

## Danish University Colleges

### **Does adding a dietician to the liaison team after discharge of geriatric patients improve nutritional outcome a randomised controlled trial**

Beck, Anne Marie; Tolstrup Andersen, Ulla; Leedo, Eva

*Published in:*  
Clinical Rehabilitation

*DOI:*  
[10.1177/0269215514564700](https://doi.org/10.1177/0269215514564700)

*Publication date:*  
2015

*Document Version*  
Other version

[Link to publication](#)

*Citation for pulished version (APA):*

Beck, A. M., Tolstrup Andersen, U., & Leedo, E. (2015). Does adding a dietician to the liaison team after discharge of geriatric patients improve nutritional outcome: a randomised controlled trial. *Clinical Rehabilitation*, (11), 1117-28. <https://doi.org/10.1177/0269215514564700>

#### **General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

#### **Download policy**

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

# Does adding a dietician to the liaison team after discharge of geriatric patients improve nutritional outcome: A randomised controlled trial

Clinical Rehabilitation

1–12

© The Author(s) 2014

Reprints and permissions:

sagepub.co.uk/journalsPermissions.nav

DOI: 10.1177/0269215514564700

cre.sagepub.com



A Beck<sup>1</sup>, UT Andersen<sup>1</sup>, E Leedo<sup>1</sup>, LL Jensen<sup>1</sup>, K Martins<sup>1</sup>, M Quvang<sup>2</sup>, KØ Rask<sup>1</sup>, A Vedelspang<sup>1</sup> and F Rønholt<sup>3</sup>

## Abstract

**Objectives:** The objective was to test whether adding a dietician to a discharge Liaison-Team after discharge of geriatric patients improves nutritional status, muscle strength and patient relevant outcomes.

**Design:** Twelve-week randomized controlled trial.

**Setting and subjects:** Geriatric patients (70 + years and at nutritional risk) at discharge.

**Interventions:** Participants were randomly allocated to receive discharge Liaison-Team vs. discharge Liaison-Team in cooperation with a dietician. The dietician performed a total of three home visits with the aim of developing and implementing an individual nutritional care plan. The first visit took place at the day of discharge together with the discharge Liaison-Team while the remaining visits took place approximately three and eight weeks after discharge and were performed by a dietician alone.

**Main measures:** Nutritional status (weight, and dietary intake), muscle strength (hand grip strength, chair-stand), functional status (mobility, and activities of daily living), quality of life, use of social services, re-/hospitalization and mortality.

**Results:** Seventy-one patients were included (34 in the intervention group), and 63 (89 %) completed the second data collection after 12 weeks (31 in the intervention group). Odds ratios for hospitalization and mortality 6 months after discharge were 0.367 (0.129; 1.042) and 0.323 (0.060; 1.724). Nutritional status improved and some positive tendencies in favour of the intervention group were observed for patient relevant outcomes, i.e. activities of daily living, and quality of life. Almost 100 % of the intervention group received three home visits by a dietician.

**Conclusion:** Adding a dietician to the discharge Liaison-Team after discharge of geriatric patients can improve nutritional status and may reduce the number of times hospitalized within 6 months. A larger study is necessary to see a significant effect on other patient relevant outcomes.

<sup>1</sup>Nutrition Research Unit (EFFECT), The Nordic Kitchen, Herlev Hospital, Herlev, Denmark

<sup>2</sup>Unit for Cross-sectional Co-operation, Development and Research, Herlev Hospital, Herlev, Denmark

<sup>3</sup>Medical Department O, Herlev Hospital, Herlev, Denmark

## Corresponding author:

Anne Marie Beck, Nutrition Research Unit (EFFECT), The Nordic Kitchen, Herlev Hospital, Herlev Ringvej 75, DK-2730 Herlev, Denmark.

Email: Anne.Marie.Beck@regionh.dk

## Keywords

Undernutrition, dietician, comprehensive nutritional support, discharge Liaison-Team

Received: 7 July 2014; accepted: 23 November 2014

## Background

Undernutrition is common in older people admitted to the hospital, and nutritional status often deteriorates further during hospital stay mainly due to lack of recognition of the problem.<sup>1</sup> At discharge a high amount of older patients will still be undernourished or at nutritional risk resulting in an increased risk of hospitalization.<sup>2,3</sup>

Hospital stays are generally getting shorter which leaves limited time to improve a poor nutritional status. Even a short hospital stay increases the risk of loss of muscle strength, functional capacity and ability to cope with activities of daily living (ADL).<sup>4</sup> For older medical patients it is shown that only one in three have regained their habitual physical function one year after discharge.<sup>5</sup> Furthermore, many older people continue to lose weight during the first six months after discharge.<sup>6</sup>

