Are informal carers and community care workers effective in managing malnutrition in the older adult community? A systematic review of current evidence
Marshall, Skye; Bauer, Judith; Capra, Sandra; Isenring, Elizabeth

Published in:
Journal of Nutrition, Health and Aging

DOI:
10.1007/s12603-013-0341-z

Published: 01/01/2013

Document Version:
Peer reviewed version

Link to publication in Bond University research repository.

Recommended citation(APA):
Are informal carers and community care workers effective in managing malnutrition in the older adult community? A systematic review of current evidence

Skye Marshall\textsuperscript{a,b,c}, Judith Bauer\textsuperscript{a,d}, Sandra Capra\textsuperscript{a,e}, Elizabeth Isenring\textsuperscript{a,f,g,h}

\textsuperscript{a} Centre for Dietetics Research, School of Human Movement Studies, University of Queensland, Brisbane, Queensland, 4072, Australia
\textsuperscript{b} Corresponding author. School of Human Movement Studies, Room 407B, Building 26, the University of Queensland, Brisbane, Queensland, 4072, Australia. Phone: 61+ 07336 56982, Fax: 61+ 07 3365 6877, skye.marshall@uq.net.au
\textsuperscript{c} BNutr&Diet(Hons), PhD Candidate
\textsuperscript{d} Associate Professor Nutrition and Dietetics
\textsuperscript{e} Professor of Nutrition
\textsuperscript{f} BHSc(Nutr&Diet)(Hons), PhD
\textsuperscript{g} Princess Alexandra Hospital, Woolloongabba, Queensland
\textsuperscript{h} Alternate corresponding author. School of Human Movement Studies, Room 407B, Building 26, the University of Queensland, Brisbane, Queensland, 4072, Australia. Phone: 61+ 07 3365 6982, Fax: 61+ 07 3365 6877, e.isenring@uq.edu.au

Text words: 2829
Abstract

**Background:** Enhancing the effectiveness of the community and aged care workforce to prevent malnutrition and functional decline is important in reducing hospital and aged care facility demand. **Objective:** To investigate the impact of nutrition-related interventions delivered to or by informal carers and non-clinical community care workers on malnutrition-related health outcomes of community-dwelling older adults (≥65 years). **Methods:** Intervention studies were searched for using six electronic databases for English-language publications from January 1980 to 30 May 2012. **Results:** Nine studies were eligible for inclusion. The strength and quality of the evidence was moderate (six studies with level II intervention evidence, five with positive quality). Types of interventions used were highly varied. The majority of interventions were delivered to informal carers (6 studies), with three of these studies also involving older adult care recipients. Five interventions were targeted at identifying, preventing and/or treating malnutrition specifically (two positive quality, three neutral quality, n=2368). As a result of these interventions, nutritional status improved or stabilized (two positive quality, two neutral quality, n=2333). No study reported an improvement in functional status but two successfully prevented further decline in their participants (two neutral quality, n=1097). **Conclusion:** Interventions targeted at identifying, preventing and/or treating malnutrition were able to improve or prevent decline in nutritional and functional status, without increasing informal carer burden. The findings of this review support the involvement of non-clinical community care workers and informal carers as part of the nutritional care team for community-dwelling older adults.

**Keywords:** aged, caregiver, community, malnutrition, nutrition
Introduction

The World Health Organization has said “...population ageing is one of humanity’s greatest triumphs” (1) and while this is true, it also presents some of the greatest challenges to the health and aged care sectors. As populations continue to age, enhancing the effectiveness of the community and aged care workforce to improve overall health of older adults will be key in reducing hospital and aged care facility demand, a priority target of current health service research and policy (2-4).

Malnutrition (undernutrition) occurs when food and nutrient intake is unable to meet nutrient requirements over time leading to a disruption of homeostasis in body weight, body composition and physical function (5). The consequences of malnutrition are significant, including increased risk of pressure ulcers, impaired wound healing, falls, hospitalizations, earlier institutionalization and mortality (6-13). In Australia, the prevalence of malnutrition in the community is estimated to be 10-30% (14), however chronic disease states and the physiological and psychosocial changes that occur in ageing place older adults (≥65y (15)) at higher nutritional risk (14). In a multinational comparison (n=12 countries; n=964 community-dwelling participants) using retrospective pooled data of studies which utilized the MNA (Mini Nutritional Assessment tool), 32% of older adults were classified as at risk of malnutrition, and 6% were classified as malnourished (9.5% males, 5.3% females) (16).

