Improving nutritional discharge planning and follow up in older medical inpatients: Hospital to Home Outreach for Malnourished Elders

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Improving nutritional discharge planning and follow-up in older medical inpatients: Hospital to Home Outreach for Malnourished Elders (HHOME)

ABSTRACT

Aim: Nutritional decline during and after acute hospitalisation is common amongst older people. This quality improvement initiative aimed to introduce a dietitian-led discharge planning and follow-up program (Hospital to Home Outreach for Malnourished Elders, HHOME) at two hospitals within usual resources to improve nutritional and functional recovery.

Methods: Prospective pre-post evaluation design was used. Medical patients aged 65+ years at risk of malnutrition and discharged to independent living were eligible. Participants receiving nutrition discharge planning and dietetic telephone follow-up for four weeks post-discharge ("HHOME") were compared to usual care ("pre-HHOME"). Nutritional (weight, Mini Nutritional Assessment (MNA)), functional (gait speed, handgrip strength, modified Barthel Index) and quality of life (AQoL-6D) outcomes were measured on discharge and six weeks later.

Results: At six weeks, no significant difference in nutritional status was observed between pre-HHOME (n=39) and HHOME cohorts, although the HHOME cohort on average maintained weight while pre-HHOME cohort lost weight (0.4±2.9kg vs. -1.0±3.7kg, p=0.060). Greater improvement in gait speed was seen in HHOME group (+0.24±0.27 vs. +0.11±0.22, p=0.046) with no other significant outcome improvements. Across both cohorts, half were readmitted to hospital and 10% died within 12 weeks post-discharge.

22 Conclusions: The nutritional discharge planning and dietetic follow-up provided to older
23 community-living malnourished patients made a small impact on nutritional and functional
24 parameters but clinical outcomes remained poor.

25 Keywords: malnutrition, dietetics, patient discharge, hospitalization, ageing, older adults

INTRODUCTION

Malnutrition is a significant problem in hospitalised older patients. Around half of older inpatients are malnourished at the time of admission to hospital,[1] which puts them at risk of longer hospital stays, more readmissions, and reduced quality of life.[2-4] Despite careful implementation of inpatient nutritional interventions, older inpatients continue to have sub-optimal nutritional intake,[5-7], which compounds the catabolic conditions of acute illness. A greater focus on nutritional recovery in the early post-hospital period might complement inpatient care and may improve post-hospital outcomes. Studies suggest that older patients are slow to return to their baseline nutritional state after hospitalisation,[8, 9] and frequently experience low nutritional intake,[10] weight loss[11] and often have limited dietetic follow-up[12] once home in the community. Dietetic intervention in the early post-discharge period (via telehealth counselling or home visits) may help in improving intake from food and/or oral nutritional supplements (ONS) with early restoration of nutritional and functional status,[13-16] with potential for reducing morbidity and decreasing utilisation of health care resources.

We previously conducted a feasibility pilot of a multidisciplinary (dietetic and nursing) discharge intervention providing follow-up by home visits and telephone.[17] This model was acceptable to patients and identified local gaps and opportunities for improving nutritional discharge care, but was resource intensive. Informed by this experience and a multidisciplinary stakeholder group, we designed a quality improvement intervention to improve nutritional discharge planning and follow-up within existing hospital and community resources. The aim was to introduce a dietitian-led discharge planning and follow-up program for malnourished or high malnutrition risk older patients admitted to internal medicine services of two hospitals, in order to improve nutritional and functional recovery measured six weeks after hospitalisation.

METHODS

The study was undertaken within a metropolitan health service district which provides care to approximately one million people in northern Brisbane, Australia. Primary care services are provided by a large primary healthcare network and a range of non-government service providers. The study was conducted in the internal medicine wards of the two metropolitan hospitals, which together provide acute general medical inpatient services for about 8000 patients annually. Most patients are admitted via the emergency departments, the majority are aged over 65 years, and both departments focus on interdisciplinary care and early discharge planning.