It seems necessary to integrate nutritional support also in the period after discharge. Until now, there are relatively few studies on the effect of cross-sector nutritional support to older patients and the effect of patient relevant outcomes (i.e. quality of life and hospitalization).<sup>7</sup> None of the studies identified in the systematic review<sup>7</sup> used a multimodal approach including nutrition, and sought to address the many other issues; the multi-morbidity, the reduced level of functioning and the excessive use of medication, which may have a negative impact on appetite and food intake. An established model to increasing cross-sector cooperation in Denmark is the discharge Liaison-Team based in the hospital, including our hospital. The purpose of the discharge Liaison-Team is to facilitate the cross-sector transition of older patients between hospital and private home. Hence to follow-up on the medical treatment, the patient's functional abilities and ability to cope with ADL, and the need for change in use of social services (e.g. home care, home

nursing and meals-on-wheels) necessary to the completion of hospital treatment and the rehabilitation of the patient. This takes place at the day of discharge in the geriatric patient's own home and is done in close cooperation with the general practitioner, the community nurse and other relevant professionals. The method is based on a former randomised controlled trial (RCT) which found a decreased risk of hospitalization after 12 weeks (26 % vs. 36 %,  $P=0.012$ ).<sup>8</sup>

The aim of this RCT was to test whether adding a dietician to the discharge Liaison-Team after discharge of geriatric patients improves nutritional status, muscle strength and patient relevant outcomes; mobility, ADL, quality of life, use of social services, hospitalization and mortality.

## Methods

The study was designed as a twelve-week RCT comparing discharge standard discharge Liaison-Team vs. discharge Liaison-Team in cooperation with a dietician. The dietician performed a total of three home visits over a period of 12 weeks.

Patients were randomised the day before discharge and before the baseline assessment. Simple randomisation was used, i.e. each allocation was written on paper, concealed in an opaque envelope and gathered in a jar from which the patients drew a lot after recruitment. Participants, the dieticians, the research assistants and the discharge Liaison-Team, were not blinded for the result of the randomisation.

All older (70+ years of age) patients hospitalised at the wards of Geriatric Medicine (16 beds) and Orthopaedic Surgery (22 beds) at Herlev Hospital (736 beds and 21 wards) were screened by the nursing staff, the dieticians or the research assistants for nutritional risk.

Patients were eligible for this study if they; were at nutritional risk according to the level 2 screening in NRS2002,<sup>9</sup> which is the mandatory tool in Danish hospitals; received nutritional support by means of small volume commercial oral nutritional supplements with a high density of energy and protein at the wards; and were planned to be discharged to their private home assisted by the discharge Liaison-Team.

Patients were excluded from the study when they: suffered from dementia or terminal disease; had impaired renal function (GFR <30 mL/min/1.73 m<sup>2</sup>); were unable to understand the Danish language; were residing in nursing homes or rehabilitation homes; were un-capable of performing hand-grip test; were planning a weight reducing diet or were unable or unwilling to give informed consent.

It was planned that all included patients should be followed home by the discharge Liaison-Team. At Herlev Hospital the discharge Liaison-Team consists of a nurse, an occupational therapist and a physiotherapist. One of these follows the patient to their own home at the day of discharge.

The discharge Liaison-Team visit is guided by an agenda:

- Testing and eventual installation of different aids (e.g. raised toilet seats, walking aids).
- Reviewing of the discharge letter, medication list, prescriptions and use of medication together with the patient.
- Contacting, if relevant, the discharging ward, the home care, and the general practitioner.
- Writing a discharge Liaison-Team note in the Electronic Patient Journal and forwarding this to the home care, and the general practitioner. The Electronic Patient Journal is a common system for all hospitals in the Region of Copenhagen, where medical records for all patients are stored.
- If relevant, additional follow-up visits or contacts by telephone.

### **Intervention**

For patients randomized to the intervention group the dietician joined the discharge Liaison-Team

when the patient was discharged from the hospital. Before discharge the dietician initiated prescription of oral nutritional supplements, if relevant. In the home of the participant the dietician performed an individual nutritional assessment focusing on dietary intake, activity level and weight of each participant, as a basis for developing an individual nutrition care plan consistent with estimated nutritional requirements and nutritional rehabilitation goals. Specific focus was on optimizing the intake of protein and the distribution of protein during the day.<sup>10</sup> The information gathered by the discharge Liaison-Team i.e. regarding the medical treatment, the patient's functional abilities and ability to cope with ADL, and a need for change in social services was taken into consideration. Basal metabolic rate was assessed by means of Schoefield and a factorial method, including activity level and a possible weight gain factor for a BMI below 18.5. This was used to estimate the total energy- and protein requirement for each patient.<sup>11</sup>

To assess dietary intake, the dietician performed a standardised dietary history interview at each visit in order to determine total energy and protein intake of the participant. Strategies for achieving energy and protein requirements and achieving compliance included dietary counselling with attention to nutritional risk factors, timing, size and frequency of meals, recommendations for nutrient dense foods and drinks, and provision of educational material. Providers of meals-on-wheels were contacted, if relevant, to change the meals delivered to and paid by the participants to a high energy and protein dense menu. Subscription of commercial small volume oral nutritional supplements, with high energy and protein density and reimbursed with 60% from the Health Insurance as well as vitamin D, calcium and other vitamins-minerals was also considered to achieve optimal nutritional status.