Despite the significant physical, social and economic consequences of malnutrition and significant prevalence in the older population, there is strong evidence to show malnutrition is under-recognized and under-diagnosed in the community setting. Until this is addressed, no clear recommendations can be made regarding frequency of malnutrition screening nor treatment protocols (14, 17).
An ageing population increases the pressure of resourcing adequately trained health professionals in the aged and health care sectors (18). In response to these workforce pressures, the aged care sector has been moving towards a more streamlined, lower cost workforce by utilizing non-clinical staff, which currently make up the majority of the workforce (19). Due to these changes in the aged care workforce, non-clinical community care workers and informal carers may have the most important role in the provision of services to prevent malnutrition in community-dwelling older adults. However, there is limited research in this area and it is unclear to what extent these caregivers are able to affect malnutrition-related outcomes in community-dwelling older adults.

**Aim**

To investigate the impact of nutritional interventions delivered to or by informal carers and non-clinical community care workers on malnutrition-related health outcomes of community-dwelling older adults.
A systematic literature review of current evidence was conducted. The review methodology was designed in reference to the Cochrane Handbook of Systematic Reviews of Interventions (20).

**Search strategy**

Intervention studies were searched for using the electronic databases CENTRAL, CINAHL (via Ebscohost), EMBASE, Health Source: Nursing/Academic Edition, PubMed and Web of Science for English-language publications from 1980 to 30 May 2012. The search strategy was tailored utilizing each databases’ controlled vocabulary or subject terms (Appendix).

Briefly, the MeSH Terms aged, caregivers, homemaker services, home health aides, community networks, inservice training, education, nonprofessional, protein energy malnutrition, malnutrition, and nutritional status were used to search PubMed and CENTRAL in various combinations. CENTRAL was also searched using the MeSH terms as keywords. The search terms for CINAHL (via Ebscohost), Health Source: Nursing/Academic Edition (via Ebscohost), EMBASE and Web of Science were those that were the equivalent of the MeSH term. Where a controlled vocabulary did not have a suitable subject term the search term was entered as a keyword.

Interventions were considered which were delivered to 1) informal carers: adults ≥18y who provide care for community-dwelling older adults, ≥65y (15), and have no professional caregiving education or training, or 2) Non-clinical community care workers: paid workers who provide in-home care to community-dwelling older adults and have no health-related professional background or education. Interventions were considered if they were delivered in an in-home, community or outpatient setting. Studies which addressed samples of adults <65y were included if the mean age of the study population was ≥65y. Studies in which the
community-dwelling older adult receives intervention were included if their informal carer or community carer was involved.

Exclusions

Studies were excluded if participants received enteral tube feeding, parenteral nutrition, hemodialysis, peritoneal dialysis and diabetes, cardiovascular or cancer. Studies that delivered an intervention without any nutritional component, did not involve informal or non-clinical community care workers or did not target the intervention to improving outcomes in community-dwelling older adult care recipients were also excluded. Abstract, conference papers and unpublished studies were not considered.

Selection of studies

A two-step screening process was employed. In step 1, one author scanned the titles and abstracts of studies identified by the search for their eligibility. Full text articles that were identified as eligible or unclear were retrieved. At step 2, full-text articles were screened by one author for eligibility and included studies were checked by a second author.

Data extraction and synthesis

Data was extracted into standardized tables by a single author. A list of outcome measures meaningful to the review objective was developed in order to identify the relevant effects of interventions and highlight gaps in the current body of evidence. The list of outcomes was divided into primary outcomes (outcomes of foremost interest for analysis) and secondary outcomes (not primary concern but still relevant). The primary outcome measures in the care recipient were malnutrition, weight change, muscle strength, quality of life, functional status, institutionalization and hospitalization. Secondary outcome measures in the care recipient included body fat, muscle mass, nutritional intake, nutritional knowledge, biomarkers of...
nutritional status, complications/comorbidities of malnutrition (edema, pressure ulcers, infections, delayed wound healing), subjective wellbeing and healthcare costs/utilization.

Secondary outcome measures in the informal carer included carer burden, mental health, quality of life, self-efficacy, subjective wellbeing and nutritional knowledge. Secondary outcomes measures of non-clinical community care workers included nutritional knowledge, food preparation skill competencies, care behavior and cost-effectiveness to organization.

