Brief intervention using the PaperWeight Armband to identify older people at risk of undernutrition in the community: a preliminary evaluation

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ABSTRACT

Background The risk of undernutrition in older adults in the community is high, with clear negative impacts on health and well-being. Nutritional screening is not routine and undernutrition often goes unrecognised. A community-level population public health intervention has the potential to target environments where the risk of undernutrition is highest. A programme has been established locally using the PaperWeight Armband as a simple nutritional screening tool in residents over 65 years, followed by supporting advice and community interventions. We undertook a nested pilot cohort evaluation within the wider programme to assess whether this could impact positively.

Methods Participants found to be at risk of undernutrition in the programme were recruited consecutively. Baseline weight and other descriptors including accommodation and frailty were recorded, and then again at 12 weeks.

Results 83 participants were recruited from a wide variety of community settings, age range 65–99 years; 75% were women. Sixty-seven recruits were followed up for 12-week review. Of these, 54 (81%) had a positive outcome, recording either weight gain (66%) or no weight loss (15%) at 12 weeks. Benefit was seen in all living circumstances but was least evident in the frailest participants.

Conclusion The intervention is associated with positive outcomes, with reduction or stabilisation of nutritional risk in the majority of participants studied. The intervention can be delivered in a wide range of settings and does not require healthcare professions for the screening. Longer and larger studies are now required to study the health, well-being and socioeconomic impacts of the intervention in depth.

INTRODUCTION

Undernutrition among the older UK population is a common and significant problem. The British Association for Parenteral and Enteral Nutrition (BAPEN) and National Institute for Health and Care Excellence (NICE) report that the prevalence of malnutrition is between 10%–14% of older adults living in sheltered housing, 30% of hospital admissions and 35% in care homes.[1–3] In the UK, more than 3 million people are believed to be malnourished, of which 1 million are over the age of 65 years.[4] At any given time, 93% of this cohort are living in the community and often present a hidden problem.[1]

Although there is widespread acknowledgement among clinical practitioners about the value of nutritional screening, it is not routine and often goes unrecognised and untreated.[5] Data from the BAPEN Nutritional Care Tool in 2017 highlight that despite 40% of hospital inpatients being screened, they do not receive any form of nutrition support and similar findings have been reported in the community.[6 7] This inertia has resulted in spiralling costs associated with malnutrition with an estimated cost of £19.6 billion in England (£23.5 billion in the UK). Most of the costs in healthcare (£15.2 billion) are predominantly in secondary care, with £4 billion from social care, and older adults accounting for 52% of the total costs associated with malnutrition.[3]

There are well-documented barriers to the use of clinical nutritional screening tools in routine day-to-day interactions with older people.[8–10] While general practitioners (GPs) and nurses may be best placed to screen, this requires a healthcare episode to occur and for the involved practitioners to be aware of the issue. There are multiple barriers to delivering this systematically including time constraints, lack of awareness and knowledge, low prioritisation of nutritional well-being, and lack of suitable equipment and training.[10]

Therefore, a community-level population health programme and intervention, delivered by community agencies rather than healthcare professionals, has the potential to target the environments where undernutrition most commonly occurs. The potential advantage of identification and intervention at an earlier stage in the process may potentially support better health outcomes and quality of life for the individual, as well as potential societal and economic benefits.[11] The expenditure on treatment and strategies to identify and manage undernutrition is a very small proportion (2.5%) of the overall costs of malnutrition. Economic analysis by NICE suggested a cost saving of £123 530 per 100 000 population, a net saving of £65 million for England.[3]

The Nutrition and Hydration Programme was established in 2017 as part of the Greater Manchester Health and Social Care (GMHSC) Partnership Population Health Plan, a component of Greater Manchester's unique devolution to combine health and social care.[12] The aim of the programme is to raise awareness about the risks and signs of undernutrition and dehydration among individuals, but with a new focus on carers and

non-clinically trained individuals and community-based therapists who have routine contact with older people aged over 65 years. The brief intervention is designed to target this cohort and to mitigate the risks of undernutrition and dehydration by intervening early and proactively. The PaperWeight Armband is a surrogate measure for body mass index (BMI) and provides the focus for the brief intervention, potentially identifying people with a BMI less than 20 kg/m^2. Its key advantage is that it is a simple standalone tool which does not require equipment to measure weight and height, items that are not usually present in non-clinical environments. The instructions on the PaperWeight Armband are self-explanatory so can be used by individual members of the public.

