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Rehabilitation for older people in long-term care

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Cochrane Database of Systematic Reviews, Issue 2, 2009 (Status in this issue: Unchanged)
Copyright © 2009 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
DOI: 10.1002/14651858.CD004294.pub2
This version first published online: 21 January 2009 in Issue 1, 2009.
Last assessed as up-to-date: 29 July 2008. (Help document - Dates and Statuses explained)


ABSTRACT

Background
Examination of demographic trends indicates that the worldwide population is progressively ageing. It is expected that such longevity will be associated with an increase in morbidity and demand for long-term residential care. This review examines whether there is evidence that physical rehabilitation benefits older people in long-term care.

Objectives
To evaluate physical rehabilitation interventions directed at improving physical function among older people in long-term care.

Search strategy
We searched the trials registers of the following Cochrane entities: Stroke Group (searched March 2008), Effective Practice and Organisation of Care Group (searched August 2006) and the Rehabilitation and Related Therapies Field, (searched August 2006). In addition, we searched 17 relevant electronic databases including the Cochrane Central Register of Controlled Trials (The Cochrane Library 2007, Issue 3), MEDLINE (1966 to 1 October 2007), EMBASE (1980 to 1 October 2007), CINAHL (1982 to 1 October 2007), AMED (1985 to 1 October 2007), PsycINFO (1967 to 1 October 2007) and PEDro (searched 1 October 2007). We also searched trials and research registers and conference proceedings, checked reference lists, and contacted authors and researchers in the field and other relevant Cochrane entities.

Selection criteria
Randomised studies comparing a rehabilitation intervention designed to maintain or improve physical function with either no intervention or an alternative intervention in older people aged 60 years or over who have permanent long-term care residency.

Data collection and analysis
Two authors independently assessed trial quality and extracted data. We contacted study authors for additional information.

Main results
Forty-nine trials involving 3611 participants were included. On average, 74 (range 12 to 468) participants were randomised into trials at baseline. Of studies which reported age, the overall mean age was 82 years (range of 69 to 89). Most interventions lasted less than 20 weeks, and comprised approximately three 30 to 45-minute group sessions per week. Twelve trials conducted post-intervention follow up (maximum one year). Most often a ‘usual care’ control group was used, but social activity and alternative interventions also featured. The primary outcome, daily activity restriction, was reported by 38 trials. A range of secondary outcomes are also reported.

Authors’ conclusions

Provision of physical rehabilitation interventions to long-term care residents is worthwhile and safe, reducing disability with few adverse events.

Most trials reported improvement in physical condition. However, there is insufficient evidence to make recommendations about the best intervention, improvement sustainability and cost-effectiveness.

Plain Language Summary

Rehabilitation for older people in long-term care

Rehabilitation treatments may be effective in improving the physical condition of older people in long-term care. In 1997 the number of over-65 year olds constituted 6.6% of the world’s population, and this is predicted to increase to 10% by 2025. It is expected that this will lead to a rise in demand for long-term residential care. There is therefore a demand for ways of preventing any deterioration in health and increasing independence in activities of daily living, for example walking and dressing, among residents. Physical rehabilitation (interventions based on the exercising the body) may have a role and this review examines the evidence available. Forty-nine trials are included in this review, 30 of which were conducted in the USA. In total, 3611 participants with an average age of 82 years were involved, more than two-thirds of whom were female. Most interventions in some way addressed disability in routine daily life, for example walking, eating and dressing. The trial outcomes addressed by this review are disability in daily life, strength, flexibility, balance, general physical condition, mood, cognitive status, participant drop out, session attendance, death, illness, and unwanted effects associated with the intervention, such as injuries. Due to the wide variety of outcome measures used, the studies could not be summarised statistically, therefore a narrative review is provided. While variations between the trials means specific recommendations cannot be made, they were overwhelmingly successful, demonstrating that many different types of physical rehabilitation have benefits to physical health with few reports of unwanted events relating to the intervention.