Results were reported as significant at the \( P<0.05 \) level. Non-significant (NS) results were reported as such. As well as study design, participant characteristics and outcomes, the interventions were described. Control groups did not receive nutritional intervention or care unless specified otherwise.

Review of study quality

The strength of studies was determined using the National Health and Medical Research Council (NHMRC) levels of evidence according to type of research question (21). The NHMRC levels of evidence provide a guide to the strength of evidence addressing clinical questions based on a hierarchy of study design, and are graded I (strongest) to IV (weakest) (21). The quality of studies was assessed using the Academy of Nutrition and Dietetics’ Quality Criteria Checklists for primary research or review article, where appropriate, and designated with a positive (+, strong quality), neutral (Ø, neither strong nor weak quality) or negative (-, weak quality) assessment (22). Review of strength and quality of studies was conducted by one author and checked by a second author. Where the authors did not agree, the study was reviewed by a third author. Results of studies identified as having a negative study quality were excluded from data synthesis.
Results

The search identified a total of 1962 citations, of which 175 full-texts were retrieved at step 1 (Figure 1). Using an inclusion/exclusion form, 11 studies were identified as eligible for review (Table 1). Table 2 describes the nutrition interventions and outcomes of the included studies. There were seven studies which addressed primary outcomes, four of which also measured secondary outcomes (23-26). Two studies solely addressed secondary outcomes (27, 28), and two addressed no outcomes (29, 30). Overall the strength of the evidence was moderate with six of the 11 studies being randomized controlled trials (RCTs), five with positive quality. Four studies were found to have neutral quality (26, 29, 31, 32) and two were found to have negative quality (28, 30), which were excluded from analysis. There were no conflicts in assessment of study strength and quality between primary and secondary investigators.

Interventions delivered to informal carers or non-clinical care workers of community-dwelling older adults

The majority of interventions were delivered to informal carers (n=6), with three of these studies also including older adult care recipients. Three studies were identified which involved non-clinical community care workers (29, 31, 32), however all had neutral quality and the only study which provides level II intervention evidence did not measure primary or secondary outcomes of interest. In addition, the study by Salva et al. (25) reported that 6-9% of carers in the study were ‘paid carers’, however the methods and results were not disaggregated by type of caregiver. The study by Lauque et al. (24) provided intervention in the form of oral nutrition supplementation only to older adults and did not involve carers or care workers. However, in this study the control group’s usual care included informal carer education and this resulted in significant improvements. For this reason results of only the
control group were considered. There were four studies identified which provided intervention to the general older adult population (27, 29, 32, 33), and four targeted at older adults with dementia (23-26).

Of the seven studies which addressed primary outcomes associated with malnutrition in older adult care recipients, five were targeted at identifying, preventing and/or treating malnutrition (24-26, 31, 32). The RCT by Lauque et al. (24) aimed to prevent and treat malnutrition in older adults with Alzheimer’s disease. Although this resulted in significant improvements in malnutrition (using the MNA score), unfortunately the education provided to the informal carers was not described. Salva et al. (25) delivered the NutriAlz program to informal carers of older adults at nutritional risk. However, the intervention was also provided to physicians who enhanced the care of the older adults, and it is therefore unclear to what extent the results reflect the intervention provided to informal carers. In the study by Riviere et al (26) health professionals, including a dietitian, provided group education to informal carers of older adults with Alzheimer’s disease to prevent weight loss in this group. The intervention was multidimensional as it addressed appropriate food choices as well as skill building and patient monitoring. The study by Laforest et al. (31) was the only study in which non-clinical community care workers were trained to screen and provide education to older adults. The study conducted by Leggo et al. (32) also involved non-clinical community care workers, however, only in malnutrition screening. Participants identified as being at risk of malnutrition were referred to a clinical dietitian for treatment.

In two of the four studies in which the intervention did not focus on malnutrition, nutritional components were only minor parts of the intervention and were not described (23, 27). Of the remaining two studies, Hyland et al. (29) delivered a comprehensive and feasible program to improve the nutritional health of older adults however the study only reported qualitative results relating to the experiences of the non-clinical community care workers. Hyland et al.
(29) refer to a second paper which measured outcomes of interest, including non-clinical community care worker nutrition knowledge; however this was unavailable for review. The study by Masud Rana et al. (33) aimed to improve health-related quality of life in old age however focused on bone and joint-related illness and provided education not consistent with malnutrition prevention or treatment, for example promotion of fat free foods.

