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THE IMPACT OF TRAINED VOLUNTEER MEALTIME ASSISTANTS ON THE DIETARY INTAKE OF OLDER FEMALE IN-PATIENTS: THE SOUTHAMPTON MEALTIME ASSISTANCE STUDY

H.C. ROBERTS[1,2,3], A.L. PILGRIM[2,3], K.A. JAMESON[2], C. COOPER[2,3], A.A. SAYER[1,2,3,4,5], S. ROBINSON[2,3]

1. Academic Geriatric Medicine and 2. MRC Lifecourse Epidemiology Unit, University of Southampton; 3. Biomedical Research Centre University of Southampton and University Hospital Southampton NHS FT; 4. Newcastle University Institute of Ageing and 5. Institute of Health and Society Newcastle University. Corresponding author: Dr Helen Roberts, Academic Geriatric Medicine Mailpoint 807, Southampton General Hospital, Southampton SO16 6YD, Tel: 023 8120 4354 Email : hcr@soton.ac.uk

Abstract: *Objective:* Malnutrition among older hospital inpatients is common and is associated with poor clinical outcomes. Time-pressured staff may struggle to provide mealtime assistance. This study aimed to evaluate the impact of trained volunteer mealtime assistants on the dietary intake of older inpatients. *Design:* Quasi-experimental two year pre and post- test study of the introduction of volunteer mealtime assistants to one acute medical female ward, with contemporaneous comparison with a control ward. *Setting:* Two acute medical female wards in a university hospital in England. *Participants:* Female acute medical inpatients aged 70 years and over who were not tube fed, nil by mouth, terminally ill or being nursed in a side room. *Intervention:* The introduction of volunteer mealtime assistants to one ward to help patients during weekday lunchtimes in the intervention year. *Measurements:* Patients' background and clinical characteristics were assessed; 24-hour records were completed for individual patients to document dietary intake in both years on the two wards. *Results:* A total of 407 patients, mean (SD) age 87.5 (5.4) years, were studied over the two-year period; the majority (57%) needed mealtime assistance and up to 50% were confused. Patients' clinical characteristics did not differ between wards in the observational or intervention years. Throughout the intervention year volunteers provided mealtime assistance on weekday lunchtimes on the intervention ward only. Daily energy (median 1039 kcal; IQR 709, 1414) and protein (median 38.9 g: IQR 26.6, 54.0) intakes were very low (n=407). No differences in dietary intake were found between the wards in the observational or intervention years, or in a pre-post-test comparison of patients on the intervention ward. Data were therefore combined for further analysis to explore influences on dietary intake. In a multivariate model, the only independent predictor of energy intake was the feeding assistance required by patients; greater need for help was associated with lower energy intake ($P<0.001$). Independent predictors of protein intake were the feeding assistance given ($P<0.001$) and use of sip feeds; sip feed users had slightly higher protein intakes ($P=0.014$). *Conclusions:* Trained volunteers were able to deliver mealtime assistance on a large scale in an effective and sustainable manner, with the potential to release time for nursing staff to complete other clinical tasks. The study participants had a low median intake of energy and protein highlighting the importance of patient factors associated with acute illness; a stratified approach including oral and parenteral nutritional supplementation may be required for some acutely unwell patients. The level of mealtime assistance required was the factor most strongly associated with patients' poor intake of energy and protein and may be a useful simple indicator of patients at risk of poor nutrition.

Key words: Nutrition, older, inpatients, volunteer, mealtime assistant.

Introduction

Poor nutrition among older people in hospital is well recognised in many countries, and a pooled analysis of data based on the Mini Nutritional Assessment tool recently reported an estimated prevalence of malnutrition of 39% among older inpatients in Belgium, Switzerland, Germany, Italy and Sweden (1). In England nutritional screening surveys using the Malnutrition Universal Screening Tool (MUST) similarly found a prevalence of malnutrition of 38% among patients in Care of the Elderly wards (2). Malnutrition often predates admission and is associated with poor outcomes of hospital care including increased mortality (3) and longer lengths of stay (4). Factors recognised widely to contribute to poor dietary intake include acute illness, co-morbidities, cognitive impairment, low mood and medication (5). The hospital environment has also been scrutinised, with reports from Australia and other countries of food being placed out of reach or going cold because of clinical care at mealtimes, and a lack of assistance from ward staff with eating (6). In the UK the Care Quality Commission reported that 12% of hospitals surveyed in 2012 were not meeting the minimum legal standards for mealtime care of older people (7).

Initiatives to address this issue include the use of coloured trays to identify patients at risk of poor nutrition, and protected mealtimes when non-urgent clinical care stops to allow patients and staff to focus on patients' dietary intake. However the few studies of protected mealtimes, conducted in the UK and Australia, have typically not demonstrated an increase in patients' dietary intake (8, 9). The few trials of additional mealtime assistance have shown mixed results. Increased dietary intake has been shown in a study employing dietetic assistants to help older women with hip fracture (10) and when using undergraduate nutrition students to target feeding assistance for older dysphagic patients (11). However among

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older general medical patients additional assistance from healthcare assistants has not been demonstrated to increase patients' dietary intake (12), nor among patients with dementia (13).