All in all, three home visits were planned. The first visit was planned to take place at the day of discharge together with the discharge Liaison-Team, while the remaining visits took place approximately three and eight weeks after discharge and was performed by the dietician alone. The aim of visit two and three was to implement the individual dietetic advice and optimize participants' nutritional status by way of reviewing the nutrition care plan, dietary

counselling, motivation and education, monitoring participant weight, and ensuring that energy and protein requirements were achieved. If considered relevant the participants would receive a short follow-up consultation by telephone by the dieticians in order to give advice and to stimulate compliance to the proposed nutritional care plan in-between the home visits. If relevant, the home care and community nursing staff were invited to participate in all three visits. After all three visits the dietary intervention was documented in the discharge Liaison-Team notes and forwarded to the home care, the community nursing and the general practitioner.

After obtaining the patients' informed consent, the research assistants collected data before discharge, regarding possible confounders. This included the following characteristics:

- Age, gender.
- Diagnoses.
- Cumulated Ambulation Score describes the patient's independence with regard to three activities resulting in a score ranging from 0 to 6 where 6 is independent.<sup>12</sup>
- The Mini Mental State Examination (MMSE). Participants, who had difficulties with seeing, hearing or writing, was not asked to complete the MMSE-test.
- Use of oral vitamin D supplement.

Outcome parameters were measured just before discharge and after 12 weeks in the home of the participants. Evaluation of re-/hospitalizations was done after 30 days, 12 weeks and 6 months after discharge. And evaluation of mortality was done after 12 weeks and 6 months after discharge.

All outcome parameters measured are listed below. If nothing else is stated the data were collected by the research assistants who were not blinded to the result of the randomisation.

### *Nutritional status*

- Weight was measured with patients wearing light indoor clothes and no shoes. Scales present in the two wards were used in the hospital

and calibrated project scales were used in the participants' home.

- Body Mass Index (BMI) was calculated as actual weight in kilograms divided by the square of height in meters. As the measurement of height is often not feasible in the chronically diseased, older and frail population, data on height was retrieved from self-reported height.
- Energy and protein intake was assessed by means of a 4-days dietary record and included oral nutritional supplements. Participants received instructions from the research assistants on how to fill in the dietary record. At the hospital, the staff and the research assistants assisted the participants with the recording. At home the participants received the dietary record in advance of the visit. At the visit the finalised record was inspected and ambiguous entries clarified. If the participants were not able to perform the dietary registration, a dietary history interview was performed. The intake of energy and protein was calculated by means of information in the Danish food composition table (available at: [www.foodcomp.dk](http://www.foodcomp.dk)). Schoefield equations were used to calculate the basal metabolic rate by means of information about age and body weight.<sup>11</sup> Underreporting of dietary intake was considered when calculated energy intake/basal metabolic rate were below 1.1.
- Intake of supplements, i.e. oral vitamin D, and commercial oral nutritional supplements was gathered at baseline and after 12 weeks, and by the dieticians at the visits to the intervention group.

### *Muscle strength*

- Hand-grip strength (in kg) was measured with a Jamar 5030J1 Hydraulic Hand Dynamometer. The maximal hand-grip score from three measurements was used.
- Leg muscle strength was assessed by means of 30-seconds chair stand.<sup>13</sup> The mode of chair stand including any modifications (chair height, assistance needed) was registered.

### Functional status

- Mobility was assessed using the validated de Morton Mobility Index (DEMMI)<sup>14</sup> resulting in a DEMMI SCORE (0-100 where 100 is independent mobility).
- ADL was assessed using the Barthel-Index-100.<sup>15,16</sup> A high point score indicates that the patient is independent in the activity.

### Quality of life

Quality of Life was assessed by means of EuroQol-5D-3L (EQ-5D-3L) where the score is ranging from 1.000 to -0.624, where -0.624 is worse than death.<sup>17</sup>

### Social services

Use of social services, i.e. meals-on-wheels, home nursing care, private care, and rehabilitation plans, was gathered by information from the participants or their relatives.

### Re-hospitalizations and mortality

Re-hospitalizations were evaluated after 30 days, and hospitalization 12 weeks and 6 months after discharge. Furthermore, hospitalizations 6 months before inclusion in the study were evaluated. Data on admissions to the hospital before, during and after the study were based on the Hospital Patient Register and the Electronic Patient Journal where data about all patients can be found. Information about the number of days spent in the hospital could also be collected from these.

Mortality, 12 weeks and 6 months after discharge was also evaluated by means of the Hospital Patient Register and the Electronic Patient Journal, together with information obtained from relatives during the intervention period.

**Ethics.** The protocol was sent to the Danish Ethical Board which concluded that approval was not needed and that the project could be carried out as described. Still, informed consent was obtained from all participants. They were also informed about their right to withdraw their consent at any time.

**Statistical analysis.** Primary outcome was muscle strength measured as hand grip strength. For a clinical relevant difference of 2 kg in hand grip strength and an expected drop-out rate of 5 %, <sup>18</sup> a statistical significant level of 0.05 and a power of 80%, 40 patients in each group was required to detect a significant difference. Based on the experience from the discharge Liaison-Team and a former intervention study, <sup>18</sup> it was estimated that this number could be reached after approx 4 months.

