should help prevent future deterioration and support the maintenance of health. Crucially, patients rated the service highly, indicating they considered the service provided patient-centred care. It is known that tailored and individualised care, focusing on what is important to patients, generates better health outcomes⁽³⁵⁾.

Service evaluations have consistently shown that oral nutritional supplements are used inappropriately, yet they have a significant cost in general practice⁽²⁰⁾. Roles for dietitians have emerged to optimise the use of these products, demonstrating reduced costs for prescription, but no detriment to BMI and good patient satisfaction^(19; 21; 36). This project showed a similar effect; the dietitian saved money by ensuring that ONS were appropriately prescribed and monitored, and this saving was sufficient to fund the dietitian's time.

There are other potential cost savings, such as the costs of avoiding hospitalisation, reduced health and care service use, and in particular to reduction in GP appointments. We already know that patients at risk of malnutrition have higher healthcare resource use, including hospitalisations⁽³⁷⁾, and it has been shown that malnutrition is often undetected in general practice, results in higher healthcare resource use, and when managed appropriately can potentially save money^(6; 22; 38). This project suggests that such savings are possible using this model of dietetic care. Not only did the dietitian potentially reduce costs in some areas but also significantly influenced patient safety and quality of care.

It is also worth noting factors which may influence successful model implementation. A combination of eFI and BMI was used to identify patients who may benefit from a dietetic review, and who were then triaged by the dietitian. eFI alone was not suitable to screen the GP database because although eFI correlates well with mortality and hospitalisation, a low risk of frailty does not exclude a high risk of malnutrition. Similarly, a high risk of frailty can be driven by numerous factors and is not always related to malnutrition. Thus, the use of low BMI alone or combined with moderate or higher eFI would be the recommended measure to screen GP databases for patients suitable for dietetic triage. BMI is available for most patients in GP electronic records and is convenient to use for this purpose.

Another important factor was that the dietitian had already developed high level skills in influencing behavioural change. This would be an important competency in this role to ensure its effectiveness. Integration as part of the whole healthcare team was also reported to be important, to enable more effective signposting of patients to other services (i.e. social prescriber, falls team), ensuring a holistic approach to care, enabling informal education, raising awareness of the dietitian's presence and putting the patient at the centre of care. The Systmone 'task' module also enabled rapid communication and action between the team and the dietitian. The dietitian also benefited from professional support and access to resources from the community dietetic service, since the dietitian was contracted from this department rather than employed directly.

Factors which could further enhance the effectiveness of the service include specific administrative support to help the dietitian work more efficiently by making appointments and other similar tasks. For this discrete project no administrative support was included in the project budget. The lack of a supplementary prescribing arrangement and the dietitian's lack of a supplementary prescribing qualification, hampered swift and efficient prescription changes. Putting such an arrangement in place and ensuring the dietitian had the appropriate competency would support more efficient working and greater time saving. On-going evaluation of the service would also be crucial and so systems for recording outcome data need to be developed locally.

Conclusion

The project illustrates the value of dietitians as a member of the multi-disciplinary practice team in primary care for the care of older people at risk of malnutrition and frailty, demonstrating improvements in frailty status, nutritional status and strength. Cost savings on oral nutritional supplements were made and other potential cost saving were evident. Inter-professional benefits were also gained from informal education through the dietitian's contribution.

3917 words / 2500-4000 words

Transparency statement

The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported.

References

1. Hickson M, Child J, Collinson A (2018) Future Dietitian 2025: informing the development of a workforce strategy for dietetics. *J Hum Nutr Diet* **31**, 23-32.