The use of volunteers to help older people in hospital at mealtimes has attracted recent interest but little evaluation (14). An Australian study of 23 patients reported increased energy and protein intakes at two lunchtimes when volunteers were present, compared to two days when they were helped by ward staff as routine care (15) and an American study reported increased dietary intake among 34 patients helped by volunteers (16). Other small studies have reported volunteer activity (17) or anecdotal benefits (18) but did not measure dietary intake. Volunteers are likely to be increasingly important in an era when healthcare systems are generally limited in both financial resources and the ability to recruit sufficient nursing staff. In order to address this gap in the literature through a larger controlled study, the Southampton Mealtime Assistance Study aimed to evaluate the use of trained volunteer mealtime assistants to help older inpatients. The feasibility and acceptability of recruiting and training volunteer mealtime assistants in this study has previously been reported (19). This paper reports the impact of the introduction of mealtime assistants on the intake of energy and protein among older female medical patients.

Methods

Study design

This was a quasi-experimental study with a pre-post-test design. Patients on the intervention ward were compared during the observational (non-intervention) year and the intervention year with parallel comparison with patients on a control ward in the same department during both years. The period of data collection of one year pre and post intervention was chosen to account for issues related to seasonality such as patients' medical conditions and changes in menu and food choice. During the intervention year trained volunteers provided mealtime assistance to patients in the intervention ward on weekday lunchtimes while those on the control ward received usual care from nursing staff. The protocol has been previously described (20). Data collection was repeated in both years on both wards: the primary outcome was patients' dietary intake, collected as individual patient records over 24 hour periods. Demographic data was abstracted from the medical records and the observed levels of confusion among patients and mealtime assistance requirements were recorded.

Participants and setting

All participants aged 70 years and more admitted between February 2010 and January 2012 to two female acute medical wards within the same department at a university hospital in England were eligible for inclusion. The selection of female wards reflects the hospital policy of single sex wards, the resources available for the study and the recognition that the majority of older people are female. Only patients who were nil by mouth, tube fed, on the Liverpool Care Pathway for the dying, or being nursed in a side room were excluded. The patient case-mix, medical and nursing care was very similar on both wards. At the end of the observational year the hospital coincidentally introduced the red tray system to heighten awareness of patients at risk of malnutrition, and also reinforced protected mealtimes whereby clinical activity was suspended during mealtimes to allow staff to concentrate on helping patients to eat. These changes took place in both wards.

Intervention

Volunteers attended a half day training session with a speech and language therapist and dietitian on aspects of assisting older patients at mealtimes including practice in safe feeding strategies (19). They then assisted the nursing staff on the intervention ward during weekday lunchtimes during the intervention year. After cleaning patients' hands and trays prior to lunch, specific assistance included encouragement to eat, opening up packages, cutting up food and feeding patients. The nursing staff indicated which patients needed feeding and the volunteers offered additional help to other patients, recording the help that was actually given at the end of each mealtime. The volunteers were not available at other mealtimes or weekends. In total 29 volunteers assisted patients on the intervention ward during 229 lunchtimes during the year; patients on the control ward received usual mealtime care from the nursing staff.

Data collection

Date of birth, height, weight, body mass index (BMI), Malnutrition Universal Screening Tool ('MUST') score (21), and primary diagnosis were abstracted from patients' clinical records. The level of mealtime assistance given to each patient at lunchtime on the days when dietary intake was measured was observed and recorded as none; cutting up food and preparation of the tray eg opening packages; encouragement to eat; feeding patients; patient refused to eat . The presence on that day of any confusion (a deliberate term to capture delirium, dementia and medication side-effects) among the patients was rated by each patient's nurse as none, mild, moderate or severe.

The primary outcome was the dietary intake of energy and protein by individual patients, which was recorded for a 24 hour period on 14 weekdays in the observational year (7 days on both the intervention and control wards approximately monthly between April and December) and 12 weekdays in the intervention year (6 days on each ward in a similar manner between April and November). The dietary assessment days included a range of weekdays and there was no systematic difference in the availability of volunteers or ward nurses on these days. Typically 16-20 patients were assessed in each day and were evaluated once during their admission. Each individual patient record included all food and drink

consumed by the patient at three mealtimes, seven drinks rounds, sip feeds, and additional food and drinks provided by relatives or consumed at other times including during the night. Research nurses recorded all food items delivered to patients and collected the trays at the end of each meal service or drinks round. All leftover food items, drinks and sip feeds were weighed individually. To derive weights of food consumed, portion size information was obtained from the hospital caterer whose portion control measures ensured that each meal component was within 10% of the stated weight; for other foods, standard portion sizes or manufacturers' information was used as described in the study protocol (20). The nutrient intake of individual patients was derived from the weight of food consumed and its nutritional content. The latter was obtained from the hospital caterer, UK food composition tables and manufacturers' data.

A sample size of 100 subjects per ward in each year was estimated to be sufficient to detect a difference of 218 kcal/day in dietary energy intake with 80% power at the 5% level, assuming a mean (SD) dietary intake of 1300 (550) kcal/day (20).