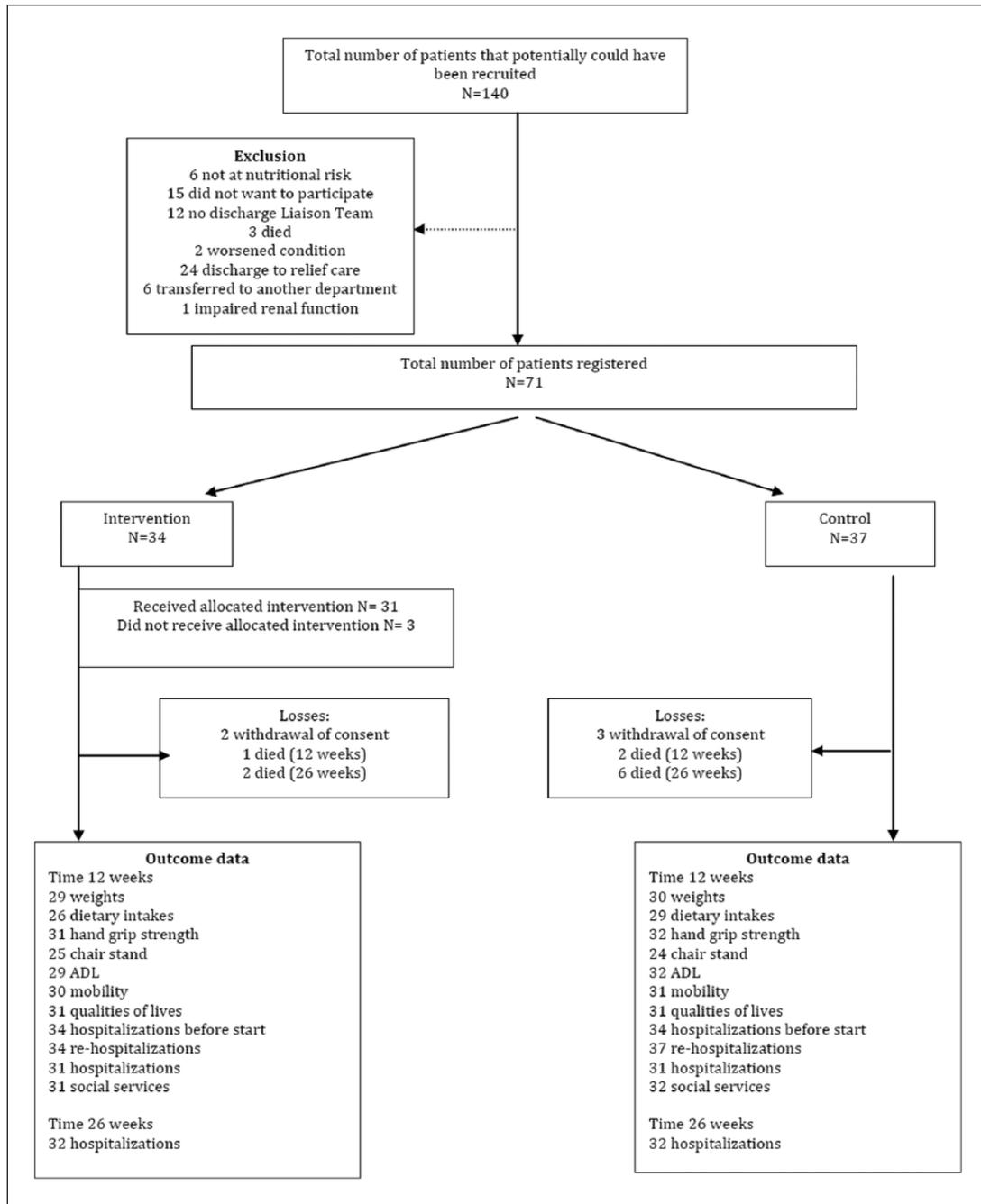
Data-entry and control were conducted by the research assistants under supervision of the principal investigator. The principal investigator was responsible for the data cleaning and analysis. All statistical analyses were performed using IBM SPSS Statistics 19. Data was entered in EXCEL and was subsequently exported into SPSS software for analyses. Primary analyses were undertaken using intention to treat principles, i.e. all participants were included in the analyses, regardless of whether they completed the study or not. Wilcoxon signed rank sum test, Mann-Whitney U test, odds ratio, Pearson Chi-square or Fisher's Exact test of associations was used as appropriate. Data are presented as median (95 % CI), number (%) or odds ratio (95 % CI). A *P*-value <0.05 was considered significant. The analyses were undertaken by the principal investigator who was blinded to the randomisation.

## Results

A total of 140 patients were invited to participate in the period March to September 2013 and 71 (51 %) were included and randomised into two groups. The reasons for exclusion can be seen in the flow-chart (Figure 1). There was no difference between the participants and non-participants in relation to age, sex, nutritional risk score and admission diagnosis (data not shown).

### Characteristics of participants

The characteristics of the participants are presented in Table 1. The prevalence of those discharged to home with the discharge Liaison-Team was identical. A total of 15 participants were instead discharged to a rehabilitation unit. More participants in the control group than in the intervention group



**Figure 1.** Flow-chart for the study.

were discharged to day care with exercise (7 (19%) vs. 1 (3%),  $P=0.03$ ). Oral nutritional supplements prescriptions were part of the intervention, and the

prevalence of participants with such a prescription, at discharge was therefore different (16 (48%) vs. 5 (14%),  $P=0.001$ ).