2. NHS Digital (2017) General and Personal Medical Services, England As at 30 September 2017, Provisional Experimental statistics. <https://digital.nhs.uk/data-and-information/publications/statistical/general-and-personal-medical-services/as-at-30-september-2017-provisional-experimental-statistics> (accessed 11/01/2019 2019)
3. NHS England (2019) *The NHS Long Term Plan – a summary*. London: NHS.
4. NHS England, Royal College of General Practitioners (2016) *General Practice Forward View*. London: NHS England.
5. Primary Care Workforce Commission (2015) *The future of primary care: creating teams for tomorrow*. Leeds: Health Education England.
6. Fry CM, Ramet S, Hubbard RJ *et al.* (2017) GP patient databases show that malnutrition is underreported and under-treated in patients with chronic disease. *Clinical Nutrition ESPEN* **22**, 120-121.
7. Fried LP, Tangen CM, Walston J *et al.* (2001) Frailty in older adults: evidence for a phenotype. *J Gerontol A Biol Sci Med Sci* **56**, M146-156.
8. Office for National Statistics (2019) Overview of the UK population: August 2019: UK Government.
9. Hanlon P, Nicholl BI, Jani BD *et al.* (2018) Frailty and pre-frailty in middle-aged and older adults and its association with multimorbidity and mortality: a prospective analysis of 493 737 UK Biobank participants. *Lancet Public Health* **3**, e323-e332.
10. Gale CR, Cooper C, Sayer AA (2015) Prevalence of frailty and disability: findings from the English Longitudinal Study of Ageing. *Age Ageing* **44**, 162-165.
11. NHS England (2019) Supporting routine frailty identification and frailty through the GP Contract 2017/2018, pp. 12.
12. NHS England (2018) GMS Contract requirements for the identification and management of people with frailty - guidance on Batch-coding, pp. 2.
13. Verlaan S, Ligthart-Melis GC, Wijers SLJ *et al.* (2017) High Prevalence of Physical Frailty Among Community-Dwelling Malnourished Older Adults-A Systematic Review and Meta-Analysis. *J Am Med Dir Assoc* **18**, 374-382.
14. Wei K, Nyunt MSZ, Gao Q *et al.* (2017) Frailty and Malnutrition: Related and Distinct Syndrome Prevalence and Association among Community-Dwelling Older Adults: Singapore Longitudinal Ageing Studies. *J Am Med Dir Assoc* **18**, 1019-1028.
15. Travers J, Romero-Ortuno R, Bailey J *et al.* (2019) Delaying and reversing frailty: a systematic review of primary care interventions. *Br J Gen Pract* **69**, e61-e69.
16. Endevelt R, Lemberger J, Bregman J *et al.* (2011) Intensive dietary intervention by a dietitian as a case manager among community dwelling older adults: the EDIT study. *Journal of Nutrition, Health & Aging* **15**, 624-630.
17. Schilp J, Kruijenga HM, Wijnhoven HA *et al.* (2013) Effects of a dietetic treatment in older, undernourished, community-dwelling individuals in primary care: a randomized controlled trial. *Eur J Nutr* **52**, 1939-1948.
18. Schilp J, Bosmans JE, Kruijenga HM *et al.* (2014) Is dietetic treatment for undernutrition in older individuals in primary care cost-effective? *J Am Med Dir Assoc* **15**, 226.e227-226.e213.
19. Kemmner J, Gater D (2016) *Clinical Community Dietetics – Including Report from Prescribing Support*. Torbay, UK: Torbay and South Devon NHS Trust.
20. Older People Specialist Interest Group (2016) *Specialist Dietitians in Appropriate Prescribing of Nutritional Products in Primary Care*. Birmingham, UK: British Dietetic Association.
21. Gratton E, Donovan G (2016) An evaluation of the impact of an integrated dietitian-led service on economic, clinical and patient satisfaction outcomes in patients prescribed oral nutritional supplements. *Pharmacoepidemiol Drug Saf* **25**, 10-11.
22. Fry GL, Brown F, Cawood AL *et al.* (2017) Appropriate management of disease related malnutrition in GP practices improves nutritional status & reduces healthcare use, with potential cost savings. *Malnutrition Matters*, OC64.