The baseline model of nutrition care has been described previously.[18] Each hospital had approximately 0.5 full time Accredited Practising Dietitians per 30 bed ward, with the dietitian role focused on inpatient malnutrition care. Beyond individual dietary counselling and prescription of ONS, the dietitian had little role in discharge planning. Each ward had a nursing case manager and access to a specialist discharge facilitation nurse. Existing roles and responsibilities for nutrition care are shown in Table 1.

An action research approach was used to engage clinicians and managers in the design and implementation of the HHOME program. [19] Formal and informal consultation was undertaken with stakeholders from a range of disciplines (clinicians and managers from dietetics, nursing and medical streams), health care settings (hospital, community services, general practitioner (GP) networks) and consumer representative. The purpose of consultation was to identify service goals, current services and practices, and barriers and enablers to nutritional discharge planning and follow-up. A steering committee representing these stakeholders endorsed the proposed service model, identified and prioritised intervention strategies, and supported their implementation.

The HHOME model is outlined in Table 1, and targeted patients aged 65 years and older being discharged to independent living in the community and identified at nutrition risk (as part of routine care using the Malnutrition Screening Tool[209]). New roles for the ward dietitian included comprehensive nutrition discharge assessment and planning, liaison with nursing staff to identify and refer to appropriate community nutrition services if required, and post-discharge dietitian follow-up for all at risk patients. Dietitian review within one week of hospital discharge was provided by telephone to the patient (and carer if identified as beneficial) by the ward dietitian already known to the patient. Where patients were referred to other post-acute dietetic services, they would instead receive a home visit by the dietitian of that team. The dietitian provided up to four weeks of nutrition-related case management to resolve new or existing nutritional issues. This included re-assessment of nutritional intake and barriers experienced, review of nutrition goals and strategies, provision of further education and liaison with family/carers, GP, community service providers and/or hospital staff. A written summary of the telephone review was posted to the patient after each contact. Referrals were made to community service providers for nutrition-related cares (meal delivery, meal preparation, shopping assistance, ongoing dietitian review) as well as non-nutrition related cares (e.g. personal hygiene assistance, nursing or other allied health review) as required. Three senior dietitians (AY, LR, KD)~~initials removed for blinded review)~~ used action research cycles of "look, think, act" and an enabling facilitation approach to support co-design and implementation of strategies with dietitians at each site over a six-month period, starting in mid-2013. Implementation challenges identified by stakeholders and dietitians were mapped to the COM-B-system, a behaviour change theory founded on the understanding that capability, opportunity and motivation interact to generate behaviours.[21] Barriers to changing dietetic behaviours and routines related to capability (limited awareness

of community nutrition services amongst dietitians and discharge nurses), opportunity (no system to support transfer of nutrition information to the community, no process to "book in" outreach telephone calls to ensure appropriate funding allocated for this service) and motivation (limited confidence amongst dietitians in their ability to undertake post-discharge case management, perception that post-discharge care was of lower priority than traditional inpatient role). Figure 1 outlines the implementation strategies used to address these challenges.

A prospective before-and-after study design measured processes of nutrition care and outcomes in a cohort of older medical patients before ("pre-HHOME" cohort, recruited 2012-2013) and after ("HHOME" cohort, recruited 2014) implementation of the new model of care. Characteristics and outcomes of the pre-HHOME cohort have been reported previously,[18] and the same inclusion criteria were used for the HHOME cohort. Consecutive patients admitted to the medical wards at each hospital were screened for inclusion. Patients were eligible if they were aged 65 years or older, had an inpatient stay of three or more days, were discharged back to the community within the local hospital district and were screened at risk of malnutrition. Patients were excluded if receiving palliative care (expected prognosis <3 months), already receiving enteral or parenteral nutrition support, or were assessed as well-nourished using Mini Nutritional Assessment (MNA).[22] Written informed consent was obtained from all participants or substitute decision maker where the patient could not provide consent themselves. The study was approved by Human Research Ethics Committees of both hospitals (HREC/12/QRBW/159, 23rd July 2012).