Background

Examination of demographic trends indicates that the worldwide population is progressively ageing. In 1997 the number of over-65 year olds constituted 6.6% of the world’s population, and this is expected to increase to 10% by 2025, amounting to 800 million people globally (WHO 1998). However this prospect of longevity may be associated with a concomitant increase in morbidity, and requirement for long-term care in a residential setting. The increased demand effected by longer life expectancy has seen a burgeoning of private care homes. In 2001 there were 142,500 nursing home beds and 260,066 residential care home places for older people in England (DoH 2001). In the USA in 1997 there were 1,465,000 nursing home residents, and this figure is expected to reach three million by 2030 (Sahayoun 2001). Rehabilitation programmes appropriate to the circumstances and needs of older people are developing an encouraging evidence base. In addition, governing bodies worldwide are responding to the pressures exerted by current demographic patterns by placing increased emphasis on promoting health and independence in old age, which may result in greater investment in rehabilitation services. This review examines the evidence for the effectiveness of physical rehabilitation for older people in long-term care.

Objectives

To evaluate the benefits and harms of rehabilitation interventions directed at maintaining, or improving, physical function for older people in long-term care.

Methods
Criteria for considering studies for this review

Types of studies
We included all studies that were randomised controlled trials (RCTs) or cluster RCTs, which evaluated physical rehabilitation programmes for older people. Studies compared a rehabilitation intervention designed to maintain or improve physical function with either no intervention or an alternative intervention. During the review process the review team reached consensus to exclude those trials in which physical exercise was a component of a multifaceted intervention primarily aimed at falls prevention as this topic is addressed in other Cochrane reviews (Cameron 2005; Gillespie 2003). We excluded trials in which only a proportion of participants met the inclusion criteria unless outcome data pertaining to these participants were reported separately. Our original intention was to focus on those studies that comprised a minimum of one month of follow up. However, only a minority of studies reported any follow up. We report data from final assessment.

Types of participants
Older people who reside in a care home or hospital as their place of permanent abode. Older people are those aged 60 years or over, and including all participants in studies where the mean age is 60 or over. The term 'care home' is as defined in a previous review (Ward 2003):

- provides communal living facilities for long-term care;
- provides overnight accommodation;
- provides nursing or personal care;
- provides for people with illness, disability or dependence.

Types of interventions
Physical rehabilitation is defined as those interventions that aim to maintain or improve physical function. We excluded interventions that primarily address cognitive deficits or mood disorders or both unless they also aim to improve the physical state. We evaluated interventions by content, not by the personnel implementing them, for example physiotherapist, occupational therapist. We included studies that address a defined subgroup of care home residents, such as stroke patients.

Types of outcome measures

Primary outcome measure
- Function in activities of daily living (ADL) (e.g. measured by the Barthel Index, Functional Independence Measure)

Secondary outcome measures
- Exercise tolerance (e.g. walking distance)
- Muscle power (e.g. isokinetic and isometric dynamometry) and flexibility (e.g. joint range of movement)
- Balance (e.g. Berg balance scale, functional reach test)
- Perceived health status (e.g. Sickness Impact Profile, Nottingham Health Profile)
- Mood (e.g. Geriatric Depression Scale)
- Fear of falling (e.g. Falls self-efficacy Index)
- Global poor outcome comprising death or deterioration in physical function

The outcomes are assessed at the scheduled end of each trial in relation to the baseline values. We anticipated disparity between studies, and this is given due consideration in the review. A variety of assessment measures are used in the included studies, making data comparison difficult. In future updates we hope to review opportunities for data synthesis. In this event we anticipate dichotomising outcomes into deteriorated, and maintained or improved.

Search methods for identification of studies
See: 'Specialized register' section in Cochrane Stroke Group
The extensive nature of this topic was reflected in the search of a wide range of resources, both electronic and non-electronic, without language restrictions. We searched the trials registers of the following Cochrane Groups: Stroke Group (last searched 18 March 2008), Effective Practice and Organisation of Care Group (last searched August 2006) and the Rehabilitation and Related Therapies Field, (last searched August 2006). In addition, we searched the following databases (Appendix 1):

- The Cochrane Central Register of Controlled Trials (The Cochrane Library 2007 issue 3)
- MEDLINE (1966 to 1 October 2007)
- EMBASE (1980 to 1 October 2007)
- Cumulative Index to Nursing and Allied Health Literature (CINAHL) (1982 to 1 October 2007)
- Allied and Complementary Medicine Database (AMED) (1985 to 1 October 2007)
- Physiotherapy Evidence Database (PEDro) (searched 1 October 2007)
- British Nursing Index (1994 to 1 October 2007)
- Applied Social Science Index and Abstracts (ASSIA) (1987 to 1 October 2007)
- International Bibliography of Social Sciences (IBSS) (1951 to 1 October 2007)
- PsyCINFO (1967 to 1 October 2007)
- Database of Abstracts of Reviews of Effects (DARE) (searched 1 October 2007)
- Health Management Information Consortium Database (HMIC) (searched 1 October 2007)
NHS Economic Evaluation Database (NHS EED) (searched 1 October 2007)
- Health Technology Assessment (HTA) Database (searched 1 October 2007)
- ISI Web of Knowledge (searched 1 October 2007)
- Google Scholar (searched July 2007)
- Index to Theses (http://www.theses.com/) (searched 1 October 2007)
- Proquest Dissertations and Theses (searched July 2007)