Outcomes in older adult care recipients

Nutritional and functional status were the most commonly reported primary outcomes. Three of four studies that measured nutritional status reported an improvement (24, 25, 32) and Riviere et al. reported no change (26) (two positive quality, two neutral quality, n=2333 participants in total). Where no change was seen in the intervention group of the study by Riviere et al. (26), decline was seen in the control group. No study reported an improvement in functional status, however, two of the three studies which measured this outcome prevented decline in their participants (25, 26) (two neutral quality, n=1097 participants in total). These two studies were focused on the prevention and treatment of malnutrition in participants with dementia (25, 26). Although Lauque et al. (24) reported a significant decline in functional status in their control group (the group of interest which utilized informal carer), a significant decline was also seen in their intervention group, however, to a lesser extent (-0.60±1.24 vs -0.50±1.22).

Where care recipient quality of life (one positive quality study, n=1031 participants in total) and energy and protein intake (one positive quality study, n=91 participants) were measured, improvements in results were found (24, 33). In the studies which reported no change in hospitalization, healthcare utilization and institutionalization incidence (23, 24), it is important to note that these study populations were high risk (dementia) and it may be beyond the capacity of the interventions chosen to affect these measures. No studies were
identified which reported on the primary outcome of muscle strength or secondary outcomes of body fat and subjective wellbeing in older adult care recipients.

Outcomes in informal and non-clinical community care workers

No studies were identified which addressed secondary outcomes of interest in non-clinical community care workers. Four studies were identified which measured secondary outcomes in informal carers (23, 25-27), of which carer burden (n=3) followed by mental health (n=2) were the most frequently measured. In studies which addressed malnutrition, no significant change in carer burden was found (25, 26) (one positive quality, one neutral quality, n=1097 participants in total). Though the intervention delivered by Kurz et al. (23) did not lead to change in informal carer mental health, quality of life significantly improved (positive quality, n=292 participants). The intervention delivered by Toseland et al. (27) improved the mental health of informal carers with no change in carer burden. No studies were found which reported a decline in any outcome in informal carers.
The goals of managing malnutrition in an older population include prevention of decline as well as treatment of disease (14). Therefore it must be recognized that for outcome measures concerning malnutrition in older adults, such as nutritional status, functional status, quality of life and weight change, that a non-significant result, when timing of data collection is appropriate, indicates a prevention of decline or disease. Indeed, two reviews of protein and energy supplementation in older adults at risk of malnutrition reported similar findings as the current review, with the majority of studies showing no change in functional status or quality of life of the participants (34, 35). Regarding economic outcomes, results published subsequently to the included paper (27), Toseland et al. (36) reported that the intervention delivered to informal carers resulted in a total health care cost saving of $1,529.89 per caregiver and $5,760.00 per care recipient compared with usual care; these cost savings were mostly driven by reductions in outpatient costs.

In this respect, interventions involving informal carers and non-clinical community care workers are an effective method to address malnutrition in the older adult community, without increasing the burden of care or cost of management. It is unfortunate that the only study identified which involved role redesign for non-clinical community care workers did not report on the older adult care recipients’ response to intervention (31).

In practice, the involvement of non-clinical community care workers and informal carers as part of the nutritional care team for community-dwelling older adults may improve nutritional status and prevent decline in functional status and quality of life. However, consideration should be given to the older adult disease state, community setting, resources available, multidisciplinary health professional involvement and the degree of caregiver training and supervision in nutritional management of older adults.
There is a need to explore the extent to which informal carers’ and non-clinical community care workers’ roles can affect malnutrition in the general older adult population as opposed to certain high risk groups only. It is clear from the limited studies presented here that non-clinical community care workers can be used to identify malnutrition but it is less clear how they can be best used to provide basic interventions and the economic impact this might have in terms of health care utilization and costs. Researchers should report interventions fully and use validated outcome measures including a confirmed diagnosis of malnutrition, functional status and quality of life, while also reporting the effects of interventions on carers’ wellbeing.