The primary outcomes were change in weight and MNA score at six weeks. Secondary outcomes were functional outcomes, including hand grip strength, walk speed, self-reported

functional status using modified Barthel index (MBI)[23], and health-related quality of life using Assessment of Quality of Life-6D (AQoL-6D)[24]. Assessments were conducted by a trained research assistant (APD or medical registrar) at baseline (as close to hospital discharge as was practical) and repeated in the participant's home six weeks post-discharge. MNA is a validated measure of nutritional status with a score <17 indicating malnutrition, and 17-23.5 indicating risk of malnutrition[22]. Weight was measured using a single Tanita HD351 scale, precise to 0.1kg. Grip strength was defined as best of three measurements on dominant hand, using a single Jamar hydraulic dynamometer (second position) with participants seated (elbow by their side, flexed to right angle; neutral wrist position). Walk speed was measured with a stopwatch precise to 0.1 second over a four-metre track, with participants instructed to walk at their normal pace from a static start. AQoL-6D was completed by the participants, usually with assistance from the research assistant due to poor vision. As quality of life was introduced as an outcome mid-way, data are only available for 13 participants from the pre-HHOME group. Patient characteristics (age, gender, living arrangements, diagnosis, comorbidities) and length of hospital stay were collected from hospital records. Information about nutrition and community-based care was obtained from patients, carers and/or medical notes. Unplanned hospital readmission and mortality data were obtained from a state-wide hospital admissions database twelve weeks post-discharge to allow description of clinical outcomes of participants.

Data on nutrition care processes were obtained from medical records and discharge summaries of all participants by a student dietitian (blinded to intervention group) to determine fidelity of the intervention. Process measures included whether the dietitian documented the following: dietetic assessment of discharge needs, completion of nutrition discharge summary, prescription of ONS, post-discharge dietetic follow-up, and referral to nutrition-related community services.

Participant characteristics were described using standard summary statistics and compared between the pre-HHOME and HHOME cohorts. Analyses of nutritional and functional outcomes were conducted using intention-to-treat principles; that is, all available data from all participants were included in analysis regardless of whether they received the HHOME program as intended. Paired t-tests were used to assess differences in outcomes (weight, MNA score, grip strength, MBI, walk speed, overall quality of life) at baseline and six weeks post-discharge for each intervention cohort. Independent t-tests were used to compare the mean change in each outcome (from baseline to six weeks post-discharge) between the pre-HHOME and HHOME cohorts. Where variance was not normally distributed (MBI), a non-parametric equivalent was used (within-group change: Wilcoxon Matched-Pair Signed-Rank test, between group change: Mann-Whitney U test). Based on pilot data,[17] it was estimated that 48 participants were required for each group to show a difference of 2 points on the MNA (two tailed, alpha 0.05, 80% power).

RESULTS

Of 2,578 older medical inpatients screened for inclusion in the evaluation, 202 were eligible and 80 consented to participate (pre-HHOME n=39, HHOME n=41) (Figure 2). Participant characteristics are summarised in Table 3. Half of participants lived alone, and half had been hospitalised in the previous six months. Overall, 41% of participants (n=33) were malnourished (MNA <17) with the remainder at risk of malnutrition (MNA 17-23.5), and 43% (n=34) had some dependency with activities of daily living (MBI <90). Participants had slow mean gait speed[25] and poor grip strength at discharge. Cohorts had similar age, nutritional status and functional measures at baseline; co-morbidity levels, weight and BMI were lower in the HHOME group.

Improved discharge care was seen for the HHOME group, with 100% of patients in this group assessed by the hospital dietitian for discharge needs (compared to pre-HHOME: 51%, n=20). More HHOME participants had a nutrition care plan documented in the discharge summary (75% vs. 33%), were prescribed ONS (90% vs. 41%) and received post-discharge dietetic follow-up at six-weeks (88% vs. 18%), compared with pre-HHOME. Of those who did not receive dietitian follow-up (n=4), three were readmitted to hospital before the scheduled review and one declined follow-up. There was no significant difference between groups in regards to referrals to nutrition-related community services such as meal delivery, meal preparation and/or shopping assistance (pre-HHOME: 31%, HHOME: 38%).