23. Ahn JA, Park J, Kim CJ (2018) Effects of an individualised nutritional education and support programme on dietary habits, nutritional knowledge and nutritional status of older adults living alone. *J Clin Nurs* **27**, 2142-2151.
24. Clegg A, Bates C, Young J *et al.* (2016) Development and validation of an electronic frailty index using routine primary care electronic health record data. *Age Ageing* **45**, 353-360.
25. Murphy JL, Aburrow A, Guestini A *et al.* (2020) Identifying older people at risk of malnutrition and treatment in the community: prevalence and concurrent validation of the Patients Association Nutrition Checklist with 'MUST'. *J Hum Nutr Diet* **33**, 31-37.
26. Rockwood K, Song X, MacKnight C *et al.* (2005) A global clinical measure of fitness and frailty in elderly people. *CMAJ* **173**, 489-495.
27. Instone J, Tilley C (2020) What can First Contact Practitioner Dietitians do? Birmingham, UK: British Dietetic Association.
28. Cooper R, Kuh D, Hardy R *et al.* (2010) Objectively measured physical capability levels and mortality: systematic review and meta-analysis. *BMJ* **341**, c4467.
29. NICE (2006) Nutrition support for adults: oral nutrition support, enteral tube feeding and parenteral nutrition. *Clinical Guideline*.
30. European Nutrition for Health Alliance (2006) *Malnutrition among Older People in the Community: Policy Recommendations*.: In association with BAPEN, ILCUK and Associate Parliamentary Food and Health Forum.
31. Abizanda P, Sinclair A, Barcons N *et al.* (2016) Costs of Malnutrition in Institutionalized and Community-Dwelling Older Adults: A Systematic Review. *J Am Med Dir Assoc* **17**, 17-23.
32. Guest JF, Panca M, Baeyens JP *et al.* (2011) Health economic impact of managing patients following a community-based diagnosis of malnutrition in the UK. *Clin Nutr* **30**, 422-429.
33. Bhaskaran K, Dos-Santos-Silva I, Leon DA *et al.* (2018) Association of BMI with overall and cause-specific mortality: a population-based cohort study of 3.6 million adults in the UK. *Lancet Diabetes Endocrinol* **6**, 944-953.
34. Celis-Morales CA, Welsh P, Lyall DM *et al.* (2018) Associations of grip strength with cardiovascular, respiratory, and cancer outcomes and all cause mortality: prospective cohort study of half a million UK Biobank participants. *BMJ* **361**, k1651.
35. Coulter A, Entwistle VA, Eccles A *et al.* (2015) Personalised care planning for adults with chronic or long-term health conditions. *Cochrane Database Syst Rev*, CD010523.
36. Ragubeer R, Patel HJ (2011) Pilot to improve the appropriate prescription of oral nutritional supplements within the walsall area. *Proc Nutr Soc* **70**, E272.
37. Elia M (2015) *The cost of malnutrition in England and potential cost savings from nutritional interventions (short version)*. Southampton: BAPEN.
38. Fry GL, Brown F, Cawood AL *et al.* (2017) Older malnourished individuals registered with their GP use greater healthcare resources than non-malnourished individuals. *Malnutrition Matters*, OC63.

Box 1: Case studies showing the dietitian's impact on healthcare costs, patient safety and quality of care

Patient A: Presented with a low BMI (16kg/m²). The patient reported they had lost weight but had not acted on this. The patient was at risk of refeeding syndrome. Dietary advice was given and monitoring showed improvements in weight, strength and hydration. The dietitian thus ameliorated the serious risk of refeeding syndrome and therefore, possible admission to hospital, as well as improving the patient's overall health status.

Patient B: Presented with COPD and low BMI (17kg/m²) and struggling to cope with shopping and preparing meals. Advised to increase energy and protein and facilitated social care to ensure carers were in place to help with meals. This enabled patient to stay in their own home preventing an admission to a nursing home or secondary care.

Patient C: Presented with hypertension and multiple falls. Frailty assessment indicated severe frailty and history taken during consultation showed that the patient was unable to manage at home safely. The dietitian referred the patient to the falls team and the patient ultimately opted to live in a care home with all meals and appropriate support provided. This demonstrates the dietitian's role in ensuring patient safety and quality of care.