The aim of the population health programme is to enable people to become aware of their risk of malnutrition and receive appropriate interventions without needing an official healthcare encounter, so the approach used here has been designed to be simple enough for anyone to use. To facilitate widespread uptake of the use of the PaperWeight Armband, training has been delivered to frontline staff, volunteers and members of the public to raise awareness of the importance of good nutrition and hydration and to allow them to gain confidence in using the tools and resources available.

There has been no formal independent research in a community setting of the impact of brief interventions with the PaperWeight Armband and subsequent outcomes.[13] One study in abstract form only used PaperWeight Armband to screen 35 people over the age of 50 years and identified 18% to be at risk of undernutrition but did not report on outcomes of the intervention following identification of nutritional risk.[14] The GMHSC, therefore, commissioned an evaluation to be conducted as a nested feasibility study within the larger non-research programme.[15]

One important element we considered was frailty, using the Rockwood scale. This is a global scale used to summarise the overall level of fitness or frailty of an older adult, ranging from a score of 1 if very fit to 9 if terminally ill. It is assessed by an individual's level of dependency and functional ability.[16]

The primary aim was to assess whether the signposting of individuals found to be at risk of undernutrition by the use of the PaperWeight Armband had the potential to prevent weight loss or lead to weight gain. A descriptive account of the participants' circumstances and frailty was also recorded.

METHODS

Governance

A clinical reference group provided oversight to the GMHSC steering group for the programme and comprised of a consultant dietitian from Salford Royal National Health Service Foundation Trust, the chief executive of Age UK Salford, the programme director from Greater Manchester Nutrition and Hydration based at Age UK Salford, a clinical academic from the University of Manchester, a GP from Oldham, the director of Public Health for Stockport and a nutrition manager from a care home in Stockport. This clinical reference group has access to lead representatives from each region of Greater Manchester participating, thereby allowing a forum for sharing intelligence, analysis, perspectives and outputs related to the implementation of the programme and the feasibility study.

Resources

The PaperWeight Armband is a non-clinical and non-intrusive public health tool for identifying undernutrition by measuring the bare non-dominant upper arm.[15] It is a non-clinical, alternative measurement to BMI but does not require the provision of equipment to measure height and weight and can be used by anyone in any setting. The Malnutrition Advisory Group for BAPEN stated in 2011 if mid-upper arm circumference (MUAC) is >23.5 cm, the patient is likely to have a healthy BMI and is at low risk of malnutrition. If MUAC is <23.5 cm, the patient is likely to have a BMI <20 kg/m^2 and may be at risk of malnutrition. This is a widely accepted surrogate BMI measure if patients cannot be weighed. The PaperWeight Armband reflects the cut-off measures cited by BAPEN and systematic reviews.

Once secured, if the armband slips easily up and down over the bare non-dominant arm, it is a strong indicator of possible undernutrition in that the individual may have a BMI <20 kg/m^2. The red line on the PaperWeight Armband reflects a mid-arm circumference of 23.5 cm. There is a Quick Response code and website address printed on the PaperWeight Armband which links to all of the programme resources. These have been co-designed with an older adult population reference group and are available on the website: https://www.ageuk.org.uk/salford/about-us/improving-nutrition-and-hydration/our-resources/.

