Nutritional Education for community dwelling older people: A systematic review of randomized controlled trials.

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Abstract

Objectives

To evaluate the effectiveness of nutritional education or advice on physical function, emotional health, quality of life, nutritional indices, anthropometric indicators, mortality, service use and costs of care in people over 65 years of age living at home.

Design

Systematic review of randomised controlled trials (RCTs)

Data Sources.

PUBMED, CINAHL, PSYCINFO, the Cochrane Central Register of Controlled Trials and the National Research Register.

Methods

We included studies evaluating nutritional education or advice for people aged 65 and over living in their own homes that measured one or more of the following outcomes: physical function, emotional well being, service use, dietary change and other anthropometric indicators. Studies were assessed for risk of bias on six domains. Due to high heterogeneity, results were not pooled but are reported narratively.

Results

Twenty three studies met our inclusion criteria. All but one of the interventions were delivered by health care professionals; ten were delivered

by nurses. The review found evidence to suggest that nutritional education or advice can be used to positively influence diet and improve physical function. There was also evidence that some biochemical markers can be positively affected, although these are surrogate outcomes and are generally disease specific. Several studies indicated that complex interventions, with nutritional education as a component, also reduce depression. The evidence from this review on the impact on weight change was inconclusive. There was no evidence of an improvement in anxiety, quality of life, service use, costs of care or mortality.

However, many studies were at moderate or high risk of bias, and for some outcomes the data were insufficient to make judgments about effectiveness.

Conclusions

This review indicates that nutritional education or advice can positively affect physical function and diet, whilst complex interventions with nutritional education as a component, can reduce depression in people over 65 years who live at home. However, more research is needed to determine whether outcomes are influenced by types of intervention, morbidity, and socioeconomic circumstance of participants.

Relevance to Clinical Practice

Nutritional education, alone or as part of a complex intervention, can improve diet and physical function and may reduce depression in the over 65s living at home.

What is already known about this topic?

- Older people are at increased risk of poor nutrition which has adverse consequences for health and well being.

- A number of educational interventions have been developed to improve nutritional status.

What does this paper add?

- The review identifies that nutritional education or advice can improve diet and physical function and may reduce depression in older people.

- The educational interventions reviewed are within the current scope of practice for community nurses and the review provides evidence that nurses should spend time on these types of activity.

- Further research is needed to provide evidence on the most effective approaches to enable older people to improve their diets and thus health.

1. Introduction

Good diet along with a range of other lifestyle and environmental factors such as exercise is thought to delay the onset of disease and frailty in the older population (Kirkwood, 2008). However, poor or undernutrition in the older population is widely agreed to be a worldwide problem (Visvanathan,

2003) with prevalence of undernutrition in community dwelling people in industrialised nations estimated to be between five and ten per cent in older people aged over 70 years (Posner et al., 1994, Elia and Stratton, 2005, Stratton et al., 2004).

Although older people have been found to be a population group at risk of poor nutrition (NICE, 2006), the older population is extremely diverse and heterogeneous. The most recent national survey of the diet and nutritional status of older people in the UK (Finch et al, 1998) found that the majority of older people sampled were adequately nourished, but that the diets of some subgroups (low socio-economic groups, older age groups and those living in institutions), gave cause for concern.

Margetts et al (2003) have found that a lower consumption of energy, meat products or fruit and vegetables are associated with poor nutritional status in older people, and that those at a high risk of undernutrition are likely to have a poorer health status. Poor nutritional status is linked to many adverse health consequences which affect functional status including reduced muscle strength, respiratory problems, poor mobility, low energy, decreased immune response, poor wound healing, impaired thermoregulation and declining psychosocial function and well being (Westergren et al, 2002, Evans et al, 2004; Chen et al, 2007) as well as the development of diseases such as cardiovascular disease (British Heart Foundation, 2006). Poor functional status also affects dietary intake, this interaction leading to a downward health spiral (Egbert, 1996).

In addition, poor nutritional status leads to significant costs. The annual cost to the UK alone for the treatment for disease–related malnutrition has been estimated at over seven billion pounds a year with about one billion of that being spent on treating people living in their own homes (Elia, Stratton, Russell et al, 2005; Russell, 2007).

Health promotion and Screening

Preventing illness and promoting the health of older people have become an economic and a social priority, according to WHO (2003, 2009), and DH (2001, 2006). Nutrition is one of the domains included in the UK *Single Assessment Process* (DH, 2001).

However, health promotion and disease prevention interventions have frequently excluded older people (Sahyoun and Anderson, 2009), perhaps because of a pervading view within healthcare that older people are resistant to change despite evidence that they can be more effective at making changes to their diets than younger people (Wing et al, 2004).

There is a clear case for opportunistic nutritional screening of older people when they come into contact with primary care services to identify those who could benefit from appropriate interventions and health promotion activities (Edington, 1999). A number of nutritional screening and assessment tools have been developed to assist health professionals in this task (Green and

Watson, 2006; Elia, Zellipour & Stratton, 2005). Studies have shown, however, that the introduction of tools does not always improve subsequent care (Perry, 1997; Jordon et al, 2003). Nutritional care is often poorly performed by nurses; in terms of both consistency and comprehensiveness for individual patients (BAPEN, 2009). Reasons for this are unclear, especially as the majority of nurses' report that nutrition is important to the maintenance of good health (RCN, 2007). There is some evidence that nurses, like other healthcare workers, are ambivalent about providing nutritional care (Christensson et al., 2003; RCN, 2007).