Conclusion

The inclusion of non-clinical community care workers and informal carers is a promising area for identifying, preventing and treating malnutrition in community-dwelling older adults in order to increase the efficacy of the health and aged care workforce. Interventions targeted at identifying, preventing and/or treating malnutrition were able to improve or prevent decline in nutritional and functional status, without increasing informal carer burden.
Acknowledgements

The authors declare that they have no financial, personal or potential competing interests. The current research received no funding. SM is supported by an Australian Postgraduate Award as part of her PhD Candidature.

SM carried out the literature review, data extraction and analysis, interpretation of data, drafting and revising manuscript; JB and EI reviewed study quality and strength; and SC, JB and EI provided supervision, guidance and revision of the manuscript.
### Table 1: Characteristics of identified studies

<table>
<thead>
<tr>
<th>Citation</th>
<th>Setting</th>
<th>Study Design</th>
<th>Study Sample</th>
<th>Attrition</th>
<th>NHMRC Level (21)</th>
<th>AND Quality (22)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Studies addressing primary with or without secondary outcomes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kurz, et. al. 2010 (23)</td>
<td>Austria, Switzerland, Germany</td>
<td>RCT</td>
<td>Informal carers of older adults with dementia&lt;br&gt;¬&lt;br&gt;n=292 patient-carer dyads&lt;br&gt;¬&lt;br&gt;Care recipient age: µ76y&lt;br&gt;¬&lt;br&gt;Carer age: µ62y</td>
<td>Unclear</td>
<td>II, Intervention evidence</td>
<td>+</td>
</tr>
<tr>
<td>Lauque, et. al. 2004 (24)</td>
<td>France</td>
<td>RCT</td>
<td>Older adults with Alzheimer’s disease&lt;br&gt;¬&lt;br&gt;n=91&lt;br&gt;¬&lt;br&gt;Care recipient age: µ79y</td>
<td>12%</td>
<td>II, Intervention evidence</td>
<td>+</td>
</tr>
<tr>
<td>Masud Rana, et. al. 2009 (33)</td>
<td>Bangladesh</td>
<td>Cluster RCT. Cluster units: villages</td>
<td>Older adults and their families&lt;br&gt;¬&lt;br&gt;n=1031&lt;br&gt;¬&lt;br&gt;Care recipient age: ≥60y</td>
<td>18.6%</td>
<td>II, Intervention evidence</td>
<td>+</td>
</tr>
<tr>
<td>Salva, et al. 2011 (25)</td>
<td>Spain</td>
<td>Cluster RCT. Cluster units: medical facility</td>
<td>Physicians, older adult with dementia and their carer (informal or professional)&lt;br&gt;¬&lt;br&gt;n=946 patient-carer dyads&lt;br&gt;¬&lt;br&gt;Care recipient age µ79.0y</td>
<td>31%</td>
<td>II, intervention evidence</td>
<td>+</td>
</tr>
<tr>
<td>Riviere, et al. 2001 (26)</td>
<td>France</td>
<td>Non-randomized experimental trial: Controlled before-and-after study</td>
<td>Informal carers of older adults with Alzheimer’s disease&lt;br&gt;¬&lt;br&gt;n=151 patient-carer dyads&lt;br&gt;¬&lt;br&gt;Care recipient age: µ75.4 – 77.3y&lt;br&gt;¬&lt;br&gt;Carer age: µ60.5 – 64.8y</td>
<td>5%</td>
<td>III-2, intervention evidence</td>
<td>Ø</td>
</tr>
<tr>
<td>Laforest, et al. 2007 (31)</td>
<td>Canada</td>
<td>Pilot case-series: post-test</td>
<td>Older adult nutrition volunteers and older adult care recipients&lt;br&gt;¬&lt;br&gt;n=35&lt;br&gt;¬&lt;br&gt;Care recipient age: µ82y&lt;br&gt;¬&lt;br&gt;Carer age: ≥65y</td>
<td>17% (care recipients)</td>
<td>IV, Intervention evidence</td>
<td>Ø</td>
</tr>
<tr>
<td>Leggo, et al. 2008 (32)</td>
<td>Australia</td>
<td>Case series: pre-test/post-test</td>
<td>HACC eligible older adults and HACC providers&lt;br&gt;¬&lt;br&gt;n=1145&lt;br&gt;¬&lt;br&gt;Care recipient age: µ76.5y</td>
<td>40% receiving intervention (n=57)</td>
<td>IV, Intervention evidence</td>
<td>Ø</td>
</tr>
<tr>
<td><strong>Studies addressing secondary outcomes only</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toseland, et. al. 2004 (27)</td>
<td>USA</td>
<td>RCT</td>
<td>Informal carers (spouses) of frail older adults&lt;br&gt;¬&lt;br&gt;n=105 patient-carer dyads&lt;br&gt;¬&lt;br&gt;Care recipient age: µ72y&lt;br&gt;¬&lt;br&gt;Carer age: µ68 – 69y</td>
<td>Unclear</td>
<td>II, Intervention evidence</td>
<td>+</td>
</tr>
<tr>
<td>Glanz &amp; Scarf, 1985 (28)</td>
<td>USA</td>
<td>N/A</td>
<td>N/A&lt;br&gt;¬&lt;br&gt;n/A&lt;br&gt;¬&lt;br&gt;n/A</td>
<td>N/A</td>
<td>IV, Intervention evidence</td>
<td>–</td>
</tr>
<tr>
<td><strong>Studies with no primary or secondary outcomes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Location</td>
<td>Design</td>
<td>Participants</td>
<td>Comparator</td>
<td>Evidence Level</td>
<td>Notes</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------</td>
<td>------------</td>
<td>------------------------------------------------------------------------------</td>
<td>------------</td>
<td>----------------</td>
<td>-------</td>
</tr>
<tr>
<td>Hyland, et al.</td>
<td>UK</td>
<td>Cluster RCT</td>
<td>Older adults and peer community nutrition assistants</td>
<td>Unclear</td>
<td>II, Intervention evidence</td>
<td>Ø</td>
</tr>
<tr>
<td>2006 (29)</td>
<td></td>
<td></td>
<td>n=97</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Care recipient age: µ76y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Carer age: &gt;60y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paul, et al.</td>
<td>USA</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>IV, Intervention evidence</td>
<td>–</td>
</tr>
<tr>
<td>2000 (30)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AND, Academy of Nutrition and Dietetics; HACC, Home and Community Care; NHMRC, National Health and Medical Research Council; RCT, Randomized controlled trial; y, year.
Table 2: Intervention characteristics and outcomes of identified studies