**Table 1.** Baseline characteristics of participants (N=71).

Group	Intervention group (N=34) Median (95% CI)	Control group (N=37) Median (95% CI)	P-value <sup>a</sup>
Age, years	85 (86;87)	85 (82;88)	0.734
Female, N (%)	22 (65 %)	26 (70 %)	0.617
Geriatric Medicine department, N (%)	28 (82 %)	28 (70 %)	0.491
Discharge Liaison-Team, N (%)	28 (82 %)	27 (73 %)	0.345
MMSE, points	27 (25;28)	26 (24;27)	0.062
Admission diagnosis			0.673
–COPD/pneumonia, N (%)	3 (9 %)	3 (8 %)	
–Urinary tract infection, N (%)	3 (9 %)	1 (3 %)	
–Fall, N (%)	8 (24 %)	10 (27 %)	
–Dehydration, N (%)	3 (9 %)	6 (16 %)	
–Gastrointestinal disturbances, N (%)	11 (31 %)	8 (22 %)	
–Fracture, N (%)	6 (18 %)	9 (24 %)	
Nutritional risk score	3 (3;3)	3 (3;3)	0.936
Cumulated Ambulation Score b)	5 (4;6)	5 (4;5)	0.338
Use of oral vitamin D supplement, N (%)	15 (45 %)	17 (46 %)	0.967
Nutritional status			
–Weight, kg	65.5 (56.8;70.8)	59.3 (55.8;66.0)	0.290
–BMI	22.1 (20.4;25.6)	22.3 (20.2;24.0)	0.630
–Energy intake, MJ/d	6.0 (5.0;7.1)	5.5 (5.2;6.1)	0.122
–Protein intake, g/d	48 (44;60)	44 (37;49)	0.085
Muscle strength			
–Hand grip strength, max kg	20.4 (16.5;21.2)	18.7 (15.9;22.3)	0.739
Functional status			
–Mobility, score <sup>c</sup>	48 (41;57)	48 (41;53)	0.974
–ADL, score <sup>d</sup>	80 (70;90)	80 (70;91)	0.837
Quality of life, score <sup>e</sup>	0.623 (0.496;0.723)	0.708 (0.654;0.743)	0.087
Social services			
–Home-care, N (%)	18 (53 %)	24 (65 %)	0.307
–Community nursing, N (%)	6 (18 %)	7 (19 %)	0.890
–Day care with exercise, N (%)	1 (3 %)	<b>7 (19 %)</b>	<b>0.033</b>
–Dare care without exercise, N (%)	0 (0 %)	0 (0 %)	–
–Meals-on-wheels, N (%)	6 (18 %)	7 (19 %)	0.890
Oral nutritional supplement prescription, N (%)	16 (48 %)	5 (14 %)	0.001

<sup>a</sup>P-values from Pearson Chi-Square or Mann-Whitney U Test, <sup>b</sup>Cumulated Ambulation Score 0-6 (6 is best), <sup>c</sup>de Morton Mobility Index 0-100 (100 is best), <sup>d</sup>Barthel Index 0-100 (100 is best), <sup>e</sup>EQ-5D-3L score 1.000 to -0.624 (1.000 is best).

CI = Confidence Intervals; MMSE = Mini Mental State Examination; ADL = Activities of Daily Living.

### Study flow

A total of 63 (89%) participants completed the second data collection, see flow-chart (Figure 1). All the participants in the intervention group discharged home with the discharge Liaison-Team received the first dietician visit together with the

discharge Liaison-Team. Those discharged to a rehabilitation unit received the first visit from the dietician within a week. Of the 31 participants who completed the study, 30 (97%) received the planned remaining two dietician visits. One participant was hospitalised for a longer time period during the 12

week period which meant the visits were cancelled and that re-scheduling was not possible.

### Effect on outcomes

The intervention had a positive effect on weight, energy and protein intake (see Table 2). The prevalence of underreporting was identical. No differences between intervention and control were seen in relation to functional status, quality of life and use of social services (Table 2). However, some positive tendencies in favour of the intervention group were observed, i.e. in the prevalence who improved their ADL (20 (69%) vs. 15 (52%),  $P=0.180$ ), and their quality of life (22 (71%) vs. 17 (55%),  $P=0.189$ ).

Hospitalization was significantly lower ( $P=0.017$ ) in the intervention group six months after trial start (see Table 3). The positive trend was already observed 12 weeks after start. The odds ratio for re-/hospitalization within 6 months was 0.367 [0.129; 1.042]. The odds ratio for mortality within 6 months was 0.323 [0.060; 1.724].

Six months before the start of the study there was no difference between the groups with regard to re-/hospitalisation (see Table 3).

### Discussion

In this study we found that adding a dietician to the discharge Liaison-Team after discharge of geriatric patients could improve nutritional status, i.e. weight, energy and protein intake. With regard to hospitalization the intervention had a positive effect on the total number of times it occurred within 6 months. Furthermore, some positive tendencies in favour of the intervention group were observed for patient relevant outcomes, i.e. ADL, quality of life, and hospitalization during the 12 weeks intervention period and mortality after 6 months.