In an effort to identify further published, unpublished and ongoing trials:
(1) we searched the following ongoing trials and research registers in December 2007; National Research Register (http://www.nrr.nhs.uk/), Current Controlled Trials (www.controlled-trials.com) and HSRProj (Health Services Research Projects in Progress, http://www.nlm.nih.gov/hsrproj/);
(2) we scanned reference lists of relevant studies;
(3) we contacted investigators and subject area experts and requested additional information from authors of relevant trials;
(5) we searched the following available proceedings of the World Congress of Physical Therapy: 1953, 1963, 1967, 1982. In view of the comprehensive nature of the electronic search we did not handsearch journals. We also contacted the Cochrane Dementia and Cognitive Improvement Group (August 2006) and the Cochrane Health Promotion and Public Health Field (August 2006) who indicated that their own Field registers would not contain studies of relevance to this topic.

Data collection and analysis
Two review authors independently assessed all identified study titles, and when required, the accompanying abstracts. We obtained the full texts of all potentially relevant studies. At least two members of the review team examined identified studies for eligibility according to predetermined inclusion criteria, and subsequently graded their methodological quality using the following measures of validity.

- Was the assignment to treatment groups really random?
- Was the assigned intervention adequately concealed prior to allocation?
- Were the control and treatment groups comparable at entry?
- Were the interventions clearly defined?
- Were those assessing outcomes blind to treatment allocation?
- Were the outcomes analysed on an intention to treat basis?
- Were all interventions other than the treatment options standardised between the two groups?

We rated each criterion as met, unmet, or unclear, and produced an overall summary of the validity of each study, as described in the Cochrane Handbook for Systematic Reviews of Interventions (Higgins 2008). We resolved any disagreements by discussion and contacted study authors for clarification if appropriate.

Two review authors independently extracted and recorded data using a standardised paper data collection form. We resolved discrepancies by discussion, and where possible, we contacted study authors to provide clarification or additional data if necessary. We reported whether cluster RCTs accounted for clustering in the trial analysis.

The included studies are heterogeneous. They examine different types of intervention, and evaluate them with a wide battery of outcome measures. Such variety made a meta-analysis unfeasible. If sufficient homogeneity exists amongst included studies in the future, we plan to combine the results in a fixed-effect meta-analysis. We will use RevMan 5.0 (RevMan 2008) for data synthesis. We will calculate relative risks (RR) and 95% confidence intervals (CI) for dichotomous outcomes. For continuous outcomes, we will express effect sizes using mean differences/standardised mean differences (depending on the commonality of outcome measures used), and 95% CIs. If cluster RCTs are included, we will seek statistical advice regarding data analysis.

If data permit, we will undertake sensitivity analysis assessing the impact of each separate aspect of methodological quality on the estimate of treatment effect for the primary outcome. If significant heterogeneity exists (P < 0.2), we will conduct a sensitivity analysis on the basis of methodological quality and the effect of dropouts. If heterogeneity persists, we will investigate other possible explanations by way of subgroup analyses. If sufficient data is available these will include:

- age (old versus very old, e.g. above and below 75 years);
- pathology-specific interventions;
- mode of delivery (group versus individual interventions);
- residential category (residential care home versus nursing home: nursing homes are defined as facilities in which qualified nursing care is available 24 hours a day).

This review provides a narrative exploration of the extent to which included studies demonstrated that their rehabilitative interventions were of benefit to the participants, and the nature and sustainability of any benefits are discussed.

RES U LT S
Description of studies
See: Characteristics of included studies; Characteristics of excluded studies; Characteristics of studies awaiting assessment; Characteristics of ongoing studies.
The extensive search strategy produced over 20,000 references. From these, 49 studies fulfilled the eligibility criteria and are included in this review.