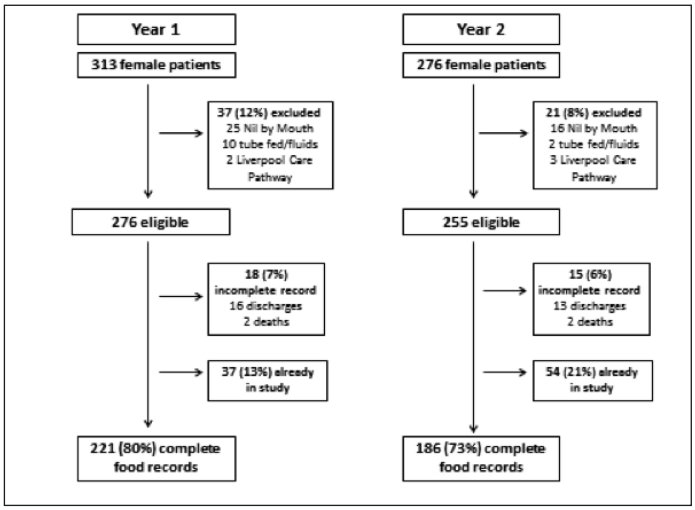
Statistical Analysis

Data were double entered, cleaned and analysed using Stata release 13 (StataCorp, Texas, 2010). Normality was assessed and variables transformed by taking the natural log or deriving Fisher-Yates z-scores where necessary. Summary statistics - mean (SD), median (IQR), number (%) - were used to describe the participants and their dietary intake. Differences in these between the wards and years were assessed using t-tests, $\chi 2$ tests, Fisher's exact tests and Mann-Whitney tests as appropriate. Planned sub-group analysis of clinical factors used to identify those at high risk of poor nutrition (defined a priori as patients who either had a MUST score of 1 or more, were confused, were prescribed a soft diet or additional sip feeds) were conducted. Univariate and mutually adjusted generalised estimating equations (GEE) analyses were used to assess the association between these factors, as well as the level of mealtime assistance, on the dietary intake of energy and protein.

Results

In total 221 patients (intervention ward) and 186 patients (control ward) had their dietary intake assessed over a 24 hour period, representing 77% of the total ward population available on those days. In both years a small number of discharges or deaths led to incomplete records which were excluded, as were a few patients with long admissions who had been previously studied (Figure 1). The patients' mean age was very similar in both wards and both years, and overall there was little difference in participants' characteristics, MUST scores, or primary diagnosis between wards in each year (Table 1). Patient characteristics did not differ significantly between year one and year two on either ward (data not shown). In both years, the majority of patients had a BMI within the normal range and a low MUST score indicating a low risk of malnutrition; however confusion was a common problem on both wards.

Figure 1
Participant recruitment



As expected, there was little difference in the amount of mealtime assistance given when comparing the control and intervention wards during the observational year. Typically each bay of six patients had one nurse helping at each lunch time. However, during the intervention year, the level of mealtime assistance on both wards remained similar. On the control ward this continued to be provided by nursing staff; on the intervention ward two or three volunteers replaced nursing staff on weekday lunchtimes, enabling them to focus on patients with swallowing difficulties and other duties. This meant that for both wards there was no change in the overall level of feeding assistance provided from the observational to the intervention year.

Patients' daily energy and protein intakes were very low, with median (IQR) values of 1039kcal (709, 1414) and 38.9g (26.6, 54.0) respectively (Table 2). There was no difference in patients' daily or lunchtime energy and protein dietary intake between the intervention and control wards in either the observational year or the intervention year, nor when comparing intakes in the observational and intervention years following the introduction of volunteer feeding assistants on the intervention ward (data not shown). Lunch was the main meal on both wards with a median of 32% energy and 37% protein intake, while intake between meals (drinks, sip feeds and extra foods) accounted for 19% and 17% respectively of overall total daily energy and protein intake (data not shown). Planned subgroup analysis considered differences between wards according to patients' risk of malnutrition, current confusion, use of soft diets and sip feeds. With the exception of a difference in energy