The major weakness of the present study is the low participation rate, which means that the study lacked power in relation to discover a significant effect on the patient relevant outcomes, in spite of the positive tendencies observed (see Tables 2 and 3). If we had reached the planned 40 patients in

each group the difference in hospitalization after 6 months would probably have been significant.

In this study there were possibilities of contamination between intervention and control groups. Since the aim of the study could not be blinded to the discharge Liaison-Team, the chosen method could raise the discharge Liaison-Teams attention in relation to nutritional aspects in both intervention and control participants. To try to prevent this contamination it was mainly the same discharge Liaison-Team member who followed participants in the intervention group to their home.

Since the participants were not blinded for the intervention, it was not possible to blind the research assistants who performed the data collection. However, the patient relevant outcomes, quality of life, mortality and hospitalisation are unbiased measures. Specifically with regard to data about the latter two mentioned, the Danish Hospital Patient Register is a reliably tool.

We had estimated that we could include 80 patients within 4 months. However, in practice the in-hospital procedure regarding the discharge Liaison-Team made this difficult. Often the discharge Liaison-Team only knew one day in advance if a patient was going to be discharged with the team. This made it difficult to achieve the inclusion procedure and baseline data collection, and hence some relevant patients were not included. Furthermore, the condition of some included patients changed; and hence they were not followed home by the discharge Liaison-Team, as otherwise scheduled. All in all, fewer patients than expected were followed home by the discharge Liaison-Team. It was therefore necessary to include patients discharged to a rehabilitation unit. At these units it was also possible to involve relevant health care professionals in a multimodal approach. This method has in a former study proven a positive effect on hospital admissions as well.<sup>19</sup>

The major strength of this study is the high compliance to the multimodal intervention. It seems feasible to implement the method in every day practice, where no time is needed to achieve the inclusion procedure and baseline data collection. We only had a few exclusion criteria and there were no differences between the participants and

**Table 2.** Change in study variables after 12 weeks of treatment.

Outcomes	Final data		Changes		P-value <sup>a</sup>
	Intervention group median (95% CI)	Control group median (95% CI)	Intervention group median (95% CI)	Control group median (95% CI)	
<b>Nutritional status</b>					
-Weight, kg	66.1 (58.8;70.7)	58.7 (56.5;62.4)	0.5 (-1.0;3.1)	-0.9 (-3.2;0.8)	0.025
-Energy intake, MJ/d	7.9 (7.4;9.1)	6.4 (5.9;7.2)	1.4 (0.9;3.0)	0.9 (-0.1;1.2)	0.168
-Energy intake <1.1 x BMR, N (%)	4 (15 %)	9 (32 %)			0.150
-Protein intake, g/d	71 (59;84)	52 (41;57)	19 (12;26)	3 (-4;15)	0.003
<b>Muscle strength</b>					
Hand grip strength, max kg	19.1 (15.7;22.2)	19.2 (15.4;22.1)	0.5 (-1.0;2.5)	-0.4 (-2.5;1.0)	0.151
Chair stand, improved, N (%)	16 (64 %)	15 (63 %)			0.913
<b>Functional status</b>					
-Mobility, score <sup>b</sup>	44 (39;62)	53 (36;62)	0 (-6;15)	0 (-3;14)	0.885
-ADL, score <sup>c</sup>	87 (82;95)	90 (80;95)	6 (-2;11)	0 (-1;15)	0.565
Quality of life, score <sup>d</sup>	0.722 (0.655;0.771)	0.722 (0.594;0.723)			0.657
<b>Social services</b>					
-Home-care, N (%)	25 (81 %)	28 (88 %)			0.457
-Community nursing, N (%)	18 (58 %)	17 (53 %)			0.693
-Day care with exercise, N (%)	7 (23 %)	7 (22 %)			0.946
-Dare care without exercise, N (%)	1 (3 %)	3 (9 %)			0.317
-Meals-on-wheels, N (%)	14 (45 %)	10 (31 %)	0.121 (0.0;0.180)	0.09 (-0.06;0.07)	0.297
Oral nutritional supplement, N (%)	13 (48 %)	5 (17 %)			0.001

<sup>a</sup>P-values from Pearson Chi-Square or Mann-Whitney U Test, <sup>b</sup>de Morton Mobility Index 0-100 (100 is best), <sup>c</sup>Barthel Index 0-100 (100 is best), <sup>d</sup>EQ-5D-3L score 1.000 to -0.624 (1.000 is best).

CI = Confidence Intervals; BMR = Basal metabolic rate; ADL = Activities of Daily Living.