Included studies
A total of 361 participants were randomised into the included trials, prior to any attrition. A general overview is given below; further details can be found in Characteristics of included studies.

Design
Several experimental designs were utilised. Thirty-nine studies randomised individuals into experimental groups. The remaining 10 used cluster designs where facilities, not individuals, were randomised (Brown 2004; Choi 2005; Faber 2006; Gillies 1999; McMurdo 1993; McMurdo 1994; Mihalko 1996; Morris 1999; Rosendahl 2006; Sackley 2006). One study followed cluster randomisation of exercise type with randomisation of individual participants to exercise or control conditions (Faber 2006). Eight trials used a cross-over design (Baum 2003; Brown 2004; DeKuiper 1993; Kinion 1993; Lang 1992; Ouslander 2005; Pomeroy 1993; Sauvage 1992). Usually this meant that after a set period of time participants allocated to the control group also received the intervention, or that the experimental groups swapped over. Eight studies stratified participants before randomisation to ensure even distribution of certain participants between groups, for example, older, more sick, or less mobile individuals (Baum 2003; Bautmans 2005; Lazowski 1999; MacRitchie 2001; Mulrow 1994; Prybylski 1996; Rosendahl 2006; Sackley 2006). A 'matched pairs' design, where participants were systematically matched on characteristics of interest, and then randomly allocated into intervention groups was used in four studies (Au-Yeung 2002; Morris 1999; Schoenfelder 2000; Schoenfelder 2004). A repeated measures design, where all participants received all conditions was also used (DeKuiper 1993; Lang 1992; Riccio 1990).

Comparison groups
Most studies compared two groups; the intervention of interest and some sort of control. However, nine studies compared three groups (Clark 1975; Cott 2002; Faber 2006; Gillies 1999; Lang 1992; Morris 1999; Schnelle 1995; Stevens 2006; Tappen 1994). Three studies compared four groups (Faber 2006; Fiatarone 1994; Rosendahl 2006).
Thirty-five studies compared their intervention to a 'usual care' control group, allowing examination of whether the intervention was better or worse than their usual situation. In the remaining studies 'usual care' was supplemented in some way, for example, a social meeting or different exercise. A social or recreational activity control session, for example talking, playing cards or reminiscing, featured in 16 studies (e.g. Baum 2003; Brown 2004). Others compared different exercise programmes, usually a novel approach with a traditional type (Au-Yeung 2002; Bautmans 2005; Brill 1998; Bruyere 2005; Faber 2006; Gillies 1999; Lang 1992; Lazowski 1999; Mihalko 1996; Riccio 1990; Urbscheit 2001; Yoder 1989). Two studies compared three exercise types (DeKuiper 1993; Lang 1992). The remaining studies supplemented 'usual care', for example, with a night-time sleep enhancement intervention (Alessi 1999); a continence intervention (Schnelle 1995); or a nursing care intervention (Morris 1999 - additional to another 'usual care' control). Two studies compared four groups, an exercise with a social activity control, and nutritional supplement with a placebo control to examine whether exercise alone was better than the social activity control, and whether benefit from exercise is enhanced by nutritional supplementation (Fiatarone 1994; Rosendahl 2006). One study compared two different exercise programmes, each with their own control group (Faber 2006).

Follow up
All studies assessed participants after intervention completion, follow up of participants after this was rare, undertaken by just 12 studies. Most frequently, follow up after the end of the intervention was at three months (Au-Yeung 2002; Rosendahl 2006; Sackley 2006; Schoenfelder 2000; Schoenfelder 2004), one year was very unusual (Faber 2006; Meuleman 2000; Urbscheit 2001). One study followed participants progress for 10 months (Morris 1999; for participants the minimum exercise programme exposure was four months). Two studies followed participants at one month (Clark 1975; Silhoven 2004); and finally, just one week (Mihalko 1996).

Sample size
On average, included studies randomised 74 participants into their trial prior to any attrition. This ranges from just 12 participants (Sauvage 1992) to 468 (Morris 1999). Only 10 studies included 100 or more participants (Faber 2006; Fiatarone 1994; Morris 1999; Mulrow 1994; Ouslander 2005; Prybylski 1996; Rosendahl 2006; Sackley 2006; Schnelle 2002; Stevens 2006). Fewer than 35 participants were randomised in 21 studies; of these, 10 were particularly small with 20 or fewer participants (Baum 2003; Brill 1998; Gillies 1999; Karl 1982; Lang 1992; Naso 1990; Sauvage 1992; Schoenfelder 2000; Stamford 1972; Urbscheit 2001). One study (Sauvage 1992) is especially problematic, reporting data from just 10 individuals. Starting with 12 participants, they allocated six each to the intervention and control groups. On losing two intervention participants, they allowed four control participants to complete the intervention. Therefore they report data for eight intervention and six control participants.