Role of Community health professionals (HPs)/Community nurses

Effective screening is needed to identify those at risk of poor nutrition, but it is essential that following this, action can be taken to address any nutritional risks identified. Edington (1999) argues that practice and community nurses see most of the patients at risk of undernutrition based in the community and therefore are ideally placed to carry out screening. However, despite this potential there is less evidence to demonstrate the effectiveness of the health promotion aspect of nurses' role (Kennelly, 2010), with one study finding that there were substantial differences in the performance of individual nurses that impacted on the outcomes of programmes (Stuck et al, 2000). More recently, evidence suggests that a range of preventive interventions carried out in the home by nurses can have a positive effect on health, functional status, mortality rates, admission to hospital and costs (Markle-Reid et al, 2006). However, it is important to acknowledge that although nutritional education, opportunistic screening and follow up were often included, they were not the

focus of this study.

Community practice is acknowledged to be unpredictable and changeable and as such it requires nurses to be responsive, flexible and adaptable (QNI, 2006). Nurses in the UK are increasingly encouraged to choose from a wide range of educational materials and media suitable for different environments (DH, 2010a, DH 2010b). BAPEN (2009) and the European Nutrition for Health Alliance (2006) both call for further training on nutrition for all health professionals.

Laws et al (2010) have recently argued that primary health care offers an ideal setting for individually focused lifestyle interventions but little attention has been paid to the work of community nurses despite nurses considering this as an appropriate aspect of their role (RCN, 2007). Nutrition has been identified in the UK as one high priority nursing research area, particularly in regard to the evaluation of care interventions and patient outcomes (Ross et al, 2002).

Barriers to achieving good nutrition in the community have been cited and include: lack of client motivation, low incomes of clients, low levels of client education, clients with long history of eating fast food, poor access to affordable and nutritious fresh food and lack of nurse time (RCN, 2007). It is worth noting that most research and clinical work has concentrated on nutritional interventions provided in acute care (NICE, 2006; Cartwright, 2007), and much of this has focused on the use of dietary supplementation to

prevent or treat malnutrition (e.g. Elia, Zellipour, & Stratton, 2005).

There is a need therefore for a systematic review to assess whether interventions involving nutritional education for people aged over 65 years who live in their own homes can impact on physical function, mental health, quality of life, anthropometric measures, mortality, service use and costs of care.

2. Objectives

To examine whether a range of nutritional education interventions can be used by health care professionals to improve physical function, mental health and quality of life, nutritional indices, anthropometric measures, mortality, service use and costs of care in people over 65 years of age who live at home.

3. Methods

The inclusion criteria and methods for the review were pre-specified in a protocol. To reduce the likelihood of introducing bias post-hoc changes were not made.

3.1 Inclusion criteria

We included Randomised Controlled Trials (RCTs) of nutritional educational interventions for people over the age of 65 years living in their own homes. We excluded RCTs with participants living in residential or sheltered housing where food is provided. We included any type of nutritional intervention that

contained dietary advice and education, and / or the provision of information
This included studies where nutritional education was the sole component and
those where it was part of a more complex intervention, such as those
involving education on diet and exercise. As the review was originally
intended to inform nursing practice we were interested in interventions that
either were, or had the potential to be, delivered by nurses. We excluded
interventions relating to parenteral/enteral feeds, medications, and the
prescription of sip / supplementary feeds as these were considered discreet
activities in their own right within the field of nutritional intervention. The
specified outcomes were physical function, mental health, quality of life,
nutritional indices, anthropometric measures, mortality and service use
(shown in Box 1).

There were no date restrictions for inclusion in the review but studies were
limited to English language publications only.

3.2 Search Strategy.

We searched the following electronic databases: Cochrane Database of
Systematic Reviews, Cochrane Database of Abstracts of Effectiveness,
Cochrane Central Register of Controlled Trials, Pubmed, CINAHL, PsycInfo,
National Research Register in July 2008. A full list of search terms can be
seen in Box 2. In addition we used 'lateral searching' techniques such as
those recommended when searching for studies on complex interventions
(Greenhalgh et al, 2005). This included checking all reference lists,
contacting experts and tracking citations.

3.3 Study Screening

Electronic search results were downloaded into EndNote bibliographic software and duplicates deleted. Two reviewers independently screened titles and abstracts against the predefined inclusion criteria. Full manuscripts of all potentially relevant citations were obtained and these were screened independently by two reviewers using a screening form with clearly defined criteria. Any disagreements were resolved by consensus or by discussion with a third reviewer.

3.4 Data Extraction and Critical Appraisal

Data were extracted by two reviewers independently onto a pre-designed, piloted form. Data were collected on participants, intervention (including type, duration and who it was delivered by), measurement tools, outcomes and results. Interventions were classified as either nutritional education only or complex interventions (based on the Medical Research Council, 2008 guidance, with complex involving several interactive components). The methodological quality of studies was assessed using criteria based on those of the Cochrane Collaboration (Higgins and Green, 2009). This assesses the risk of bias on six domains:

- Sequence generation - was the allocation sequence adequately generated?
- Allocation concealment – was allocation adequately concealed?
- Blinding of participants -was adequate knowledge of the allocated intervention adequately concealed from outcome assessors?