Nutritional, functional and quality of life outcomes are shown in Table 4. Over the six-week post-discharge period, the HHOME cohort maintained average weight (mean difference: 0.4kg (SD 2.9), p=0.48), compared with mean weight loss of 1kg (SD 3.7; *p*=0.06) in the pre-HHOME group, with a non-significant between-group difference (*p*=0.06). When weight change was calculated as a percentage of discharge weight (to account for a lower mean weight in the HHOME group at baseline), there was a significant difference in percentage weight change between the two groups (pre-HHOME: -1.7% (SD 4.6%); HHOME: 0.1% (SD 5.3%), p=0.04). MNA scores improved in both groups, with no difference observed between the pre-HHOME and HHOME groups. Walk speed improved in both groups, with significantly greater improvement in the HHOME group. No significant difference was seen in grip strength, functional dependency or overall quality of life.

Length of hospital stay was significantly shorter in the HHOME group (pre-HHOME: 9 days [IQR 4-14], HHOME: 6 days [IQR 5-19], *p*=0.047). Over the twelve-week post-discharge period, 49% of participants (n=39) had at least one unplanned hospital admission (pre-

198 HHOME: 15 (48%), HHOME: 24 (59%), p=0.073), with nine participants having ≥2 hospital
199 admissions. By twelve weeks post-discharge, three participants (4%) were admitted to
200 residential aged care facilities (pre-HHOME: 1, HHOME: 2) and eight participants (10%)
201 had died (pre-HHOME: 4, HHOME: 4).

202

DISCUSSION

Previous controlled trials suggest that nutritional discharge planning and post-discharge follow-up may improve nutritional, functional and/or clinical outcomes for older malnourished medical patients.[13-16, 26] Using a collaborative quality improvement approach, we implemented measureable changes in clinical practice within existing hospital and community resources. The trend to reduced weight loss in the HHOME group suggests that this complex intervention improved nutritional intake. However, apart from a small improvement in walk speed of uncertain clinical significance, this did not translate into improvements in other nutritional and functional measures or quality of life, and malnourished community-living elders in our study experienced poor clinical outcomes following hospitalisation. Length of hospital stay was shorter in the HHOME cohort, which was an unexpected finding given that the intervention focused mostly on post-discharge care. This was also observed by Sharma et al. in their post-discharge intervention,[26] suggesting a possible intervention effect. However other factors may have also explained the difference in length of stay including patient characteristics (lower comorbidity index in HHOME cohort) or other changes to patient flow and discharge processes in the organisation.

Our results are generally consistent with other studies of post-hospital nutrition interventions. The Australian randomised controlled trial of a comparable post-discharge model by Sharma et al. showed no difference in nutritional status, mortality or quality of life, but like our study, described a reduced length of stay, perhaps reflecting improved team communication and discharge planning and importance of providing early nutrition support during hospitalisation.[26] A randomised controlled trial of discharge planning, telephone follow-up and nutritional supplements showed an increase in weight and a trend to reduced functional limitations but no changes in other functional measures including physical performance, strength and activities of daily living.[14] In contrast, the study by Feldblum et al.

(individualised nutrition planning and home visit follow-up) did not show a significant weight gain but did find improvements in the MNA, mostly due to subjective measures.[13] There was no change in function but a significant reduction in six-month mortality. In a similar study, Beck et al. found improved intake and weight gain, but no change in most functional measures and no change in mortality.[15] Similar to our study, they found a trend to increased readmissions, perhaps reflecting earlier detection of clinical deterioration with closer post-hospital follow-up. The randomised controlled trial of post-hospital ONS by Deutz et al. (weekly home or telephone follow-up by study personnel to encourage adherence) demonstrated weight gain and reduced mortality, but no improvement in activities of daily living.[27]