**Table 3.** Re-hospitalization (within 30 days), hospitalization and mortality.

Outcomes	Intervention group	Control group	P-value <sup>a</sup>
	Median (95% CI)	Median (95% CI)	
Re-hospitalization within 30 days, N (%)	5 (15 %)	7 (19 %)	0.756
Number of times within 30 days, N (%)			0.399
0, N (%)	29 (85%)	30 (81 %)	
1, N (%)	4 (12 %)	3 (8 %)	
2, N (%)	1 (3 %)	4 (11 %)	
Total number of times within 30 days	0 (0;0)	0 (0;0)	0.560
Hospitalization within 12 weeks, N (%)	8 (26 %)	12 (35 %)	0.435
Number of times within 12 weeks, N (%)			0.427
0, N (%)	23 (75 %)	22 (65 %)	
1, N (%)	6 (19 %)	5 (15 %)	
2, N (%)	1 (3 %)	4 (12 %)	
3, N (%)	1 (3 %)	3 (10 %)	
Total number of times within 12 weeks	0 (0;0)	0 (0;1)	0.291
Hospitalization within 6 months, N (%)	9 (28 %)	16 (52 %)	0.074
Number of times within 6 months, N (%)			0.138
0, N (%)	23 (72.5)	15 (48 %)	
1, N (%)	6 (19 %)	4 (13 %)	
2, N (%)	2 (6 %)	5 (16 %)	
3, N (%)	1 (3 %)	3 (10 %)	
4, N (%)	0 (0 %)	3 (10 %)	
5, N (%)	0 (0 %)	1 (3 %)	
Total number of times within 6 months	0 (0;0)	0 (0;2)	0.017
Hospitalization within 6 months before start of trial N (%)	10 (29 %)	13 (35 %)	0.623
Number of times within 6 months before start, N (%)			0.526
0, N (%)	24 (70 %)	24 (64 %)	
1, N (%)	7 (21 %)	8 (22 %)	
2, N (%)	2 (6 %)	5 (14 %)	
3, N (%)	1 (3 %)	0 (0 %)	
Total number of times within 6 months before start	0 (0;0)	0 (0;1)	0.586
Death			
Within 12 weeks, N (%)	1 (3 %)	2 (5 %)	1.000
Within 6 months, N (%)	2 (6 %)	6 (16 %)	0.264

<sup>a</sup>P-values from Fisher's Exact Test, Pearson Chi-Square or Mann-Whitney U Test.  
CI = Confidence Intervals.

non-participants. Hence, we think that our sample and findings is representative. Furthermore, according to our knowledge, no other studies have assessed the effect of adding a dietician to a discharge Liaison-Team. The discharge Liaison-Team model is based on a RCT which have proven a decreased risk of hospitalization (26 % vs. 36 % after 12 weeks,  $P=0.012$ ) using this model.<sup>8</sup> In contrast to

our findings this difference was significant which may be due to lack of power in the present study. The prevalence of hospitalization after 12 weeks in our study was 25% vs. 35% (see Table 3). Hence the discharge Liaison-Team model alone was less effective in relation to hospitalization, than in the original RCT. In the original RCT, the mortality after 12 week was 7 % vs. 10 %.<sup>8</sup> In the present

study it was even lower; 3 % vs. 5 % after 12 weeks (see Table 3).

It was not possible to distinguish in this project whether the positive out-come was due to being discharged with the discharge liaison team or the three visits from a dietitian at home, though we believe the success was due to a synergy of combining the two ways of working.

In a Danish RCT comparing discharge follow-up in geriatric patients' home by general practitioners vs. discharge follow-up in patients' homes by general practitioners and dieticians the results also showed a positive effect of the nutritional status but no effect on hospitalization.<sup>18</sup> This was in spite of a higher number of participants (total  $N=132$ ) than in the present study and hence a higher power. An explanation might be that the multimodal approach was not achieved as planned in the former study.<sup>18</sup> This was not the case in the present study, where all the participants in the intervention group discharged with the discharge Liaison-Team received the first dietician visit together with the discharge Liaison-Team.

From Table 2 it can be seen that the control group continued to lose weight after discharge, which has also been reported by others.<sup>6</sup> Even though it seems important to integrate nutritional support also to the period after discharge, there are relatively few studies on the effect of cross-sector nutritional support. An earlier systematic review identified six studies, which have used commercial oral nutritional supplements<sup>7</sup> and a recent systematic review identified 15 multimodal intervention studies, of which two included cross-sector aspects.<sup>20</sup> Both reviews concluded limited evidence on patient relevant outcomes.<sup>7,20</sup>

We decided to use a multimodal intervention, which included individual education, motivation and counselling, dietary modification and supplementation offered by a dietician. This method was based on the experience from our former study<sup>10</sup> where we showed a very high compliance among the participants to such an approach. The intervention was not very time consuming, neither in the former nor in the present study, averaging two hours per visit.

It is necessary to provide adequate nutritional support after hospitalization to rehabilitate geriatric patients as close to pre-morbid function as possible so that physical decline, and re-/hospitalization are minimized. The result of this project has documented a positive effect of a method to ensure the cross-sector quality of nutritional support to geriatric patients. The method was feasible in practice and well-received by the older patients. The next step might be to assess whether this method may ultimately lead to reduced health care costs. An earlier study has assessed the budget impact oral nutritional supplements to undernourished older adults and found that it may be cost saving, due to not the least, the reduction in hospitalizations.<sup>21</sup>

In conclusion, adding a dietician to the discharge Liaison-Team after discharge of geriatric patients can improve nutritional status and may reduce the number of times hospitalized within 6 months. A larger study is necessary to see significant effect on other patient relevant outcomes.