Table 1: Characteristics of the patients seen by the dietitian

Characteristic	Number of patients (n=63)	%
Age group (years)		
65-69	14	22.2
70-74	11	17.5
75-79	14	22.2
80-84	8	12.7
85-89	12	19.0
90+	4	6.3
Number of diagnoses		
None	2	3.2
One	34	54.0
Two	21	33.3
Three	4	6.3
Four	2	3.2
Diagnosis (some patients had more than one diagnosis)		
CVD	33	52.0
Respiratory disease	21	33.0
Mental health conditions	7	11.0
Chronic Kidney Disease	6	9.5
Osteoporosis	6	9.5
Cancer	5	8.0
Gut disorders	4	6.0
Diabetes	2	3.0
Liver disease	2	3.0
eFI category (eFI range)		
Fit (0-0.12)	22	34.9
Mild (0.13-0.24)	18	28.6
Moderate (0.25-0.36)	13	20.6
Severe (>0.36)	10	15.9
Body Mass Index (BMI)		
<=19kg/m ²	35	55.6
>19kg/m ²	24	38.1
Missing data	4	6.3
Median (Interquartile range)	18.8 (17-20)	

Table 1: Rockwood clinical frailty scale scores pre- and post-dietetic intervention

Clinical Frailty Scale	Pre-intervention (n=58) Number (%)	Post-intervention (n=58) Number (%)
1= Very fit	0	0
2 = Well	0	0
3 = Well with treated comorbid disease	0	0
4 = Apparently vulnerable	21 (36.2%)	28 (48.3%)
5 = Mildly frail	21 (36.2%)	15 (25.9%)
6 = Moderately frail	14 (24.1%)	13 (22.4%)
7 = Severely frail	2 (3.4%)	2 (3.4%)

Table 1: Anthropometric measures pre- and post the dietetic intervention

Anthropometric measure	Pre	Post	Z score and effect size	P value
Median weight (kg) (IQR) n=54	46.9 (43.6-58.7)	48.6 (44.4-58.9)	z=4.06; r=0.39	<0.001 ¹
Median BMI (kg/m ²) (IQR) n=54	18.8 (17.1-20.0)	19.1 (17.7-20.5)	z=4.04; r=0.34	<0.001 ¹
			Mean difference (95% Confidence Interval)	
Mean left hand grip strength (kg)(sd) n=21	17.83 (7.3)	19.38 (7.07)	1.55 (0.88,2.21)	<0.001 ²
Mean right hand grip strength (kg)(sd) n=21	19.69 (6.55)	21.43 (6.61)	1.74 (1.19,2.28)	<0.001 ²
Mean mid upper arm circumference (cm)(sd) n=19	22.9 (2.18)	23.2 (2.19)	0.34 (0.18, 0.5)	<0.001 ²

Data for weight and BMI were not normally distributed. IQR=Interquartile range; ¹Wilcoxon signed rank test; ²Paired t-test.

Supplementary information

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Table 1: Dietary aims of consultations

Dietary aims	Number
Increase energy and protein intake	45
Increase protein intake only	1
Decrease energy intake	1
Increase fluid intake	13
Increase fibre and fluid intake	1
Increase range of micronutrients	17
Increase Vitamin D & Calcium	8
Review oral nutritional supplements	27