The person undertaking the intervention can then initiate a conversation about diet and hydration, which includes: eating and drinking patterns, tips to prevent dehydration and possible food-first solutions, for example, signposting the individual and their carers to advice and guidance on dietary fortification and nutritional self-care on the Age UK Salford website.

Evaluation study design

The evaluation project was a nested study within the larger programme above.[15] Eligible participants who gave informed consent to participate in the study were recruited from six localities in Greater Manchester. Participants were recruited at local Age UK events such as lunch clubs, community events and other social groups for older adults. Social work teams and domiciliary care staff also approached residents to participate in the study when they identified people who may be eligible through using the PaperWeight Armband in their routine work.

Once recruited to the study, measurements were undertaken by a single trained research assistant for consistency. Participants consented to be weighed at home on portable Salter stand-on scales to the nearest kilogram or have mid-arm muscle circumference (MAC) measured using a tape measure if they were considered unable to safely stand in order to be weighed. MAC was measured by identifying the midpoint between the acromial process of the scapula and the olecranon process of the elbow. This point was then marked on the subject's non-dominant arm and a tape measure wrapped round the subject's mid-arm and the circumference reading recorded in centimetre.[17] Participants also agreed to be visited again at week 12 by the same researcher to avoid interobserver error associated with measurements. The person undertaking the screening in the borough team leading the initial conversation collected demographics (age, sex, Greater Manchester locality) and details of other community services supporting the individual. All research procedures were undertaken in the community places where participants were recruited, or by contact in their own homes. To classify frailty, the Rockwood Clinical Frailty Scale[16] was also calculated for each individual at week 1 and repeated at week 12. This is a global scale used to summarise the overall level of fitness or frailty of an older adult, ranging from a score of 1 if very fit to 9 if terminally ill. It is assessed by level of dependency and functional ability.

This was a pilot evaluation so not based on a formal power calculation but a target was set to recruit 80 participants as a sufficient number for identifying feasibility and potential trends in potential benefits or deficiencies in the brief intervention and referral to services. As this was a pilot evaluation study, formal statistical analysis was not undertaken, only descriptive data are presented.

RESULTS

At the time of writing, 41 719 older people have been involved in the wider programme of work and discussed their appetite, drinking patterns and weight loss. Through the programme, a wide range of settings and professionals adopted the use of the PaperWeight Armband in their routine work with older adults. Online supplemental table 1 shows the types of organisations and professionals involved in each locality.

Of these people, 6371 (15%) were found to be at risk of undernutrition and were provided with resources, advice and signposting to other services.

A total of 83 participants were recruited to the feasibility study, with the first participant enrolled at the start of June 2019 and the last was recruited at the end of October 2019. Follow-up concluded in March 2020. The age range was 65–99 years and 75% were women.

Sixteen participants withdrew at or before the 12-week stage of the study, due to ill-health in 12 and 4 due to bereavement. Sixty-seven recruits were followed up for 12-week review. Of these, 54 (81%) had a positive outcome, recording either weight gain (66%) or no weight loss (15%) at 12 weeks. The median weight at the start of the study was 47.8 kg (mean 49 kg; range 31.8–72 kg) with a subsequent median weight of 49 kg at week 12 (mean weight 50.3 kg; range 32.7–68.9 kg). For those gaining weight at 12 weeks, the median weight gain was 1.7 kg (mean 2.1 kg; range 0.1–5.9 kg). For those losing weight, the median loss was 1.7 kg (mean 1.8 kg; range 0.5–3.6 kg). This is stratified by baseline weight in table 1. Improvement was observed regardless of baseline weight.

Four participants were unable to be weighed at the start of the study as they were unable to safely stand on the scales and had frailty levels ranging from 5 to 8. In the follow-up measurement, one of these still had MAC alone measured at the end of the study, but two had improved enough to be able to be weighed as well as having a repeat MAC measurement. One, with a frailty score of 8, had withdrawn due to illness. Of the three who were re-measured at follow-up, two registered an increase in MAC of 1 cm and 1.5 cm, respectively, indicative of weight gain. These were the same two who were now also able to safely stand at follow-up. The other, with a frailty score of 6, remained the same indicating no weight loss but had not improved functionally.