- Incomplete outcome data – was this adequately addressed for each outcome (this includes differential attrition between groups)?

- Selective outcome reporting – are reports of the study free of suggestion of selective outcome reporting?

- Other sources of bias – was the study apparently free of other problems that could put it at a high risk of bias?

Each domain was scored independently by two reviewers as 'Yes' (meets the criteria), 'No' (does not meet the criteria) or 'Unclear' (not enough information to judge). Disagreements were resolved by consensus or by discussion with a third reviewer. In addition, we used National Insititute of Health and Clinical Excellence (NICE) criteria to assess the applicability of studies to the UK (NICE, 2006). A study was scored on a scale of 1-4 with lower scores indicating high applicability / generalisability (results are shown in Table 1).

3.5 Data Analysis

Owing to heterogeneity in populations, interventions and outcomes it was not considered appropriate to pool studies in a meta-analysis. Instead a narrative and tabular summary of findings is presented. Where data were available binary data were expressed as relative risks (RR) and continuous data as weighted mean differences (MD), both with 95% confidence intervals. However, where the data needed to calculate a RR or MD was unavailable in the paper we used the alternative effect measures given. Table 2 includes an indication of whether results were statistically significant or not. Analyses were conducted using Microsoft Excel.

4. Characteristics of included studies

4.1 Articles selected

Database searches identified 1067 papers; 27 of which met the inclusion criteria. A further eight papers were discovered through lateral searching. Together, these papers came from 23 separate studies. A flow chart detailing the identification of studies can be found in Figure 1.   Details of the 23 primary studies, and any related papers, can be seen in Table 1.

Studies which met our inclusion criteria were published between 1991 and 2008. Thirteen studies were from the United States, four from United Kingdom, two from Australia and one study from each of Canada, Spain, Norway and Finland. Study size varied from 24 to 2558 participants, with a skewed normal distribution towards the lower end (13 studies recruited less than 200 participants).

4.2 Interventions (Table 1)

The interventions used were often multi-faceted, multi-disciplinary and varied in both length and type. Thirteen studies included nutritional education by nurses with ten delivered solely by nurses and three by nurses and doctors. Ten studies had no nurse involved, with the intervention delivered by dieticians or nutritionists in six, by doctors in two, by a pharmacist in one and by a lay person in one. Three studies did not specify who delivered the

intervention.

Interventions were all delivered by out-patient, hospital outreach or community staff (with some being delivered remotely by telephone, computer, or by post), although two studies included participants who began their education as in-patients (Rich 1995; Harari 2004). Five studies had nutritional education as the sole constituent of the programme, whilst the rest included it as part of a more complex intervention including other components such as individualized holistic care, healthy lifestyle advice, exercise advice or screening. Of these complex interventions, 12 studies offered nutritional education as a major focus of the health promotion activities, this was individualised in ten studies and delivered in a standard way in the other two.

Studies varied in the format and intensities of strategies employed. Twenty studies used more than one educational strategy (18 studies used face to face consultations, 8 provided telephone consultations, 10 engaged in classroom/ group activities, 7 used written material). The remaining three used a single strategy, either telephone (Barnason 2003), individual consultations (Bernstein 2002) or classroom based interventions (Miller 2002a). The intensity ranged from one off visits followed by targeted leaflets and /or summaries from general practitioners (Harari 2004), to six weeks of daily interactive telephone contact (Barnason 2003), to individualised consultation and telephone follow up for 12 weeks (Campbell 2008), to individual and small group weekly meetings over four months, followed by four months of fortnightly contact and then monthly contact until 30 months

(Kumanyika 2002).

Studies varied in the length of intervention delivered. We classified these differences into two groups: those which required 2 hours or less over the first 3 months (which we termed "brief lifestyle interventions", nine studies), and those that required more than 2 hours over the first 3 months (termed "lengthy lifestyle interventions", 13 studies). These classifications can be seen in Table 2. One study (Ives 1993) did not fall into either category because the intervention length varied according to individual need.

Although all studies involved education to improve nutritional intake, the specific aims of studies were different. Ten interventions were designed to promote general dietary improvement (reduced fat, salt, sugar, increased fibre, fruit and vegetables) whereas 13 offered a more targeted intervention such as reducing salt intake for participants with coronary artery disease (Barnason 2003), increasing fruit and vegetable intake for edentulous patients (Bradbury 2006) or increasing fibre and fluid intake for constipated and faecally impacted stroke patients (Harari 2004).

4.3 Participants

The populations studied varied from the healthy (Elder 1995; Ho 1991; Patrick 1999) to the frail elderly (Boult 2001). Sixteen studies focused on specific diseases including: cardiovascular disease (Azad 2008; Barnason 2003; Campbell 1998;Harari 2004; Hjerkinn 2005; Whelton 1998; Lewin 2002;

Lopez Cabezas 2006; Masley 2001; Middleton 2005; Rich 1995; Salminem 2005), chronic kidney disease (Campbell 2008), diabetes (Miller 2002a) and osteoarthritis (OA) (Messier 2004; Miller 2006). One (Ives 1993) offered screening and health promotion to participants with high cholesterol levels who were considered to be at high risk of cardiovascular disease. Other studies included participants with general functional impairment (Bernstein 2002), and those who were edentulous (Bradbury 2006) or constipated (Harari 2004). Two studies (Boult 2001; Rich 1995) identified participants as high risk of using hospital or nursing home facilities. Four studies (Boult 2001; Ho 1991; Harari 2004; Rich 1995) included more than one of the categories mentioned above.