Table 1
Description of participants' characteristics

	Observational (non-intervention) Year					Intervention Year				
	Intervention		Control		p-value for difference	Intervention		Control		p-value for difference
	N	Mean (SD)	N	Mean (SD)		N	Mean (SD)	N	Mean (SD)	
Age (years)	117	87.1 (5.3)	104	87.8 (5.8)	0.36	104	87.1 (5.3)	82	87.9 (5.1)	0.33
Height (cm)	100	160.1 (7.5)	97	157.6 (5.8)	0.01	98	158.9 (7.2)	81	158.4 (7.2)	0.65
Weight (kg)1	98	57.5 (1.3)	101	54.4 (1.2)	0.09	89	56.8 (1.3)	76	56.1 (1.3)	0.78
BMI (kg/m2)1	92	22.7 (1.3)	94	21.9 (1.2)	0.31	88	22.5 (1.3)	76	22.5 (1.3)	0.93
	Total N	*N (%)*	*Total N*	*N (%)*		*Total N*	*N (%)*	*Total N*	*N (%)*	
MUST category	90		89		0.26	92		75		0.99
0		54 (60.0)		63 (70.8)			56 (60.9)		46 (61.3)	
1		11 (12.2)		10 (11.2)			12 (13.0)		10 (13.3)	
≥2		25 (27.8)		16 (18.0)			24 (26.1)		19 (25.3)	
BMI category	92		94		0.35	88		76		0.64
>20		63 (68.5)		69 (73.4)			57 (64.8)		54 (71.1)	
18.5-20		8 (8.7)		11 (11.7)			13 (14.8)		8 (10.5)	
<18.5		21 (22.8)		14 (14.9)			18 (20.5)		14 (18.4)	
Mealtime assistance	69		56		0.42	103		81		0.09
None		28 (40.6)		28 (50.0)			41 (39.8)		37 (45.7)	
Cutting & preparation		9 (13.0)		10 (17.9)			19 (18.5)		20 (24.7)	
Encouragement		14 (20.3)		8 (14.3)			17 (16.5)		4 (4.9)	
Feeding		15 (21.7)		10 (17.9)			25 (24.3)		20 (24.7)	
Refused		3 (4.4)					1 (1.0)			
Level of confusion	68		55		0.39	104		82		0.51
None		26 (38.2)		25 (45.5)			52 (50.0)		41 (50.0)	
Mild		11 (16.2)		13 (23.6)			23 (22.1)		24 (29.3)	
Moderate		16 (23.5)		8 (14.6)			15 (14.4)		7 (8.5)	
Severe		15 (22.1)		9 (16.4)			14 (13.5)		10 (12.2)	
On a soft diet	117	36 (30.8)	104	29 (27.9)	0.64	104	38 (36.5)	82	30 (36.6)	1.00
Additional sip feeds	117	25 (21.4)	104	26 (25.0)	0.52	104	23 (22.1)	82	19 (23.2)	0.86
Primary diagnosis	114		103		0.06	104		82		0.14
Medically fit		15 (13.2)		29 (28.2)			27 (26.0)		32 (39.0)	
Infection		28 (24.6)		20 (19.4)			18 (17.3)		9 (11.0)	
Dementia		12 (10.5)		6 (5.8)			4 (3.9)		0 (0.0)	
Geriatric syndromes		9 (7.9)		12 (11.7)			14 (13.5)		12 (14.6)	
Cardiovascular		8 (7.0)		8 (7.8)			9 (8.7)		10 (12.2)	
Other		42 (36.8)		28 (27.2)			32 (30.8)		19 (23.2)	

SD: standard deviation; cm: centimetre; kg; kilogram; m; metre; N; number; %: percentage; MUST: Malnutrition Universal Screening Tool; BMI: body mass index; 1. Geometric mean (SD)

and protein intakes, that were higher among confused patients on the control ward during the intervention year, there were no other differences in patients' intakes of energy and protein observed in these subgroups, when comparing the wards in either the observational or intervention years.

The intervention did not result in greater numbers of patients receiving assistance with feeding, and dietary intakes were comparable across wards. The data were therefore combined in order to explore influences on patients' daily intake of energy and protein. The clinical factors identified a priori as likely to impact on dietary intake were a MUST score of 1 or more, confusion, being prescribed a soft diet or receipt of additional

Table 2
Dietary intake of participants

	Observational (non-intervention) Year					Intervention Year				
	Intervention		Control		p-value for difference	Intervention		Control		p-value for difference
	N	Median (IQR)	N	Median (IQR)		N	Median (IQR)	N	Median (IQR)	
Total daily intake										
Energy (kcal)	117	1028 (717-1388)	104	1017 (686-1290)	0.68	104	1065 (676-1426)	82	1082 (798-1454)	0.55
Energy (kcal/kg)	98	18.2 (11.7-23.7)	100	18.7 (13.0-24.1)	0.76	89	18.2 (10.3-26.8)	76	19.3 (14.1-26.8)	0.34
Protein (g)	117	38.9 (26.8-55.4)	104	38.6 (26.5-51.7)	0.74	104	40.1 (23.3-53.4)	82	39.1 (29.4-54.8)	0.55
Protein (g/kg)	98	0.72 (0.44-0.88)	100	0.70 (0.51-0.97)	0.67	89	0.63 (0.42 – 0.98)	76	0.66 (0.52-0.94)	0.32
Daily intake of patients with MUST score 1+										
Energy (kcal)	36	927 (669-1470)	26	1046 (585-1375)	0.97	36	992 (659-1331)	29	1105 (666-1454)	0.49
Energy (kcal/kg)	34	22.9 (11.8-31.8)	26	20.2 (11.7-29.4)	1.00	36	19.4 (11.0-27.4)	28	21.0 (16.3-32.3)	0.34
Protein (g)	36	38.0 (23.9-53.2)	26	38.4 (24.0-49.0)	0.94	36	35.4 (18.9-48.0)	29	35.9 (26.6-56.9)	0.35
Protein (g/kg)	34	0.88 (0.42, 1.16)	26	0.78 (0.55-1.16)	0.86	36	0.62 (0.45-1.06)	28	0.80 (0.56-1.31)	0.26
Daily intake of patients with confusion										
Energy (kcal)	42	959 (568-1363)	30	867 (536-1034)	0.28	52	831 (535-1404)	41	1112 (798-1441)	0.18
Energy (kcal/kg)	35	18.2 (9.9-28.0)	30	15.9 (11.7-19.9)	0.39	46	15.4 (7.8-24.0)	38	20.4 (14.3-26.9)	0.03
Protein (g)	42	37.8 (26.2-52.3)	30	34.5 (21.5-41.9)	0.23	52	31.6 (19.1-53.6)	41	38.1 (31.4-46.4)	0.12
Protein (g/kg)	35	0.73 (0.39-0.99)	30	0.61 (0.45-0.78)	0.52	46	0.50 (0.31-0.92)	38	0.72 (0.53-0.87)	0.01
Daily intake of patients on a soft diet										
Energy (kcal)	36	876 (724-1394)	29	977 (585-1300)	0.86	38	954 (647-1421)	30	877 (469-1245)	0.55
Energy (kcal/kg)	31	17.3 (12.1-28.7)	29	19.0 (11.6-26.0)	0.88	32	18.1 (9.0-25.4)	27	16.2 (10.1-21.1)	0.69
Protein (g)	36	41.9 (27.1-57.4)	29	39.6 (24.0-50.9)	0.57	38	35.7 (20.5-54.0)	30	37.1 (23.6-42.2)	0.66
Protein (g/kg)	31	0.88 (0.53-1.42)	29	0.75 (0.52-0.94)	0.76	32	0.56 (0.41-0.96)	27	0.65 (0.41-0.83)	0.92
Daily intake of patients on sip feeds										
Energy (kcal)	25	1080 (796-1322)	26	861 (585-1280)	0.25	23	1242 (923-1349)	19	989 (685-1464)	0.18
Energy (kcal/kg)	20	18.6 (14.0-27.0)	26	18.2 (11.6-23.2)	0.44	20	26.6 (20.9-27.9)	19	19.3 (14.1-26.1)	0.09
Protein (g)	25	46.9 (32.5-64.7)	26	38.1 (27.0-49.1)	0.21	23	46.4 (34.8-55.7)	19	38.7 (29.4-61.6)	0.75
Protein (g/kg)	20	0.82 (0.57-1.14)	26	0.71 (0.55-0.99)	0.40	20	0.88 (0.59-1.15)	19	0.71 (0.55-1.07)	0.69