<table>
<thead>
<tr>
<th>Citation</th>
<th>Intervention Delivery</th>
<th>Nutritional Intervention</th>
<th>Outcomes &amp; Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kurz, et. al. 2010 (23)</td>
<td><strong>Point-of-contact:</strong> Seven bi-weekly 90min group sessions and six bi-monthly refresher meetings (15m total intervention duration)*&lt;br&gt;<strong>Delivered by:</strong> specially trained psychologists or social workers&lt;br&gt;<strong>Delivered to:</strong> informal carers</td>
<td><strong>Aim of intervention:</strong> to educate informal carers about Alzheimer’s Disease&lt;br&gt;<strong>Content:</strong> designed by German Alzheimer’s Association. Module 4 (of 7) included nutrition as a problem solving example (not described)&lt;br&gt;*content also deliverable via CD-ROM</td>
<td><strong>Results of CG:</strong>&lt;br&gt;• Care recipient malnutrition: MNA score improved (μ increase of 2.4±4.21)&lt;br&gt;• Care recipient functional status: Katz ADL-index declined (μ change -0.6±1.24)&lt;br&gt;• Care recipient nutritional intake: 24h recall kcal/kg improved (μ change 2.9±8.82), grams protein/kg improved (μ change 0.19±0.48)&lt;br&gt;• No significant results found in care recipient weight change, care recipient hospitalizations, care recipient functional status (eating behavior scale), care recipient complications of malnutrition (pressure ulcers, fractures), care recipient biomarkers (serum albumin, serum C-reactive protein) or care recipient muscle mass (fat free mass, DEXA)&lt;br&gt;• Care recipient quality of life: HRQoL significantly improved in compliant intervention group (μ change 0.6; less likely improvement in non-compliant group OR=0.52, 95% CI: 0.32, 0.82; less likely improvement in control group OR= 0.44, 95% CI: 0.32, 0.59)</td>
</tr>
</tbody>
</table>
Riviere, et al. 2001 (26)  
- **Point-of-contact:** group education, nine 1h sessions over 12m  
- **Delivered by:** dietitian or other health professional  
- **Delivered to:** informal carers  

- **Aim of intervention:** to prevent weight loss in patients with Alzheimer’s disease  
- **Content:** the IG intervention focused on enriching food and how to combat eating behavior disorders but also included: 1) consequences of weight loss, skill building, weight monitoring, 2) coping with caregiver stress, 3) how to use MNA, 4) nutrition and food recommendations for balanced meals, 5) increasing protein and energy, 6) practical dietetics, 7) follow-up. The CG was offered advice provided in normal follow-up.  