Although two studies specified that participants were overweight (Messier 2000; Miller 2008), the majority did not specify if participants were overweight, underweight or of normal weight. These studies appeared to draw general inferences about the weight of participants according to the condition being studied. For example, Campbell (2008) studied men with Stage 4 Chronic Kidney Disease and this group of people are more likely to be underweight, whereas Kumanyika (2002) studied participants with hypertension who as a group are more likely to be overweight.

4.4 Outcomes

Patient outcomes measured in the included studies were divided into four categories. Within these categories there was considerable heterogeneity in the way in which outcomes were measured. (Box 1).

Studies addressed Body Mass Index (BMI) and weight differentially. Five studies treated participants on an individual basis, with aims to lose or gain weight according to need (Bernstein 2002; Bradbury 2006; Campbell 2008; Elder 1995; Lewin 2002), these studies reported weight changes by intervention or control group, rather than according to individual goal, so the results are difficult to interpret. Three studies measured changes to BMI / weight for each participant but did not report the specific aims of the intervention (Hjerkinn 2005; Ho,1991; Patrick 1999), whilst three aimed to reduce participants weight (Kumanyika 2002; Messier 2004; Miller 2008) and reported their findings on this basis.

4.5 Assessment of risk of bias

An overall assessment of the risk of bias for each quality domain can be seen in figure 2 and the results for individual studies are presented in figure 3. Although sequence generation was adequate in the majority of studies, less than 25% of studies were judged to have had adequate allocation concealment. The risk of bias from selective reporting of outcomes was judged to be low in ten, high in three and unclear in the rest. Only four studies met five or more criteria (Campbell 2008; Lewin 2002; Lopez-Cabazas 2006; Messier 2000) and five met none of the criteria (Elder 1995; Ives 1993, Miller 2008; Patrick 1999; Salminen 2005). However, in many studies inadequate reporting made quality assessment difficult. The impact of possible biases is highlighted as appropriate in the results section and considered further in the limitations and discussion sections.

5. Results

In the following section the results are presented according to the outcome categories outlined in box 1. In addition, studies are further categorised as nutritional education only against those interventions which include other health promotion activities. Finally, at the end of the section, we consider whether the length of the intervention (i.e. brief versus lengthy) influences effectiveness.

5.1 Effectiveness on physical function, mental health and quality of life outcomes (Table 2, section 1).

Seven studies reported physical function. The method of measuring this ranged from self reporting of general or specific physical function measures to timed completion of specific functional activities. Four studies (Azad 2008, Campbell 1998; Lewin, 2002; Miller 2008) compared interventions involving both nutritional and exercise components (of varying methods and intensities) with control groups that received no exercise or nutritional education, three found significant improvements in physical function. Messier (2000), assessed as low risk of bias, compared three different interventions with attention controls: nutritional education only, nutritional education plus exercise and exercise only finding no differences in nutritional education only when compared with controls, but significantly better physical function improvements in nutritional education plus exercise when compared with exercise groups. In the other two studies (Barnason 2003, nutritional

education only; Boult 2001, a complex intervention study), there were no exercise components in intervention or control groups and they both reported significant improvements in physical function.

Despite heterogeneity, the results were generally consistent with six out of seven studies reporting an improvement in physical function in the intervention groups compared with the controls.. The other study (Azad 2008) reported physical self maintenance scores (rather than physical function) and found no significant differences between groups.

Nine studies examined cognitive, emotional function or quality of life. Two studies of complex interventions measured anxiety as an outcome (Campbell 1998b; Lewin 2002) but neither found a between group difference. However, a larger study with a longer duration of intervention found significantly less 'health worry', as measured on the Quality of Wellbeing scale (Patrick 1999) at 2 and 4 years follow up.

Five studies examined the effect of complex interventions on depression. Although two of these studies found no effect on depression at 6 months (Azad 2008) or 1 year (Campbell 1998a), the other three studies showed significant improvements in depression scores in the intervention group compared with the controls at 6, 12 and 18 months.

Quality of life was reported in five studies, all of which involved complex interventions. In all but one study (Lopez-Cabezas 2006) the intervention was

delivered by a nurse. Three disease specific studies (Azad 2008; Harari 2004; Lopez-Cabezas 2006) reported no effect on quality of life measures. The remaining studies (Patrick 1999; Rich 1995) showed quality of life improved in the intervention groups when compared with the controls, although this should be interpreted with caution as Rich (1995) only reported on a subset of those included in the main study and Patrick (1999) began the study with a control group that had poorer quality of life scores than the controls.

5.2 Effectiveness on nutritional indices (Table 2 section 2)

Fifteen studies examined some form of dietary change although the focus of the interventions varied, with some aiming to increase dietary intake and others aiming to reduce fat or food intake. Three studies measured changes in the general population of over 65 year olds (Elder 1995; Ho 1991; Patrick 1999), nine involved cardiovascular patients, two people with functional impairment (Bernstein 2002; Bradbury 2006) and one study focused on Chronic Kidney Disease (Campbell 2008).