N: number; IQR: interquartile range; kcal: kilocalorie; kg: kilogram; g: gram; MUST: Malnutrition Universal Screening Tool

sip feeds and also the level of mealtime assistance (Table 3). Univariate analysis demonstrated that lower energy intakes were associated with increasing levels of mealtime assistance, with more severe confusion, and with having a soft diet. In the mutually adjusted model only the increasing level of mealtime assistance remained associated with lower intake. Protein intake was similarly negatively associated with increasing mealtime assistance and confusion, but demonstrated a positive association with use of sip feed supplements. The associations with need for feeding assistance and use of sip feeds were robust to mutual adjustment.

Discussion

There is a pressing need to improve the nutrition of older hospital inpatients in a cost-effective manner. The Southampton Mealtime Assistance study is the first large controlled trial of the use of volunteers to help at mealtimes on an acute female medical ward for older people, where a large proportion of patients were confused and required help at mealtimes. The volunteers were able to help patients with feeding and the intervention was sustained over one year (19). However, the introduction of trained volunteers did not increase patients' dietary intake.

The lack of difference in energy and protein intake when comparing wards or years of study may reflect the acuity of illness and frailty of the participants. By pooling the data we were able to explore the role of clinical factors as predictors of intake in this large population of older patients who were acutely unwell. The need for and level of mealtime assistance given was the factor most strongly associated with patients' low intake of energy and protein (independently of other factors such as confusion and the need for a soft diet) and may be a useful simple clinical indicator of patients at risk of poor

Table 3
Association of energy and protein intake with participants' characteristics