#### Clinical messages

- Adding a dietician to the discharge Liaison-Team after discharge of geriatric patients seems effective in improving nutritional status and reducing the number of times hospitalized within 6 months.
- Geriatric patients at nutritional risk can benefit from nutritional intervention by a dietician after discharge.

#### Conflict of interest

The authors declare no conflict of interest.

#### Funding

The project has been funded by a grant from the Danish Regions and the Danish Health Cartel.

#### References

1. McWhirter JP and Pennington CR. Incidence and recognition of malnutrition in hospital. *BMJ* 1994; 308: 945–948.
2. Charlton KE, Nichols C, Bowden S, Lambert K, Barone L, Mason M, et al. Older rehabilitation patients are at high

- risk of malnutrition: evidence from a large Australian database. *J Nutr Health & Aging* 2010; 14: 622–628.
3. Boumendjel N, Herrmann F, Girod V, Sieber C and Rapin C-H. Refrigerator content and admission in old people. *Lancet* 2000, 356: 563.
  4. Alley DE, Koster A, Mackey D, Cawthon P, Ferrucci L, Simonsick EM, et al. Health, Aging and Body Composition Study. Hospitalization and change in body composition and strength in a population-based cohort of older persons. *J Am Geriatr Soc* 2010; 58: 2085–2091.
  5. Boyd CM, Landefeld CS, Counsell SR, Palmer RM, Fortinsky RH, Kresevic D, et al. Recovery of activities of daily living in older adults after hospitalization for acute medical illness. *J Am Geriatr Soc* 2008; 56: 2171–2179.
  6. Miller MD, Crotty M, Whitehead C, Bannerman E and Daniels LA. Nutritional supplementation and resistance training in nutritionally at risk older adults following lower limb fracture: a randomised trial. *Clin Rehab* 2006; 20: 311–323.
  7. Beck A, Holst M and Rasmussen HH. Oral nutritional support of old patients after discharge from hospital: systematic review and meta-analysis of randomised controlled trials. *Clin Rehab* 2013; 27: 19–27.
  8. Discharge Liaison-Team. [Discharge Liaison-Team to old medical patients at discharge from hospital. A randomized controlled trial]. Gentofte Hospital, 2007 (in Danish).
  9. Kondrup J, Allison SP, Elia M, Vellas B and Plauth M. ESPEN guidelines for nutrition screening 2002. *Clin Nutr* 2003; 22: 415–421.
  10. Pedersen AN and Ovesen L (Eds). [Recommendations regarding the food served in Danish institutions]. Danish Veterinary and Food Administration. Søborg, Denmark, 2009 (in Danish).
  11. WHO. Technical Report Series 724: *Energy and protein requirements: reports of a FAO/WHO/UNU expert consultation*. World Health Organisation, 1985.
  12. Kristensen MT, Jakobsen TL, Nielsen JW, Jørgensen LM, Nienhuis RJ and Jønsson LR. Cumulated ambulation score to evaluate mobility is feasible in geriatric patients and in patients with hip fracture. *Dan Med J* 2012; 59: A4464.
  13. Jones CJ, Rikli RE and Beam WC. A 30-s Chair-Stand Test to Measure Lower Body Strength in Community-Residing Older Adults. *Res Q Exerc Sport* 1999, 70: 113–119.
  14. De Morton NA, Davidson M and Keating JL. The de Morton Mobility Index (DEMMI): An essential health index for an aging world. *Health Qual Life Outcome* 2008; 6: 63.
  15. Shah S, Vanclay F and Cooper B. Improving the sensitivity of the Barthel Index for stroke rehabilitation. *J Clin Epidemiol* 1989; 42: 703–709.
  16. Maribo T, Lauritsen JM, Wæhrens E, Poulsen I and Hesselbo B. [Barthel Index for evaluation of function: a Danish consensus on its use]. *Ugeskr Læger* 2006; 168:2790–2 (In Danish).
  17. Oemar M and Oppe M. *EQ-5D-3L User Guide*. EQ-5D version 5, 2013.
  18. Beck A, Kjær S, Hansen BS, Storm RL, Thal-Jantzen K and Bitz C. Follow-up home visits with registered dietitians have a positive effect on the functional and nutritional status of geriatric medical patients after discharge. A randomised controlled trial. *Clin Rehab* 2013; 27: 483–493.
  19. Gregersen M, Zintchouk D, Borris LC and Damsgaard EM. A geriatric multi-disciplinary and tailor-made hospital-at-home method in nursing home residents with hip fracture. *Geriatr Orthop Surg Rehabil* 2011; 2: 148–154.
  20. Thorne F and Baldwin C. Multimodal interventions including nutrition in the prevention and management of disease-related malnutrition in adults: A systematic review of randomized control trials. *Clin Nutr* 2014; 33: 375–384.
  21. Freijer K, Nuijten MJC and Schols JMGA. The budget impact of oral nutritional supplements for disease related malnutrition in elderly in the community setting. *Front Pharmacol* 2012; 3: 78.