Setting
Studies were undertaken in various countries and long-term care settings.

**Location**

Most studies were conducted in North America; 30 took place in the USA and five in Canada. Within Europe, five were conducted in the UK, two in Belgium, and one each in Denmark, Finland, Sweden and The Netherlands. Throughout the rest of the world, there were single studies from South Korea, Australia and Hong Kong.

**Participants**

A brief synopsis of inclusion and exclusion criteria applied to participants on medical, physical and psychological grounds is presented here. Further details are given in Characteristics of included studies.

**Sex**

Overall, 72% of participants were female.

**Age**

Reported data in each study indicated that mean age was greater than 65 years. Across studies reporting overall data, mean participant age was 82 years. Reported means ranged from 69 years (Clark 1975) to 89 years (Bruunsgaard 2004). A mean age of under 75 years was reported in only four small studies (Clark 1975; Karl 1982; Sauvage 1992; Stamford 1972). Mean age was not reported in 21 studies, with four reporting age range (Karl 1982; Pomeroy 1993; Naso 1990; Przybylski 1996).

**Medical status**

Only three studies explicitly stated that no participant would be excluded on medical grounds (Brown 2004; Crilly 1989; McMurdie 1994). Those judged to be ‘medically unstable’ or suffering from acute illness were frequently excluded (18 trials, e.g. Meuleman 2000). Other medical criteria were more specific. People with cardiac problems were excluded by 16 studies, for example, cardiovascular disease (e.g. Pomeroy 1993); angina, (e.g. Naso 1990); or a pacemaker (e.g. Baums 2005). Another common basis for exclusion was a terminal diagnosis or life expectancy below three months implemented by nine studies. People with neurological problems were excluded in three studies (Au-Yeung 2002; Bruunsgaard 2004; Sauvage 1992); while four studies specifically excluded stroke patients (Brill 1998; Meuleman 2000; Tappen 2000; Tappen 1994); while one study (Sackley 2006) only included stroke patients. Other studies listed medical problems common in elderly patients, such as diabetes, as reasons for exclusion (e.g. Baums 2005; Fiatarone 1994; Hruda 2003). People with joint problems or replacements or who were unable to weight bear were excluded by five studies (Au-Yeung 2002; Baum 2003; Bruyere 2005; MacRitchie 2001; Pomeroy 1993). Lastly, people with sensory deficits such as poor eyesight (Au-Yeung 2002; Silhoven 2004) or more severe blindness or deafness were sometimes excluded (e.g. Crilly 1989; Lazowski 1999). Such participants may have been excluded in other studies under other exclusion criteria, for example, inability to perform ADLs. One study (Buettner 1997) excluded participants undergoing treatment with Tacrine, a drug used in the treatment of Alzheimer’s disease. Another study (Tappen 1994) explicitly excluded those with mental illness, Parkinson’s disease, head injury or mental retardation.

**Physical status**

Frequently studies required participants to be fairly physically capable. In total, 20 studies specified that participants should be mobile (with or without assistance). Only two studies (Lazowski 1999; Meuleman 2000) explicitly included wheelchair users; one study (Schnelle 1995) required participants to self-propel their wheelchair. Four studies stipulated that participants should be able to walk more than five metres (Cott 2002; Faber 2006; Stamford 1972; Uerbschiet 2001). Seven studies specified that participants should be able to stand independently (distinct from walking ability); one study (Schnelle 1995) required participants to bear weight.

Studies seeking less capable participants were unusual. Two studies explicitly accepted non-ambulatory participants (Mihalko 1996; Schnelle 1995) with Mihalko 1996 seeking people sedentary for longer than six months. One study (Pomeroy 1993) mentions inclusion of those unable to stand. One study (Sauvage 1992) sought participants with gait impairment. Four studies only included incontinent participants (Alessi 1999; Ouslander 2005; Schnelle 2002; Schnelle 1995).