- **Care recipient malnutrition:** MNA no change in IG but decreased in CG (µ change -0.4±3.4)  
- **Care recipient weight change:** weight increased in IG (µ change 0.7±3.6kg) but decreased in CG (µ change -0.7±5.4kg)*  
- **Informal carer nutrition knowledge:** Nutrition knowledge questionnaire increased significantly (µ change 1.7±5.9)  
- **No significant results found in care recipient functional status (ADL, IADL) or informal carer burden (Zarit scale)**  
* After adjusting for baseline differences the weight change was not significant  
*only reliability of tool stated

Laforest, et al. 2007 (31)  
- **Point-of-contact:** in older adult’s home, one pre-visit and three home visits  
- **Delivered by:** dietitian trained older adult non-clinical care workers (via two 3h group-training sessions)  
- **Delivered to:** older adult care recipients  

- **Aim of intervention:** identify older adults at nutritional risk and intervene  
- **Content:** 1) screening (Elderly Nutrition Screening tool), 2) nutrition education using pamphlet and Canada’s Guide to Healthy Eating, 3) development of intervention plan based on screening result, included Meals-on-Wheels, dietitian review, assistance with feeding, etc. Plan approved by dietitian, client and case-manager before implementation, 4) follow-up/review of plan  

- **Care recipient nutrition risk:** ENS*  
- **Care recipient malnutrition:** MST (15% at risk of malnutrition), PG-SGA (5% malnourished, 82% improved score following intervention)

Leggo, et al. 2008 (32)  
- **Point-of-contact:** in older adult’s home  
- **Delivered by:** dietitian trained non-clinical community care workers (screening by project officers, allied health staff, community care coordinators) and dietitian (intervention)  
- **Delivered to:** older adult care recipients  

- **Aim of intervention:** to identify and treat malnourished clients  
- **Content:** individualized nutrition counseling with use of individualized care plan, standard guidelines for advising high energy high protein diets. µ visits 4.2 (range 2 – 10) over a median of 6m from first to last visit  

- **Care recipient malnutrition:** MST (15% at risk of malnutrition), PG-SGA (5% malnourished, 82% improved score following intervention)

<table>
<thead>
<tr>
<th>Studies addressing secondary outcomes only</th>
</tr>
</thead>
</table>
| Toseland, et. al. 2004 (27)  
- **Point-of-contact:** eight 2h weekly group education sessions followed by ten monthly sessions at a staff model health maintenance organization  
- **Delivered by:** social worker  
- **Delivered to:** informal carers  

- **Aim of intervention:** to support and education spousal caregivers of frail older adults  
- **Content:** emotion and problem focused including 1) coping strategies, 2) education on support services and health, 3) support. The fifth monthly meeting focused on nutrition and diet (not described) for both carer and care recipient  

- **Informal carer mental health:** GHQ severe depression scale decreased (CxT1= 4.55), PPI increased in the effectiveness of scale only (CxT1= 9.38)  
- **No significant results found in informal carer burden (MBBS), informal carer mental health (other GHQ components), mental component summary of SH-36 or informal carer perceived health status (physical component summary of SF-36)**  |

<table>
<thead>
<tr>
<th>Studies with no primary or secondary outcomes</th>
</tr>
</thead>
</table>
| Hyland, et. al. 2006 (29)  
- **Point-of-contact:** 20 weekly 2h group meeting at a sheltered housing complex  
- **Delivered by:** Non-clinical community care workers  
- **Delivered to:** Older adult care recipients  

- **Aim of intervention:** To provide nutrition health education  
- **Content:** home economist and dietitian developed a food club program which focused on practical food preparation and healthy eating for older adults  

- **Care recipient malnutrition:** N/A  
- **Care recipient weight change:** N/A  
- **Care recipient nutrition risk:** N/A  
- **Care recipient malnutrition:** PG-SGA (5% malnourished, 82% improved score following intervention)  |