Dietary fibre

Two studies measured dietary fibre (Elder 1995; Ho 1991) and one measured dietary fat and fibre intake combined (Patrick 1999) but none found any evidence of effect. All involved complex interventions

Fruit and vegetable intake

Three studies evaluated fruit and vegetable intake. Two were nutritional

education only (Bernstein 2002, Bradbury 2006) and one was a complex intervention (Masley 2001).   Bernstein (2002) examined healthy eating amongst functionally impaired participants aged over 69 years, and reported an increase in fruit and vegetable intake, although our calculations reflect a non-significant reduction. The other nutritional education only study reported that a tailored intervention was successful in increasing fruit and vegetable use in edentulous patients (Bradbury 2006). However, when analysed further, it was clear that this was primarily due to fruit intake rather than vegetable intake, some of which was due to increasing fruit juice intake in this group. In the complex intervention study (Masley 2001), there was an increase in self-reported fruit and vegetable intake. An additional study (Harari 2004) offering a complex intervention with stroke patients with faecal continence problems, found the intervention group more likely to modify their diet than the controls (which included increasing fruit and vegetable intake, although this was not independently measured).

Dairy/fat intake

Six studies measured dairy or fat intake and all but one (Bernstein 2002) involved complex interventions. Four involved patients with cardiovascular disease (Campbell 1998b; Hjerkinn 2005; Masley 2001; Salminem 2005), one included a general population of older people (Patrick 1999) and one involved functionally impaired older people (Berstein 2002). In the cardiovascular studies the effects were mixed. Two (Salminem 2003; Masley 2001) found no effect on fat intake although the latter found an increase in use of monounsaturated fats in cooking oils in the intervention group when

compared with the controls. Of the other cardiovascular studies one (Campbell 1998) showed an intervention effect on low fat DINE scores<30 at 1 year, although this had disappeared at four years. The other study (Hjerkinn 2005) reported significant reductions in the amounts of saturated, monounsaturated, polyunsaturated and total fats as a percentage of energy at 36 months. However,, this differed from the other studies as it included additional telephone follow up and reminders every 6 months across the study period. Of the remaining two studies one (Patrick 1999) reported a reduction in fat intake and the other, which involved nutritional education only, found an increase in milk and dairy intake (Bernstein 2002).

Together these studies provide some evidence to suggest that nutritional education can lead to change in fat intake in those over 65 years living at home but that it may need to be sustained by using reinforcement strategies. However, all the studies were judged to be at moderate or high risk of bias.

Energy intake

Energy intake was measured in two studies, one (a complex intervention) with participants who had cardiovascular disease (Hjerkinn 2005) and one (a nutritional education only intervention) with participants who had Chronic Kidney Disease (CKD) (Campbell 2008). Both studies found significant intervention effects, in the desired direction, with energy intake decreasing in cardiovascular patients and increasing in patients with chronic kidney disease.

Salt use

Salt use was only measured in one nutritional education only study (Barnason 2003) which found no effect on the use of salt for cooking or whilst eating in CABG patients. However, this study was small and may not have been powered to detect an effect.

General dietary improvement

Two complex intervention studies involved participants with cardiovascular disease (Lewin 2002; Middleton 2005) and measured general dietary improvement. Both found that the intervention group reported more improvements to their diet than the control. However, Lewin (2002) was unable to find this difference reflected in estimated dietary intake using DINE scores.

Malnutrition

Only one study (Campbell 2008) examined the prevalence of malnutrition.. This study involving patients with chronic kidney disease found a significant reduction in malnutrition amongst those who had received the intervention.

5.3 Effectiveness on anthropometric measures (Table 2, section 3).

Weight/BMI

Overall ten studies measured either, or in some cases both, weight and BMI, with eight reporting BMI and five weight.

 Eight studies reported the effect of dietary intervention upon BMI. The aims of the interventions varied according to the population involved with some

studies aiming to increase BMI and others to decrease it. Only three studies, one nutrition education only (Bernstein 2002) and two involving complex interventions; (Hjerkinn 2005; Miller 2006) found changes to BMI. These were consistent with the aims stated or the participants' needs. The Hjerkinn study (men with CVD over 65 who are more likely to be overweight, offered vegetable spread and education) and the Miller (2006) study (obese adults with Osteoarthritis, offering nutrition education, partial meal replacement and exercise) showed that interventions significantly decreased BMI. The Bernstein (2002) study showed a non-significant trend towards increasing BMI in a functionally impaired population of over 65s given nutritional education designed to increase food intake. Two of these three studies were at high risk of bias. The remaining five studies, which were of variable quality, found no significant intervention effect in the populations studied.

Five studies examined weight change amongst the over 65s, three aiming to decrease weight and the other two (Campbell 2008, Bernstein 2002) aiming to increase weight. Three studies showed an intervention effect consistent with the study aims or participants' needs, e.g. hypertentsion (Whelton 1998/Kumanyika 2002) and OA (Messier 2000 / 2004; Miller 2008), with a significant decrease in weight following intervention. The fourth study (Campbell 2008) showed no differences between groups in weight. However, this was an intervention designed to increase weight amongst CKD sufferers and it is likely that the severity of the disease overrode any potential impact of the intervention. The remaining study (Bernstein 2002) showed a non-significant trend towards an increase in weight when compared with exercise

controls.

Overall, six out of ten studies showed evidence of an effect on either weight change or BMI which were consistent with the study aims or population needs. Studies reporting changes to BMI or weight were not noticeably different in quality to those which reported no change. We found similar effects for complex interventions and nutritional education only interventions in both measures, although the Messier (2004) study found diet and exercise groups lost significantly ($p<0.05$) more weight (5.7%) than those in the diet only group (4.9%).