**Cognitive status**

Thirty-four of 49 studies included participants with some degree of cognitive deficit, usually classified by study-specific criteria. Of these exclusions, 18 were for ‘severe cognitive impairment’; two for ‘moderate cognitive impairment’ (Bruunsgaard 2004; Sauvage 1992); the ability to follow instructions was required by 18 studies (this was occasionally used in addition to a definition of moderate or severe impairment). Four studies used the Parachek Geriatric Rating Scale to exclude participants with very low communication and physical skills (DeKuiper 1993; Lang 1992; Riccio 1990; Yoder 1989). By contrast, four studies only recruited participants with a diagnosis of dementia (Buettner 1997; Pomeroy 1993; Stevens 2006; Tappen 1994); two further studies selected only participants with Alzheimer’s type dementia (Cott 2002; Tappen 2000).

**Interventions**
To provide a convenient overview, interventions are categorised according to key components. Individual programmes are described in the Characteristics of included studies table.

### Exercise-related components

Thirteen studies featured exercises designed to be useful in everyday functioning. For example, in one study (Faber 2006) the ‘functional walking programme’ featured exercises intended to practice everyday skills including standing up, climbing stairs and avoiding obstacles. The most common component, included in some form by 24 studies was strengthening, for example using elastic resistance bands or weights. Walking was also common, incorporated by 20 studies. Exercises targeted at flexibility or range of motion appeared in 12 interventions; balance in nine; and endurance exercises appeared in six. Less common features include relaxation and breathing exercises (Clark 1975; Crilly 1989; Lazowski 1999; Tappenden 1994); aerobic exercise (Clark 1975; Sauvage 1992; Stevens 2006); and Tai Chi (Choi 2005; Faber 2006). In 11 trials, participants were able to carry out the intervention seated (e.g. McMurdo 1993), and in five further studies this was optional (e.g. Karl 1982).

### Distinctive interventions

Four trials explored the potential of imagery or purposefulness for enhancing exercise participation (DeKuiper 1993; Lang 1992; Riccio 1990; Yoder 1989). Imagery, (e.g. pretending to pick apples), or ‘added purpose’ exercise, (e.g. rotary arm exercise in the form of making biscuits) were compared with rote exercise. An intervention known as Functional Incidental Training (FIT), was evaluated by three studies (Alessi 1999; Ouslander 2005; Schnelle 1995). Here, exercises targeting specific individual needs, such as standing up, are provided frequently throughout the day, incidental to daily nursing care routines such as toileting. The therapeutic recreation nursing team intervention (Buettnere 1997) is comparable to these. Here the entire nursing home environment was enhanced, with every aspect of daily life regarded as part of the intervention. A wide range of activities was provided including, for example, cardiovascular exercise, cooking, gardening, cognitive therapy and various sensory stimulation activities. Nursing staff were involved in provision and ADLs such as dressing were targeted.

Whole body vibration’, where exercises are performed on an oscillating platform, was explored by two studies (Brayere 2005; Baumanns 2005). One study (Silhoven 2004) compared dynamic balance exercise visual feedback sessions on a ‘Good Balance’ force platform with an unspecified control activity. One study (MacRitchie 2001) piloted an intervention where energetic music was played over the nursing home’s intercom, signalling volunteers among the home’s staff to go to their designated resident and spend 20 minutes facilitating walking and exercises such as knee raises and shoulder rotation in a standing position. This was compared to both social and music only control groups.

### Components supplementary to exercise

In addition to exercise, 12 interventions contained non-exercise components. Among these were a social or communication element (for example, ‘walking and talking’ (Buettner 1997; Cott 2002; Faber 2006; Schnelle 1995; Tappenden 2000). Interventions to improve continence, for example, prompted voiding (Schnelle 1995; Schnelle 1996; Schnelle 2002); nutritional supplementation (Fiatarone 1994; Rosendahl 2006); and environmental adaptations designed to improve sleep (Alessi 1999). Lastly, one study (Morris 1999) examined an intervention for nurses in combination with participant ADL training.

### Non-exercise interventions

A structured training programme directed at repeated practice of ADLs such as dressing and eating, was evaluated by one study (Tappenden 1994). One study (Brown 2004) compared indoor gardening with socialising sessions. Lastly, two studies (Przybylski 1996; Sackley 2006) assessed occupational therapy programmes.