What can we learn from these studies? Firstly, post-discharge dietetic support and follow-up likely improves weight restoration in the short term (six to twelve weeks), and may enhance recovery of nutritional status by six months. Future trials with a focus on long-term nutrition intervention may help verify this hypothesis. Secondly, we have shown it is feasible to integrate a post-discharge role into hospital dietetic practice, although the background work required to identify and liaise with community-based services and other partners should not be underestimated, and requires continuing efforts within evolving systems. For example, the recent introduction of Consumer Directed Care will help to focus more on patient goals, but may require significant information and advocacy from referring practitioners especially in vulnerable patient groups like these malnourished elders to ensure services are well matched to needs and preferences. Thirdly, studies with structured individualised discharge planning focus may reduce length of hospital stay.[28] Finally, these studies clearly enrol a frail and multi-morbid group where a nutrition-focussed intervention alone is unlikely to address underlying health needs. Broader consideration of patients' needs and incorporation of these

into tailored, multifaceted and multidisciplinary interventions are likely required to achieve meaningful functional and clinical outcomes for patients.[29]

The strength of this study is that the HHOME program was implemented and evaluated in usual clinical practice, allowing us to observe its effects within the context of a complex health system. This pragmatic design does present a number of limitations. Firstly, the systematic approach to changing nutrition practice meant that a randomised controlled trial design was not possible, and some of the observed outcome difference may have been explained by differences in baseline characteristics between groups. The pre-post design means that intervention delivery and/or outcomes may have been affected by a change in the health system beyond the intervention. For example, the shorter length of stay and higher readmission rates in the HHOME group may reflect other changes in the organisation related to patient flow; however, these findings have been reported in other randomised controlled trial designs,[15, 26] suggesting that an intervention effect is possible. As the intervention was delivered by up to ten different dietitians as part of their usual practice, there may have been variability in intervention delivery although standardised resources were used to enhance fidelity. Research assistants involved in outcome measurement were not involved in design or delivery of the intervention but were aware of the HHOME program and the pre-post design. It is possible that the six-week follow-up period was too short to observe significant improvement in nutritional and functional after acute hospitalisation, with other studies showing some benefits at 12 weeks post-discharge.[14-16] We did not assess individual adherence to post nutrition support strategies such as supplements. Finally, our sample size was below target despite recruitment sites with large volumes of older medical inpatients and inclusive eligibility criteria, resulting in limited power. Our eligibility and recruitment rates were lower than anticipated, but similar to or better than other nutrition intervention

studies,[26, 27, 309] highlighting the challenge of conducting rigorous research in this complex patient group. This was also reflected in the inability for some participants to complete all measures due to functional limitations, leading to missing data.

CONCLUSION

Introducing enhanced nutritional discharge planning and post-discharge dietetic follow-up may reduce weight loss for older medical patients at risk of malnutrition, but this low intensity dietitian-only intervention may not be enough to significantly improve clinical outcomes. Future research should consider evaluating more intensive post-discharge nutrition programs, and/or programs where nutrition is included as one element of a multicomponent approach to improve functional and quality of life outcomes in this vulnerable patient subgroup. Large studies with adequate follow-up measuring outcomes of importance to patients are needed, recognising that recruitment to such trials is challenging.

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The authors declare no conflicts of interest.