Cholesterol/lipid management

Cholesterol was the most commonly measured biochemical outcome (six studies, all complex interventions). One study (Ives 1993) reported that intervention groups made more effort than controls to lower cholesterol at 2-3 years, but this was not reflected in serum cholesterol. Two studies (Campbell 1998b; Middleton 2005) found no significant difference in self-reported cholesterol levels between control and intervention groups at final follow up. However, during the Campbell (1998b) study it became standard practice for patients with high cholesterol to receive lipid lowering medication and this may be why differences in cholesterol reported at 12 months were not sustained at year 4. Three other studies measured cholesterol readings (Hjerkinn 2005; Masley 2001; Salminem 2005), with outcome measurement varying between 12 months and three years, but none showed any significant differences between intervention and control groups.

The evidence from these RCTs suggests that complex interventions which include nutritional education are of limited success in lowering cholesterol.

Disease specific biochemical markers

Three studies measured disease specific biochemical markers (Campbell 2008; Kumanyika 2002; Miller 2008). Nutritional education was effective in raising albumin levels in patients with CKD (Campbell 2008), and reducing sodium excretion in hypertensive patients (Kumanyika 2002); but as part of a complex intervention had mixed results in influencing inflammatory biomarkers in patients with OA (Miller 2008)

Miller (2002a) measured fasting plasma glucose in adults with type 2 Diabetes, and found a significant reduction as a result of a complex intervention which was consistent with the reduction in weight found in this study.

5.4 Effectiveness on mortality, service use and costs of care (see Table 2, section 4)

Eight studies measured outcomes in these categories, and all except one (Lopez Cabezas 2006) used a nurse as part of the team delivering the intervention. All studies involved complex intervention and components other than education may have contributed to the observed effects.

Mortality

Of the six studies that examined mortality, three found no difference between intervention and control (Azad 2008; Boult 2001; Rich 1995), one a non-significant trend towards an increase in mortality (Patrick 1999) and two studies of nurse-led clinics (Campbell 1998b and Lopez Cabezas 2006) a reduction in deaths. In the study where mortality increased (Patrick 1999), the authors believe the introduction of "living wills" as part of the intervention, may have confounded mortality rates.

Service use

Of the four studies that addressed hospital readmission, three showed a reduction in admissions in the intervention group, whilst one (Azad 2008) found no difference.

One study reported district nurse (DN) visits (Harari 2004), one emergency room (ER) visits (Azad 2008) and three studies reported GP visits (Azad 2008; Campbell 1998; Harari 2004). There were no significant effects on DN or ER visits but there was some evidence of an increase in GP use at 6 months and 1 year (Azad 2008; Harari 2004).

Costs of care

Five studies examined costs, but data from one (Rich 1995) was on an unspecified subset of patients and is, therefore, not included in our analysis. The other four studies reported no intervention effect, although in one (Boult 2001), the intervention group used less home care than the controls when

adjusted for baseline use. This may indicate that the intervention changed the mode of care but did not reduce the overall costs of the treatment required.

5.5. Length of Interventions & Effectiveness

Table 2 shows the length of intervention, classified as "brief" (2 hours of less in first 3 months) or "lengthy" (more than 2 hours in first 3 months), for each study.

There was no evidence to suggest that the length of the intervention impacted on effectiveness. Indeed, for most outcomes brief interventions appeared as effective as more lengthy ones. One exception was mortality where brief complex interventions appeared to be more effective than longer interventions. However, this should be interpreted with some caution as this is based on only five studies with differing endpoints. Two outcomes (weight and biochemical markers) were only measured for lengthy interventions.

6. Discussion

This systematic review included 23 studies that examined whether educational interventions can improve nutritional and functional outcomes in community dwelling people over 65 years of age. All but one of the interventions were delivered by health care professionals of which ten were delivered by nurses. In five studies the intervention consisted of nutritional education only but in the majority of studies the nutrition education was delivered as part of a more complex health promotion package.

The review found evidence to suggest that nutritional education (sometimes as part of a complex intervention) can positively influence diet, improve physical function and reduce depression. There was also evidence that some biochemical markers, such as albumin levels in patients with CKD (Campbell 2008), and sodium excretion in hypertensive patients (Kumanyika 2002), can be positively influenced. However, this should be interpreted with caution as biochemical measures are surrogate outcomes and are generally disease specific. In addition, the extent to which there is a predictive relationship between these and functional outcomes or morbidity is not clear. The evidence from this review on the impact on weight change was inconclusive. This is consistent with the findings from a recent meta-analysis that found a lack of good quality evidence to support the efficacy of weight loss programmes in this population (Witham and Avenell, 2010).

There was no evidence in our review of an improvement in anxiety, quality of life or service use. There was some suggestion that mortality can be reduced by brief complex lifestyle interventions, but this is based on limited evidence which was insufficient to make judgments about effectiveness.

A poor quality diet in older people has been found to be associated with increased mortality and morbidity and health promotion aimed at this age group may contribute to a healthier old age (Haveman et al., 2003). A recent systematic review (Bouman et al, 2008) concluded that intensive home visiting programs (offering a range of tailored health promotion, including nutritional education) may not improve health or service use in older people

with poor health living in high income countries. In contrast, this review found some evidence to suggest that nutritional education, sometimes as one component of a complex intervention, may improve physical function, diet and depression for community dwelling older people. However, our review has not found sufficient evidence to determine whether this impacts on hospital readmissions or other service use and limited evidence on mortality.