Rockwood frailty scores ranged from 1 to 8; 34 had a high frailty rating of 6 or above at week 1. Those with lower frailty levels of 5 or below were more likely to have a positive response to the intervention at the 12-week stage (see figure 1).

The participants who withdrew before the 12-week review had slightly lower baseline weights to the whole group median 44 kg (mean 45.5 kg; range 31.8–72 kg). This was principally an effect of lower baseline weights among the four bereaved during the study, median 35.4 kg (mean 36.2 kg; range 31.8–42 kg), rather than those withdrawing for health reasons, median 44.5 kg (mean 48.9 kg; range 38.1–72 kg).

There was heterogeneity in living circumstances for participants in the study, and these are reported in table 2. Broadly, most participants were similarly likely to have a positive outcome whether independent or housed in sheltered accommodation. Those living independently but needing support were the least likely to benefit and most likely to withdraw or to have lost weight at follow-up.

DISCUSSION

This is the first study to prospectively evaluate the potential utility and outcome of PaperWeight Armband as a public health signposting tool and to test it as a brief intervention. The initial results suggest there is potential for significant impact.

Earlier work by Stratton and Lecture[18] highlighted marked geographical differences in the prevalence of malnutrition across England and an inter-relationship between deprivation, malnutrition and poor outcome. Despite this being identified over a decade ago, routine screening within the community healthcare system for undernutrition in high-risk groups, such as older people and those in areas with high deprivation, is not a priority and not a routine. Screening in other parts of the health system, especially hospitals, is more embedded. 'Fair Society Healthy Lives, the Marmot Review', published in 2010,[19] set out an analysis of the causes of health inequalities in England and what needed to be done to address them. This showed the importance of social determinants of health acting through the life course. Since then, life expectancy in England has stalled, years spent in ill-health have increased and inequalities in health have widened.[20] Greater Manchester is a city region of 2.8 million people with 10 district councils forming the Greater Manchester Combined Authority. Unique devolution has empowered Greater Manchester to further develop new ways of working with the integration of health and social care services which has enabled the development of a truly place-based population health system across Greater Manchester. This model highlights the opportunities for place-based action, population health focus and intervention across all social determinants, and the nutrition and hydration programme for older adults was one of the first programmes to be identified and funded.

The six boroughs in Greater Manchester taking part have approximately 247 000 adults aged 65+ years, and it is estimated that the workforce involved in the pilot programme

Table 1 Baseline and follow-up weights in participants receiving the PaperWeight Armband intervention

Weight range (kg)	Number in weight category at baseline (all who could be weighed, n=79)	Number in weight category at baseline for those completing follow-up at 12 weeks (n=64)	Number in weight category at 12 weeks for those completing follow-up (n=64)	Number in weight category at baseline who withdrew before follow-up at 12 weeks (n=15)
<35	4	2	1	2
35–44.9	28	20	17	8
45–54.9	30	28	29	2
55–64.9	14	12	14	2
65+	3	2	3	1