Paul, et al. 2000 (30)  

| N/A |
| N/A |
| N/A |

ADL, activities of daily living; CG, control group; CxT1/CxT2, condition x time interaction term; DEXA, dual-energy x-ray absorptiometry;  
GHQ, general health questionnaire; h, hour; HRQoL, health-related quality of life; IADL, Instrumental Activity of Daily Living; IG, intervention
group; m, month; MADRS, Montgomer-Asberg Depression Rating Scale; min, minute; MBBS, Montgomery-Borgatta burden scale; MNA, Mini-Nutritional Assessment; PPI, pressing problems index; RUD-light, Resource Utilization in Dementia, short form; SF-36, Short Form Health Survey.
1962 records identified through database searching

1767 records excluded based on title and abstract

195 full-text articles assessed for eligibility

183 Excluded articles:
- Abstract (4)
- Duplicates (20)
- Non-English (9)
- Non-intervention study (55)
- Ineligible population/intervention (88)
- No nutritional component (8)

11 studies reviewed

Excluded for negative study quality (2)

9 studies included in analysis

Figure 1: Study flow diagram
References


Appendix


PubMed and CENTRAL was searched using the following MeSH Terms:

1) Aged
2) Caregivers
3) Homemaker services
4) Home Health Aides
5) Community Networks
6) Inservice training
7) Education, nonprofessional
8) Protein energy malnutrition
9) Malnutrition
10) Nutritional status
11) Nutrition Assessment

In PubMed, MeSH Terms were searched in the following combinations:

1) 1 AND (2 OR 3 OR 4 OR 5) AND (6 OR 7)
2) (1 OR 2 OR 3 OR 4 OR 5) AND (8 OR 9 OR 10 OR 11)

In CENTRAL, MeSH Terms were searched in the following combinations:

1) Aged
2) Caregivers
3) Homemaker services
4) Home Health Aides
5) Community Networks
6) Inservice training
7) Education, nonprofessional
8) Protein energy malnutrition/prevention and control
9) Protein energy malnutrition/diet therapy
10) Malnutrition/prevention and control
11) Malnutrition/diet therapy
12) Nutritional status
13) Nutrition Assessment
14) Malnutrition/diagnosis
15) Protein energy malnutrition/diagnosis

1) 1 AND 7
2) (2 OR 3 OR 4 OR 5) AND (6 OR 7)
3) (1 OR 2 OR 3 OR 4 OR 5 OR 6) AND (8 OR 9 OR 10 OR 11 OR 12)
4) (1 OR 2 OR 3 OR 4 OR 5 OR 6) AND (13 OR 14 OR 15)

CENTRAL was also searched using keywords in the title, abstract and keywords:

1. (Elderly OR Aged OR Carer OR Caregiver OR Community Care OR Home Health Care) AND (Education OR Training) AND (Malnutrition OR Protein-Energy Malnutrition OR Nutrition OR Malnutrition)

CINAHL (via Ebscohost) was searched using the following CINAHL Headings:

1. (Aged [exp] OR Caregiver OR Home Health Care) AND (Patient Education OR Education OR Health Education OR Training [as keyword - subject]) AND (Malnutrition OR Protein-Energy Malnutrition OR Nutrition [as keyword - subject]).
Health Source: Nursing/Academic Edition (via Ebscohost) was searched using the following Health Source Subjects:

1. (Older People [exp] OR Caregivers [exp] OR Community health aides) AND (Adult education OR Aging education OR Consumer education OR Educational intervention OR Educational programs OR General education OR Health education OR Nonformal education OR Older people – education OR Veterans – education OR Training) AND (Malnutrition [exp] OR Nutrition disorders in old age OR Nutrition [as keyword – abstract/title])

EMBASE was searched using Emtree terms:

1. Aged [exp] AND (Caregiver OR Community care [exp] OR Home care [exp]) AND (Education [exp] OR Staff training) AND (Malnutrition [exp]/Diagnosis OR Malnutrition [exp]/Disease management OR Malnutrition [exp]/Prevention OR Malnutrition [exp]/Side effect OR Malnutrition [exp]/Therapy OR Diet OR Diet therapy OR Feeding behaviour OR Food intake OR Geriatric nutrition OR Meal OR Nutrient management OR Nutrition education OR Nutritional assessment OR Nutritional counselling OR Nutritional status)

Web of Science, as also searched for the following keywords in topic or title:

1. (Aged OR Elderly) AND (Caregiver OR Carer OR Community care OR Home care OR Home aides) AND (Education OR Training) AND (Nutrition OR Malnutrition)