The effectiveness of nutritional educational interventions for older people may be affected by a number of age-related factors. The increased likelihood of chronic illness and potential co-morbidities such as poor dental or oral health, and abdominal discomfort may make dietary improvements harder in this age group. In addition, limited finances, modifications to diet needed because of disease (Kwong et al, 2007) and social isolation (Gustaffson and Sidenvall, 2002) may influence diet. Other factors that may impact on the success of nutritional education include self efficacy, perceived health benefits and gender (Kwong et al, 2007). Indeed, these issues were reflected in many of the studies in this review, with sixteen studies including participants with specific chronic illnesses and others involving participants who were edentulous (Bradbury, 2006) or constipated (Harari, 2004). It is possible that nutritional education or complex interventions which are designed to address specific issues of concern will be more successful than those adopting a less focused intervention. However, there was insufficient evidence in this review to identify whether this is the case. The process by which diet acts as an intermediary between experience of health and illness, disease and disability in the older person is complex and multifactorial making the design of studies

in community settings particularly challenging.

It has been suggested that many nurses have ageist attitudes and regard dependency and disability as inevitable in older people (Runciman et al, 2005). The suggestion from our review that older people can be helped to make positive changes to their diet may challenge nurses' assumptions about the nutritional self care ability of their patients and their roles in this area of care (Christensson et al, 2003; RCN, 2007). In the UK, nurses recognise the importance of client education, but cite lack of time as a significant barrier to achieving good nutrition in the community (RCN, 2007). However, nine of the interventions in this review required less than 2 hours of professional time over a 3 month period and there was no evidence to suggest that brief interventions were less effective than more lengthy ones. In addition it may be possible to use remote technological methods of delivery to address the gap between what nurses consider desirable and what is achievable in a resource constrained environment (for example, Barnason 2003). A recent RCT from the USA (Walker et al 2009) found an educational intervention involving newsletters to be effective in improving eating habits in rural women aged 50 to 69 years.

Strengths and Limitations

We used systematic and rigorous methods to synthesize the current evidence on interventions with a nutritional education component for community dwelling older people. However, there are a number of methodological issues

that could have a bearing on the validity of these results. The review involved a diverse range of interventions, participants and outcomes. This heterogeneity meant that meta-analysis was inappropriate and made comparisons between studies more difficult. Nevertheless, despite this, we were able to make judgments about the strength and consistency of the evidence.

Many of the studies reviewed involved complex interventions of which nutritional education was only one component. In these studies it was difficult, therefore, to isolate the effectiveness of the nutritional aspect of the intervention from the other components. This difficulty is not unique to our review as it has previously been noted that nutritional interventions are often delivered as part of more complex health promotion interventions, which can lead to difficulties in drawing conclusions for clinical practice (Soderhamn et al, 2007). The reality of working in community healthcare is such that type and order of activity, consistency and professional expertise are applied flexibly according to circumstance (QNI, 2006) and do not consist of easily isolated activities (Cowley et al, 2000). The interventions of the studies included this review reflects the complexity of clinical work which should be evaluated for effectiveness (Craig et al., 2008). Systematic reviews such as ours attempt to incorporate the reality of everyday practice in order to be of use for practitioners. Throughout the review we have made it clear if the evidence relates to nutrition education only or to more complex interventions. We found evidence to suggest that nutritional education alone can influence diet and physical function, but were unable to determine whether changes to

other outcomes were attributable to nutrition education or to other aspects of the complex interventions.

Evaluating the effect on nutritional outcomes was further complicated by the complexity associated with the measurement of dietary related outcomes. Self reports of food intake may be subject to measurement error and may not accurately describe changes made (Macdiarmid and Blundell, 1997). Actual food intake is also subject to measurement problems (Bingham et al, 1994), and variation exists between the methods used to collect information on dietary intake (Soderhamn et al., 2007).

The quality of the studies varied although in the majority the risk of bias was assessed as moderate or high. Only five studies were judged to have adequate allocation concealment and poorly concealed trials may introduce selection bias and inflate treatment effects (Schulz, 1995). Only seven studies were judged to have adequate blinding but this is not altogether surprising as many outcomes are self-reported and blinding of patients and staff is not possible in studies such as these. In addition to the issues of bias, many studies were small (13 studies recruited less than 200 participants) and may have been underpowered to detect significant differences.

This review was restricted to randomized controlled trials, which are considered to be the 'gold standard' for answering questions about 'what

works' (Higgins and Green, 2009). We may have excluded important detail from other study designs employed in evaluating nursing interventions such as qualitative research which might provide useful additional information about context, applicability and process.   However, the 23 RCTs we included provide an important overview of effectiveness and highlight gaps that need to be addressed in future research.