	Energy intake (z-score)								Protein intake (z-score)							
	Univariate				Mutually adjusted				Univariate				Mutually adjusted			
	N	Regression coefficient	95% CI	p-value	N	Regression coefficient	95% CI	p-value	N	Regression coefficient	95% CI	p-value	N	Regression coefficient	95% CI	p-value
Mealtime assistance	309				269				309				269			
None (reference)		0	(0.00, 0.00)	.		0	(0.00, 0.00)	.		0	(0.00, 0.00)	.		0	(0.00, 0.00)	.
Cutting & preparation		-0.32	(-0.59, -0.04)	0.023		-0.33	(-0.63, -0.03)	0.030		-0.35	(-0.63, -0.07)	0.013		-0.31	(-0.61, -0.01)	0.046
Encouragement		-0.80	(-1.10, -0.50)	<0.001		-0.78	(-1.11, -0.45)	<0.001		-0.74	(-1.05, -0.43)	<0.001		-0.63	(-0.97, -0.30)	<0.001
Feeding		-0.93	(-1.19, -0.67)	<0.001		-1.00	(-1.31, -0.68)	<0.001		-0.65	(-0.91,-0.39)	<0.001		-0.71	(-1.03, -0.39)	<0.001
Refused		-2.22	(-3.10,-1.35)	<0.001		-2.21	(-3.26, -1.16)	<0.001		-1.99	(-2.88, -1.09)	<0.001		-1.94	(-3.00, -0.89)	<0.001
MUST score	346				269				346				269			
0 (reference)		0	(0.00, 0.00)	.		0	(0.00, 0.00)	.		0	(0.00, 0.00)	.		0	(0.00, 0.00)	.
1+		-0.11	(-0.33, 0.10)	0.291		0.05	(-0.17, 0.27)	0.644		-0.16	(-0.37, 0.05)	0.137		-0.06	(-0.29, 0.16)	0.584
Level of confusion	309				269				309				269			
None (reference)		0	(0.00, 0.00)	.		0	(0.00, 0.00)	.		0	(0.00, 0.00)	.		0	(0.00, 0.00)	.
Mild		-0.16	(-0.43, 0.12)	0.260		0.01	(-0.26, 0.28)	0.931		-0.17	(-0.44, 0.10)	0.206		-0.05	(-0.32, 0.23)	0.746
Moderate		-0.36	(-0.68, -0.04)	0.026		-0.10	(-0.43, 0.23)	0.562		-0.25	(-0.56, 0.06)	0.115		-0.09	(-0.43, 0.24)	0.584
Severe		-0.72	(-1.03, -0.40)	<0.001		-0.02	(-0.37, 0.32)	0.904		-0.70	(-1.01, -0.40)	<0.001		-0.15	(-0.50, 0.20)	0.408
Soft diet user	407				269				407				269			
No (reference)		0	(0.00, 0.00)	.		0	(0.00, 0.00)	.		0	(0.00, 0.00)	.		0	(0.00, 0.00)	.
Yes		-0.23	(-0.44, -0.03)	0.023		-0.02	(-0.27, 0.22)	0.855		-0.10	(-0.30, 0.10)	0.326		0.04	(-0.20, 0.19)	0.723
Sip feed user	407				269				407				269			
No (reference)		0	(0.00, 0.00)	.		0	(0.00, 0.00)	.		0	(0.00, 0.00)	.		0	(0.00, 0.00)	.
Yes		0.12	(-0.11, 0.35)	0.304		0.21	(-0.04, 0.46)	0.098		0.27	(0.04, 0.50)	0.020		0.31	(0.06, 0.56)	0.014

N: number; %: percentage; CI: confidence intervals; MUST: Malnutrition Universal Screening Tool

nutrition.

Similar levels of feeding assistance were observed on the two wards in both the observational and the intervention years. In the intervention year this was achieved by nursing staff on the control ward, but by volunteers and nursing staff on the intervention ward. The trained volunteers were able to successfully provide mealtime assistance and help patients to eat to the same extent as the nurses, and interview data suggests that they provided a high quality service (22). Importantly, trained volunteer mealtime assistants have the potential to free up nursing time to complete more clinical tasks.

Our results are similar to a recent Australian study of mealtime volunteers which also found no significant increase in energy and protein intake (23). Indeed previous studies of mealtime assistance have reported mixed results (10-16). However, a recent meta-analysis by Tassone and colleagues has demonstrated a significant increase in mean dietary energy and protein intake among older inpatients with mealtime assistance (24), combining studies using volunteers and paid staff acting as mealtime assistants.

Most previous studies comparing additional mealtime assistance with usual care have not reported the levels of mealtime assistance achieved with either the assistance or usual care, and a difference in level of assistance provided may be one of the factors behind the mixed results reported. One study (of protected mealtimes and/or additional nursing feeding assistance to male and female medical inpatients, mean age 81 years) which did document the level of mealtime assistance reported an increase in mealtime assistance from 30% to 76-80% patients, with a reduction in other tasks by nursing staff during meals, although this study also found no significant difference in total energy or protein intake (25). The authors suggested that patients with feeding dependency or cognitive impairment gained most benefit from mealtime assistance, which may be consistent with the findings of this study.

There are a number of possible reasons why provision of additional assistance at lunchtimes did not result in an increase in dietary intake. It is possible that mealtime assistance was already adequate. However, the interview and focus group data previously reported confirmed that nurses of all grades of seniority perceived a lack of sufficient help with mealtimes in the observational year which improved with the introduction of volunteers on the intervention ward (22). The second possibility is that there was inadequate identification of individuals who were likely to benefit from the assistance. In this pragmatic study the nurses decided who needed assistance in both wards and in both years, and while this may be subjective it is representative of clinical practice. It is possible that there were misjudgments and/or failure to identify patients who would have benefitted from additional help at mealtimes – although the lack of change in assistance given between the observational and intervention years in the intervention ward makes this less likely. It is also possible that the type of mealtime assistance was not appropriate or sufficient to increase dietary intake. However the volunteers were trained and their competency to deliver mealtime assistance was checked. Importantly the volunteers had more time than ward nurses to help individual patients (22) so this seems unlikely. It is possible that there were not enough volunteers present at mealtimes but during the study the field notes indicated that three was the optimal number and when there were more volunteers they were underemployed. It may be that the volunteers replaced some nursing staff freeing them up for other tasks. The study demonstrated that the volunteers provided the same quantity of support as the nurses but it is possible that there were differences in the quality of mealtime support. However the interviews suggest that the volunteers, who had more time, delivered a high quality service (22). The two study wards were adjoining and it is possible that the Hawthorne effect operated during the study. However the study lasted for two years and there was little transfer of staff between wards; additionally the lack of change from the observational year to the intervention year implies that any effect operated during the both years. Finally in this study we had the power to detect a difference of 218 kcal which would have represented an increase of around 20% energy intake which would be unlikely at one meal. Although measurable changes in intake were not shown in this study this is not consistent with the interview data from staff and volunteers who reported that volunteers did achieve an increase in intake for individual patients but often only by a small amount (22).