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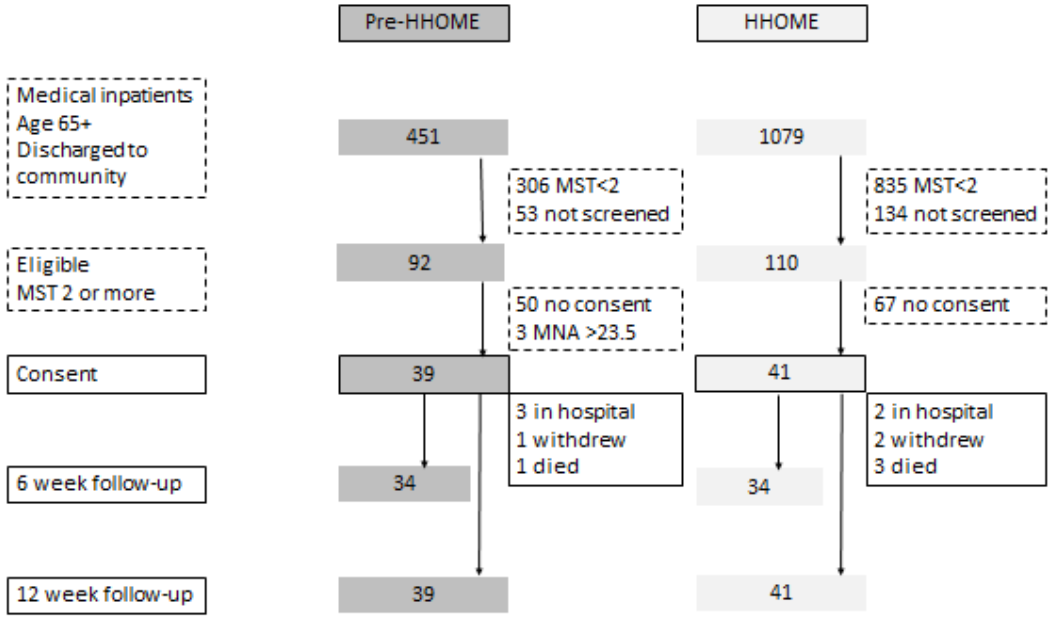
Figure 1. Summary of strategies used to facilitate implementation of the Hospital to Home Outreach for Malnourished Elders program, as mapped to the COM-B framework for behaviour change[20]

387 Figure 2. Recruitment flow diagram for pre-HHOME and HHOME cohorts



388

389 MST: Malnutrition Screening Tool (score of <2 indicates low nutrition risk); MNA: Mini

390 Nutritional Assessment (score of >23.5 indicates normal nutritional status)

391 Table 1. Nutrition practices and responsibilities before and after the introduction of the Hospital to

392 Home Outreach for Malnourished Elders (HHOME) program

	Pre HHOME (2012-2013)	HHOME (2014)
Screening and assessment	Nutrition screening of all admissions using Malnutrition Screening Tool[19] (DA, N) Nutrition assessment for at risk patients (D) Assessment of underlying causes of malnutrition (MO)	Nutrition screening of all admissions Malnutrition Screening Tool[19] (DA, N) Nutrition assessment for at risk patients (D) Assessment of underlying causes of malnutrition (MO)
Inpatient nutrition management	Nutrition care plan for at risk patients (D) Nutrition monitoring and tailoring nutrition plan based on intake and preferences (D) Delivery of prescribed snacks and supplements (DA) Meal ordering, encourage and assist intake (DA, N)	Nutrition care plan for at risk patients (D) ***Nutrition monitoring (DA)*** Delivery of prescribed snacks and supplements ***and tailoring nutrition plan based on intake and preferences*** **(DA)** Meal ordering, encourage and assist intake (DA, N)
Discharge needs assessment	Review of existing services and needs (N)	***Individualized discharge assessment with patient and family including nutrition goals, barriers and strategies, written summary (D)*** ***Review of existing services and needs (N, D)***
Discharge plan	Dietary counselling and supply of oral nutrition supplements if required (D) Referrals to community services[1] as required	Dietary counselling and supply of oral nutrition supplements if required (D) ***Referrals to community services[1] as required***

	(N) Overall summary of presenting condition, diagnosis and management plan (MO)	***(N, D)*** Overall summary of presenting condition, diagnosis and management plan (MO), ***nutrition assessment and plan included in discharge summary (D)***
Follow-up in community	Referral for community dietitian services if required (D) Provision of community services[a], community dietitian review if required (CS)	***Telephone follow-up at 1 week, case management for up to 4 weeks (D)*** Referral for community dietitian services if ***ongoing follow-up*** required (D) Provision of community services[1], community dietitian review if required (CS)

Bold type represents changes to nutrition practices and/or responsibilities

D: dietitian, DA: dietetic assistant, N: nurse, MO: medical officer, CS: community services

[a]e.g. meal delivery services, shopping assistance, meal preparation assistance, personal hygiene assistance, visits by community nurses