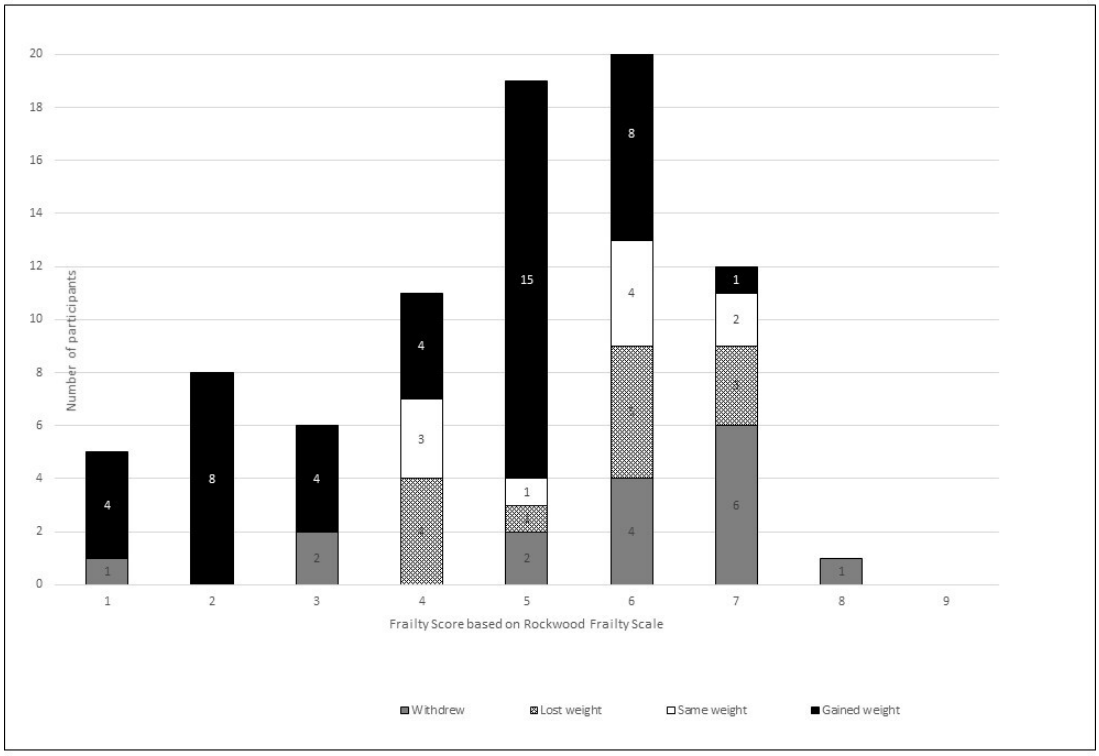

Figure 1 Pattern of weight gain or loss according to the participants' level of Rockwood frailty score at their baseline. The most common scores 4–7 represent very mild, mild, moderate and severe frailty, respectively.

collectively reaches and supports almost 95 000 older people each year, whether in housing, healthcare, home care, voluntary or leisure settings. This programme has reached 41 719 to date: this equates to 17% of the total older adult population. The outcomes of the PaperWeight Armband as a brief intervention has exceeded initial targets set out in the programme's cost–benefit analysis. Prior to GMHSC funding this academic evaluation, a formal cost–benefit analysis for the programme had used an assumption that 30% of people who engaged would have a positive outcome. In this study, 81% of individuals responded positively to the intervention, recording either weight gain or no further subsequent weight loss at 12 weeks. Therefore, a brief intervention to raise awareness of these issues with older people can potentially make a positive difference to their lives and outcomes. The training and resources for the programme also gave third sector partners a framework to address nutrition and hydration within their existing service. In particular, this is not an intervention that needs a specific clinical encounter. The programme has been commended locally as a significant achievement given the well-documented barriers for other undernutrition screening tools to be applied, and the programme's funding has now been extended.

A number of clinical pathways for the management of undernutrition in community settings are endorsed by many professional organisations (including the Royal College of General Practitioners, Royal College of Nursing, Primary Care Pharmacy Association, British Dietetic Association, BAPEN) and by the Patients Association (see www.malnutritionpathway. co.uk). However, there is very little evidence to support the concept of public health brief intervention and third sector engagement in tackling undernutrition. Many pathways reflect a medical model and rely on measurement of weight and height, which can be viewed as intrusive and time-consuming, whereas this population health intervention has allowed localities a greater awareness of the challenge ahead as 15% of residents across Greater Manchester were found to be 'at risk' using PaperWeight Armband which exceeds the 10% figure quoted by BAPEN.[4] This may be due to higher rates of health inequalities in Greater Manchester: in comparison with England averages, life expectancy and healthy life expectancy in 8 out of 10 boroughs are several years shorter