The low measured intakes of energy and protein in this study are a concern, and were found despite provision of mealtime assistance, alongside local hospital initiatives to reinforce protected mealtimes, the use of coloured trays and routine screening for malnutrition. Other authors have reported similarly low energy and protein intake among older general medical inpatients (15, 24). These are unlikely to reflect habitual intakes, and are below estimated energy requirements of sick older people (26). We do not think that these low intakes can be explained by underreporting or by limitations in the methods we used to record intake. Research staff were present on the wards from 7am until 10pm and any additional foods consumed during the day or night were recorded. Although a 24-hour period may be insufficient to capture individual energy intake with accuracy, it is sufficient to characterise group intakes (27). The most likely explanation for such low intakes is that our study included acutely unwell patients as well as frail patients with dementia, many of whom were observed to eat very little despite assistance. These results suggest that patient factors in an acute medical setting have a profound effect on food consumption. Nausea, acute infections, higher BMI and cancer have been identified as predictors of poor nutrition among general medical inpatients (28). Other authors have also demonstrated that feeding dependency and delirium contribute to poor dietary intake among older in-patients, (29) and we have recently reported that poor appetite is common among older female inpatients(30).

The energy and protein content of food items offered is also important with regard to achieving adequate dietary intake. In our study protein intake was significantly higher among sip feed users, which may indicate a role for these supplements among patients requiring mealtime assistance. The use of fortified or energy dense foods for older inpatients also needs further evaluation as interviews with patients and relatives previously reported (22) have indicated that many patients found the portion sizes too large; smaller energy dense meals suitable for older people may be needed.

This study had many strengths. It assessed the dietary intake of a large population of older female in-patients, representing the majority of ward patients and, importantly, included those who were confused. Thus it should be representative of older female patients in acute medical wards in other settings. The detailed characterisation of the dietary intake of 407 acutely unwell older inpatients over a two year period produced individual food records which included supplements, drinks and snacks: few studies report weighing individual food components in such detail. However the study also had limitations. The participants were all female and the study took place in two wards in one hospital. The pre-post-test study design is a limitation as it cannot exclude a bias due to differences in the participants or external circumstances impacting the study, although participants' characteristics were similar across both wards and in both study years. Further research is needed, and in particular randomised controlled trials, to assess the impact of volunteer mealtime assistants on the dietary intake of older men and patients in different settings.

Conclusions

This is the first large controlled trial of volunteer mealtime assistance. We have shown that trained volunteers were able to give mealtime assistance to many acutely unwell older female patients and deliver quality mealtime care on a large scale in an effective and sustainable manner, with the potential to release time for nursing staff to complete other clinical tasks. The study participants had a low median intake of energy and protein despite provision of mealtime assistance, reinforcement of protected mealtimes, the use of coloured trays and routine screening for malnutrition. This highlights the importance of patient factors associated with acute illness such as confusion, and a stratified approach including oral and parenteral nutritional supplementation may be required for some acutely unwell patients. The level of mealtime assistance required was the factor most strongly associated with patients' poor intake of energy and protein and may be a useful simple indicator of patients at risk of poor nutrition.

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Conflict of interest statement: None declared

Ethical standards: The study received full approval from the local research ethics committee and was conducted according to the Declaration of Helsinki and Good Clinical Practice requirements. It was registered with ClinicalTrials.gov NCTO1647204.