397 Table 3. Baseline patient characteristics of the pre-HHOME and HHOME cohorts

398

	PRE-HHOME (n=39)	HHOME (n=41)	*p*
Age, mean years (SD)	81.9 (7.9)	82.7 (8.6)	0.65
Male, n (%)	15 (39%)	11 (27%)	0.27
Living Alone, n (%)	21 (54%)	18 (44%)	0.37
Hospital admission in previous 6 months	22 (56%)	21 (51%)	0.64
Primary Diagnosis, n (%)			0.59
Infection	9 (23%)	13 (32%)	
Fall or Fracture	5 (13%)	5 (12%)	
Cardiorespiratory	5 (13%)	6 (15%)	
Neurological	6 (15%)	2 (5%)	
Other	14 (34%)	15 (37%)	
Charlson Co-morbidity Score, mean (SD)	2.0 (1.1)	1.3 (0.9)	**0.006**
Weight on discharge, kg, mean (SD)	64.3 (14.9)	56.0 (13.2)	**0.011**
BMI on discharge, kg/m^2, mean (SD)	23.1 (5.2)	21.2 (2.5)	0.02
MNA score[a] on discharge, mean (SD)	17.6 (4.1)	17.1 (3.5)	0.54

Grip strength on discharge, kg, mean (SD)	20 (8)	18 (9)	0.42
MBI score[b] on discharge, median (IQR)	92 (20)	90 (15)	0.77
Walk speed on discharge, m/s, mean (SD)	0.64 (0.26)	0.56 (0.20)	0.13

399 [a]MNA: Mini Nutritional Assessment (score from 0-30); score <17 indicating malnutrition, score 17-23.5
400 indicating malnutrition risk; [b]MBI: modified Barthel Index (score from 0-100); score <90 indicating at
401 least moderate dependence.

Table 4. Nutritional and functional outcomes at discharge and six weeks post-discharge of the pre-HHOME (n=34) and HHOME (n=34) cohorts

Variable	PRE-HHOME (n=34)					HHOME (n=34)					**Intervention effect**
	n	Discharge	6 weeks post discharge	Change	*p* value[a]	n	Discharge	6 weeks post discharge	Change	*p* value[1]	*p* value[b]
Weight (kg) (mean, SD)	32	65.1 (14.8)	64.0 (15.4)	-1.0 (3.7)	0.060	34	56.4 (12.9)	56.8 (12.8)	0.4 (2.9)	0.482	0.060
MNA score[c] (mean, SD)	34	17.9 (3.8)	19.6 (3.9)	1.7 (3.4)	0.007	34	16.9 (3.5)	19.0 (3.0)	2.1 (3.4)	0.001	0.609
Grip strength (kg) (mean, SD)	32	20.0 (8.3)	20.1 (8.7)	0.1	0.794	33	19.1 (8.3)	19.8 (8.0)	0.7	0.219	0.428
MBI score[d] (median, IQR)	34	92 (80 – 100)	97 (89 – 100)	N/A	0.195	34	90 (85-100)	90 (86 – 99)	N/A	0.109	0.862
4m walk speed (m/s)	30	0.69 (0.23)	0.80 (0.28)	0.11	0.009	29	0.55 (0.20)	0.79 (0.35)	0.24	0.000	0.046

(mean, SD)				(0.22)					(0.27)		
Overall QoL[e]	13	0.57 (0.23)	0.64 (0.17)	0.08	0.122	28	0.63 (0.20)	0.68 (0.20)	0.05	0.122	0.639
(mean, SD)				(0.17)					(0.17)		

[a]paired t-test (or Wilcoxeon Matched-Pair Signed-Rank) comparing discharge and six week outcomes; [b]independent t-test (or Mann-Whitney U test) comparing change in outcomes between the pre-HHOME and HHOME cohorts; [c]MNA: Mini Nutritional Assessment (score from 0-30); score <17 indicating malnutrition, score 17-23.5 indicating malnutrition risk; [d]MBI: modified Barthel Index (score from 0-100); score <90 indicating at least moderate dependence; [e]QoL: quality of life, measured using the AQoL-6D (score from 0-1, higher score indicating a higher health-related QoL).