Table 2 Outcomes according to residential circumstances

Circumstances	All (n=83)	Independent (n=30)	Independent with support (n=27)	Sheltered housing (n=15)	Receiving extra care (n=11)
Gained weight	44/67 65.7%	19/26 73.1%	7/19 36.8%	10/13 76.9%	8/9 88.9%
Lost weight	13/67 19.4%	5/26 19.2%	7/19 36.8%	1/13 7.7%	0/9 0%
No change	10/67 14.9%	2/26 7.7%	5/19 26.3%	2/13 15.4%	1/9 11.1%
Withdrew	16/83 19.3%	4/30 13.3%	8/27 29.6%	2/15 13.3%	2/11 18.2%

Extra care residential settings are where residents receive a higher level of support including 24-hour assistance from on-site carers who have access to their premises. They have been designated 'extra care' either by the local authority or the private sector provider.

than the England average. Trafford and Stockport are the only boroughs above the England average for life expectancy and health life expectancy.[21]

It is clear that undernutrition is linked to prolonged hospital stay, frequent readmissions and greater in-hospital mortality. Early diagnosis and intervention for undernutrition can therefore result in reduced costs, morbidity and mortality.[22 23] Therefore, screening for undernutrition on admission, to identify patients at risk and those who require nutrition interventions should occur for all hospitalised patients. However, more robust screening and intervention in the community would potentially reduce the burden of undernutrition in those admitted.

Based on the data collected at 12 weeks, a potential relationship emerged between clinical frailty and the participants' response to the programme's intervention. The preliminary findings suggest greater utility of the intervention would be present before significant frailty develops. However, a larger and longer term prospective study is now required. Nonetheless, it is still possible to have a successful outcome from the intervention with a comparatively high frailty rating and these ratings can change during the 12-week period from first interview.

Simple-to-apply methods, screening, brief intervention to identify the risk of undernutrition and dehydration at a community level, and brief treatment could therefore supplement screening practices in primary care and may address undernutrition risk more systematically and consistently at a population level, at pace and scale using the PaperWeight Armband.

There are some limitations to this study. The numbers studied are relatively small and the duration of the study before re-measurement was short. In this evaluation, we cannot be certain that the PaperWeight Armband intervention itself was causally beneficial, since other factors may have been at play, and a Hawthorn effect of being in a study with the participant or their carers knowing that the researcher would be returning cannot be excluded. Nor do we know what the trajectory of weight was at the time of recruitment to the study, or if the effect is sustained or impactful in terms of health and well-being benefits. However, based on these positive pilot data, a longer and larger prospective study is now needed to measure the quality of life effects, the healthcare and cost impacts of the intervention, and to better understand the barriers and facilitators to its usage in order to achieve maximal effect.

What is already known on this subject

- Undernutrition is common in the older population, but often goes unrecognised in the community as no routine screening takes place. It is associated with poorer quality of life and with adverse health outcomes. A current programme is using a simple intervention undertaken by non-clinical agencies based on the community to identify those at risk of undernutrition.

What this study adds

- The PaperWeight Armband intervention is deliverable at scale in the community, without need for clinical expertise. The initial evaluation suggests it is associated with positive outcomes, principally weight gain or stabilisation. A longer and larger research trial is now needed to assess and understand its impact.

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Contributors SE undertook the research and wrote the key content for the manuscript. ER is programme director of the Greater Manchester Nutrition and Hydration Programme and co-designed and led the overall programme. DH is chief executive of Age UK Salford, hosted and co-designed the programme. KF conceived the original armband intervention and co-designed the programme. JM co-designed and oversaw the evaluation. All coauthors reviewed and contributed to the final submission.

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Competing interests None declared.

Patient consent for publication Not required.

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