References

1. Kaiser MJ, Bauer JM, Ramsch C, Uter W, Guigoz Y, Cederholm T, et al. Frequency of malnutrition in older adults: a multinational perspective using the mini nutritional assessment. JAmGeriatrSoc. 2010;58(9):1734-8.
2. Russell C, Elia, M. Nutrition screening surveys in hospitals in England, 2007-2011. www.bapen.org.uk: BAPEN, 2014.
3. Stratton RJ, King CL, Stroud MA, Jackson AA, Elia M. 'Malnutrition Universal Screening Tool' predicts mortality and length of hospital stay in acutely ill elderly. BrJNutr. 2006;95(2):325-30.
4. Kerr A, Syddall HE, Cooper C, Turner GF, Briggs RS, Sayer AA. Does admission grip strength predict length of stay in hospitalised older patients? Age Ageing. 2006;35(1):82-4.
5. Patel MD, Martin FC. Why don't elderly hospital inpatients eat adequately? The journal of nutrition, health & aging. 2008;12(4):227-31.
6. Walton K, Williams P, Tapsell L, Hoyle M, Shen ZW, Gladman L, et al. Observations of mealtimes in hospital aged care rehabilitation wards. Appetite. 2013;67:16-21.
7. Commission CQ. Time to listen in NHS hospitals. Dignity and nutrition inspection programme 2012. 2013 3/1/2013. Report No.
8. Hickson M, Connolly A, Whelan K. Impact of protected mealtimes on ward mealtime environment, patient experience and nutrient intake in hospitalised patients. J HumNutrDiet. 2011;24(4):370-4.
9. Huxtable S, Palmer M. The efficacy of protected mealtimes in reducing mealtime interruptions and improving mealtime assistance in adult inpatients in an Australian hospital. EurJ ClinNutr. 2013;67(9):904-10.
10. Duncan DG, Beck SJ, Hood K, Johansen A. Using dietetic assistants to improve the outcome of hip fracture: a randomised controlled trial of nutritional support in an acute trauma ward. Age Ageing. 2006;35(2):148-53.
11. Wright L, Cotter D, Hickson M. The effectiveness of targeted feeding assistance to improve the nutritional intake of elderly dysphagic patients in hospital. J HumNutrDiet. 2008;21(6):555-62.
12. Hickson M, Bulpitt C, Nunes M, Peters R, Cooke J, Nicholl C, et al. Does additional feeding support provided by health care assistants improve nutritional status and outcome in acutely ill older in-patients?--a randomised control trial. ClinNutr. 2004;23(1):69-77.
13. Liu W, Cheon J, Thomas SA. Interventions on mealtime difficulties in older adults with dementia: a systematic review. IntJ NursStud. 2014;51(1):14-27.
14. Green SM, Martin HJ, Roberts HC, Sayer AA. A systematic review of the use of volunteers to improve mealtime care of adult patients or residents in institutional settings. JClinNurs. 2011;20(13-14):1810-23.
15. Manning F, Harris K, Duncan R, Walton K, Bracks J, Larby L, et al. Additional feeding assistance improves the energy and protein intakes of hospitalised elderly patients. A health services evaluation. Appetite. 2012;59(2):471-7.
16. Robinson S, Clump D, Weitzel T, Henderson L, Lee K, Schwartz C, et al. The Memorial Meal Mates: a program to improve nutrition in hospitalized older adults. GeriatrNurs. 2002;23(6):332-5.
17. Buys DR, Flood KL, Real K, Chang M, Locher JL. Mealtime assistance for hospitalized older adults: a report on the SPOONS volunteer program. J GerontolNurs. 2013;39(9):18-22.
18. Sneddon C, Best J. Introduction of mealtime volunteers in a district general hospital. Nursing standard. 2011;26(15-17):37-40.
19. Roberts HC, De Wet S, Porter K, Rood G, Diaper N, Robison J, et al. The feasibility and acceptability of training volunteer mealtime assistants to help older acute hospital inpatients: the Southampton Mealtime Assistance Study. Journal of clinical nursing. 2014.
20. Roberts HC, Pilgrim AL, Elia M, Jackson AA, Cooper C, Sayer AA, et al. Southampton mealtime assistance study: design and methods. BMC Geriatr. 2013;13:5.
21. Stratton RJ, Hackston A, Longmore D, Dixon R, Price S, Stroud M, et al. Malnutrition in hospital outpatients and inpatients: prevalence, concurrent validity and ease of use of the 'malnutrition universal screening tool' ('MUST') for adults. The British journal of nutrition. 2004;92(5):799-808.
22. Robison J, Pilgrim AL, Rood G, Diaper N, Elia M, Jackson AA, et al. Can trained volunteers make a difference at mealtimes for older people in hospital? A qualitative study of the views and experience of nurses, patients, relatives and volunteers in the Southampton Mealtime Assistance Study. International journal of older people nursing. 2015;10(2):136-45.
23. Huang CS, Dutkowski K, Fuller A, Walton K. Evaluation of a pilot volunteer feeding assistance program: influences on the dietary intakes of elderly hospitalised patients and lessons learnt. The journal of nutrition, health & aging. 2015;19(2):206-10.
24. Tassone EC, Tovey JA, Paciepnik JE, Keeton IM, Khoo AY, Van Veenendaal NG,

et al. Should we implement mealtime assistance in the hospital setting? A systematic literature review with meta-analyses. Journal of clinical nursing. 2015;24(19-20):2710-21.
25. Young AM, Mudge AM, Banks MD, Ross LJ, Daniels L. Encouraging, assisting and time to EAT: improved nutritional intake for older medical patients receiving Protected Mealtimes and/or additional nursing feeding assistance. ClinNutr. 2013;32(4):543-9.
26. Gaillard C, Alix E, Salle A, Berrut G, Ritz P. Energy requirements in frail elderly people: a review of the literature. Clinical nutrition. 2007;26(1):16-24.
27. Design concepts in nutritional epidemiology. Margetts B, editor. Oxford: Oxford University Press 1991.
28. Leistra E, Willeboordse F, MA vB-dvdS, Visser M, Weijs PJ, Haans-van den Oord A, et al. Predictors for achieving protein and energy requirements in undernourished hospital patients. ClinNutr. 2011;30(4):484-9.
29. Mudge AM, Ross LJ, Young AM, Isenring EA, Banks MD. Helping understand nutritional gaps in the elderly (HUNGER): a prospective study of patient factors associated with inadequate nutritional intake in older medical inpatients. ClinNutr. 2011;30(3):320-5.
30. Pilgrim A L BD, Jameson K A, Cooper C, A Aihie Sayer, Robinson S M, Roberts H C. Measuring appetite with the Simplified Nutritional Appetite Questionnaire identifies hospitalised older people at risk of worse health outcomes. The journal of nutrition, health & aging. 2015.