Implications for practice and research

Although not all of the interventions were delivered by nurses, they can all be considered a legitimate concern for nursing practice. With an increasing emphasis on a healthier old age (WHO, 2010a; WHO, 2010b), nurses are in a good position to lead, develop and research this area of work. Many of the interventions reviewed could be delivered to patients in an opportunistic way whilst they receive other nursing care. Where appropriate, nurses in the UK could follow the practices of nurses in other countries, in particular the USA, who have addressed nutritional education needs of a wider audience of older people using new technologies, such as on-line support, direct telephone counselling and nurse-controlled computer generated telephone advice. This review provides some evidence that community health professionals, including nurses, can use a variety of nutritional education interventions to influence important patient outcomes in the older population. The consistency in results for many outcomes for both nutritional education only and complex interventions also suggests that nutritional education is an important area of work which may be used flexibly according to circumstance by community

practitioners.

This review highlights the need for further research evaluating and comparing the effectiveness of a range of nutritional educational interventions with older people. Decision making about dietary change is complex and highly individual and there is a need for further evaluation of tailored, individualized interventions which focus on the benefits of dietary change. There is also a need for greater reliability in tools for measuring patient outcomes. In addition, a review of qualitative research could help to identify barriers and facilitators to dietary change in older people. There was limited information on the effect of the interventions on service use. It is possible that health education may empower patients and create a greater demand for service use (Harari 2004). We found insufficient information to determine how service use is influenced by nutritional education in this population.

Conclusion

The over 65s are often regarded as having well established dietary and lifestyle habits which are difficult to change (Runciman et al, 2005). This systematic review has indicated that nutritional education can influence functional outcome, dietary change and other health indicators in people over 65 years of age living at home, but there is limited evidence of their influence upon service use or mortality. Further research is required in this area of study.

Conflicts of interest

None

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Appendix :

Box 1: Inclusion Criteria by types of outcome

Physical Function, Mental Health and Quality of Life Measures

Physical function measures [1]
Ability to perform activities of daily living [2]
Cognitive function: Depression and anxiety [2]
Quality of Life measures [2]

Nutritional Indices
Dietary change *reported as any of the following: use of salt in cooking or eating, use of variety of fats in cooking or eating*; *fruit, vegetable, milk, types of fat, fibre, energy, salt intake or mean dietary intake* [3]
Dietary intake *reported as actual fruit, vegetable, types of milk, types of fat, fibre, energy, salt intake or mean dietary intake* [3]
Prevalence of malnutrition [2]

Anthropometric Measures
Body Mass index [4]
Grip strength [4]
Biochemical Indicators [4]

Mortality, Service Use and Costs of Care

Mortality *reported as one of the following: numbers of deaths, Death rates, Kaplan Meier survival curves* [4]

Admission as an in-patient to hospital *reported as any of the following: number of episodes, mean number of admissions per patient, number or percentages of patients who were admitted to hospital* [4]

Length of in-patient stay (s) *reported as total number of days* [4]

Number GP or nursing or social services visits *reported as any of the following: mean visits per patient, number of visits per patient, median visits per patient* [4]

Costs of Care *reported as any of the following: total costs in currency, mean cost per patient, mean cost per patient based on average costs per unit of care, or by medical insurance payment made in currency* [4]

[1] as defined by any validated instrument and / or standardised, commonly used clinical measure
[2] as defined by any validated instrument
[3] as measured by any self reports, food diaries or any validated instrument
[4] as measured / reported either by professionals, health service records, patient records,or by patients or relatives

Box 2. Search Terms (Pubmed).

Concept 1:
Nutrit* [tw] OR Malnutrit* [tw] OR Malnourish* [tw] OR Undernourish* [tw] OR Under-nourish* [tw] OR Undernutrit* [tw] OR Under-nutrit* [tw] OR Diet [tw] Or Diet* [tw]

OR (Food OR diet) NEAR (intake OR management)[tw]
OR Eating NEAR (difficult* OR problem* or Disability) [tw]

MESH
OR Nutritional status [mh] OR Nutrition therapy [mh] OR Nutrition assessment [mh] OR Nutrition therapy [mh] OR Nutrition disorders [mh] OR Nutritional requirements [mh] OR Malnutrition [mh] OR Protein-energy malnutrition [mh] OR Food [mh] OR Food, formulated [mh] OR Food, fortified [mh] OR Food services [mh]   **After Perry et al (2006)**

Concept 2:
Elderly [tw] OR Elder* [tw] OR Senior [tw] OR Frail [tw] OR Geriatric* [tw] OR "old people" [tw] OR "Older people" [tw] OR "over 65" [tw] OR "old adult" [tw] OR "older adult" [tw] OR "old person" [tw] OR "older person" [tw]

MESH
OR Aged [mh] OR Aged, 80 and over [mh] OR Frail Elderly [mh] OR Health service for the Aged [mh] OR Geriatric Nursing [mh] OR Geriatric Assessment [mh]

Concept 3:
Community [tw] OR "primary health care" [tw] OR "primary care" [tw] OR "community-dwelling" [tw]

MESH.
OR *Community health services [mh] OR Home care services [mh] OR Community health cent* [mh] OR Public health nursing [mh]

NOT (long term care OR Intermediate care services OR residential [tw] OR "nursing homes" [tw])

Concept 4:
Clinical Trial pt OR Randomized OR Placebo OR Drug therapy fs OR Randomly OR Trial OR Groups
                                         RCT search filter developed by Glanville (2006)

Footnote:
Each concept was run as a separate search in Pubmed, as stated, and then all concept searches were combined with the Boolean operator AND.
Abbreviations show Pubmed syntax, as follows:
fs= all fields; mh = mesh heading; pt = publication type; tw = text Words;
words enclosed by " " = appear exactly as written, ie appear together in text.