Table 2: Savings made from changes to prescribed supplements

Pt #	Original Onral Nutritional Supplement	Dose	Change made: Switched, Reduced or Stopped	New Oral Nutritional Supplement	Dose	Savings per month	Projected savings at 6 months	Projected savings at 12 months	
1	Brand 1	OD	Switched	Brand 14	OD	£ 26.70	£ 160.20	£ 320.40	
2	Brand 2	BD	Reduced	Brand 2	OD	£ 60.30	£ 361.80	£ 723.60	
3	Brand 3	BD	Switched and reduced	Brand 6	OD	£ 82.80	£ 496.80	£ 993.60	
	Brand 4	OD							
4	Brand 5	OD	Stopped	N/A	N/A	£ 83.10	£ 498.60	£ 997.20	
	Brand 6	OD							
5	Brand 5	OD	Stopped	N/A	N/A	£ 61.20	£ 367.20	£ 734.40	
6	Brand 7	BD	Switched	Brand 8	BD	£ 17.40	£ 104.40	£ 208.80	
7	Brand 6	OD	Stopped	N/A	N/A	£ 18.00	£ 108.00	£ 216.00	
8	Brand 8	OD	Switched	Brand 6	OD	£ 15.30	£ 91.80	£ 183.60	
9	Brand 8	QDS	Switched and reduced	Brand 6	BD	£ 97.20	£ 583.20	£ 1,166.40	
10	Brand 8	BD	Stopped	N/A	N/A	£ 66.60	£ 399.60	£ 799.20	
11	Brand 8	BD	Stopped	N/A	N/A	£ 66.60	£ 399.60	£ 799.20	
12	Brand 8	BD	Reduced	Brand 8	OD	£ 33.30	£ 199.80	£ 399.60	
13	Brand 9	OD	Switched	Brand 6	OD	£ 15.30	£ 91.80	£ 183.60	
14	Brand 10	TDS	Switched	Brand 10	OD	£ 24.60	£ 147.60	£ 295.20	
	Brand 4	OD		Brand 4	TDS				
15	Brand 11	TDS	Stopped	N/A	N/A	£ 100.80	£ 604.80	£ 1,209.60	
16	Brand 8	BD	Reduced	Brand 8	OD	£ 33.30	£ 199.80	£ 399.60	
17	Brand 8	BD	Reduced	Brand 8	OD	£ 33.30	£ 199.80	£ 399.60	
18	Brand 8	BD	Reduced	Brand 8	OD	£ 33.30	£ 199.80	£ 399.60	
19	Brand 7	BD	Stopped	N/A	N/A	£ 84.00	£ 504.00	£ 1,008.00	
20	Brand 9	OD	Switched	Brand 6	OD	£ 15.30	£ 91.80	£ 183.60	
21	Brand 4	BD	Switched	Brand 6	BD	£ 6.00	£ 36.00	£ 72.00	
22	Brand 9	BD	Switched	Brand 8	BD	£ -	£ -	£ -	
23	Brand 12	BD	Switched	Brand 8	BD	£ -	£ -	£ -	
24	Brand 8	TDS	Continued	Brand 8	TDS	£ -	£ -	£ -	
25	Brand 6	BD	Continued	Brand 6	BD	£ -	£ -	£ -	
26	Brand 5	7/day	Reduced	Brand 5	5/day	£ 130.20	£ 781.20	£ 1,562.40	
27	Brand 13	30ml TDS	Stopped	N/A	N/A	£177.03	£1,062.18	£2,124.36	
	Brand 5	BD							
						Sub-total	£ 1,281.63	£ 7,689.78	£ 15,379.56
Vitamins and minerals saving									
a	Forceval	OD	Stopped	N/A	N/A	£ 9.92	£ 59.52	£ 119.04	
b	Vitamin B complex	TDS	Stopped	N/A	N/A	£ 12.35	£ 74.10	£ 148.20	
	Thiamine (100mg)	TDS							
c	Vitamin B complex	TDS	Stopped	N/A	N/A	£ 12.35	£ 74.10	£ 148.20	
	Thiamine (100mg)	TDS							
						Sub-total	£ 34.62	£ 207.72	£ 415.44
						TOTAL	£ 1,316.25	£ 7,897.50	£ 15,795.00

OD: once/day; BD: twice/day; TDS: Three time/day; QDS: four times/day; N/A: not applicable;

Table 3: Participant feedback on the care received by the dietitian.

Question	Completely n (%)	Well n (%)	Somewhat	Poorly	Not at all
Did you feel able to raise concerns about your health?	18 (95%)	1 (5%)	0	0	0
Did you feel that your concerns were listened to and addressed?	17 (89%)	2 (11%)	0	0	0
How much did you feel you were involved in decisions about the treatment and care goals?	18 (95%)	1 (5%)	0	0	0
How well did you feel supported to achieve the goals?	17 (89%)	2 (11%)	0	0	0