### Outcome measures

As a consequence of the considerable variation in the purpose and content of the interventions outlined above, many outcome measures were used. Frequently these were study-specific. In total, 37 trials reported an outcome measure related to ADL, our primary outcome measure. Other common outcomes addressed by the studies include strength (22 studies), balance (15 studies), general physical condition (13 studies), mood and agitation (16 studies), cognitive performance (eight studies) and flexibility (eight studies). Morbidity, mortality and adverse events were also recorded. Details of the methods used by individual studies to assess these outcomes can be found in Characteristics of included studies.

### Excluded Studies

We excluded 43 studies; reasons are provided in Characteristics of excluded studies. We excluded studies where the intervention and control groups received the same exercise intervention with the only differential being a non-exercise component (e.g. Binder 1995, vitamin D supplement) as they were not evaluating a physical intervention. As explained above, we also excluded studies that evaluated a multifaceted intervention primarily aimed at falls prevention.

### Risk of bias in included studies

The included studies vary considerably in methodological quality. We judged 41 trials to have unclear trial quality because they did not report key aspects of their methodology; for example, how participants were allocated to study groups or the nature of participant, therapist and assessor blinding. Only six studies reached the highest level of trial quality (Baum 2003; Faber 2006;
Statistics of included studies

Intention-to-treat analyses were carried out by eight studies (Baum 2003; Bautmans 2005; Bruyere 2005; Faber 2006; Fiatarone 1994; Mulrow 1994; Rosendahl 2006; Sackley 2006). Of the cluster trials only two (Rosendahl 2006; Sackley 2006) explicitly accounted for the effect of clustering in their statistical analysis.

Two studies cause particular concern. Firstly, one (Karl 1982) did not report baseline or follow-up data or randomisation procedure. The second (Brill 1998) had only one room and time slot to conduct their weight-training intervention. This meant both groups received their intervention at the same time. It is unclear how far this deviates from the intended design. The design used in one study (Przybylski 1996) also raises potential problems. Their intervention was implemented over two years, with 29 new patients recruited throughout to replace participants who died or were discharged. The researchers had no control over who entered and left the groups and made the assumption that this was a random process.

Effects of interventions

The included studies examined many different interventions using a variety of frequently study-specific outcome measures. Such variation makes a meta-analysis potentially misleading. Therefore, we provide a narrative exploration of whether included studies demonstrated that their rehabilitative interventions were of benefit to their participants, and the nature and sustainability of any benefits. This section will begin by detailing participant eligibility, attrition and compliance; followed by the reported outcomes of interest: function in ADL, strength, physical endurance and walking capacity, flexibility, balance, general physical condition, mood and cognitive status, compliance, adverse events, morbidity and mortality, and finally, six trials judged to be of the highest quality in terms of clearly adequate concealment of allocation and blind assessment are examined separately (Baum 2003; Faber 2006; Mulrow 1994; Ouslander 2005; Rosendahl 2006; Sackley 2006).

Some trials selected extremely frail individuals and we have considered this when assessing these interventions as preventing or slowing decline may be the treatment goal in this situation. This section provides a summary; we report results of individual studies in the Characteristics of included studies table.

Trial attrition


Intervention compliance

Many studies failed to report either intervention or control session attendance. Experimental intervention session attendance was reported in 17 studies with a mean of 84%. The highest reported attendance was 97% (Au-Yeung 2002). Control session attendance was reported by 10 studies with a mean of 84%; only one study (Fiatarone 1994) reported attendance of 100%. Varying attendance levels may enhance the apparent treatment effect in favour of the experimental intervention. Session attendance was irrelevant where interventions were not provided in discreet sessions, for example, the Functional Incidental Training studies, repeated measures designs or where a ‘usual care’ control was used.

Primary outcome measure: function in ADL

In total, 37 trials reported an outcome measure related to ADL, our primary outcome measure; it was not clearly reported by 11 studies (Bruunsgaard 2004; Cott 2002; Crilly 1989; DeKuiper 1993; Lang 1992; McMurdo 1994; Riccio 1990; Silhoven 2004; Stamford 1972; Urbascheit 2001; Yoder 1989). Most often, trials reported the effect their intervention had on some aspect of walking or mobility (Alessi 1999; Au-Yeung 2002; Baum 2003; Bautmans 2005; Brill 1998; Brown 2004; Bruyere 2005; Buettner 1997; Choi 2005; Faber 2006; Fiatarone 1994; Gillies 1999; Hruda 2003; Karl 1982; Lazowski 1999; MacRitchie 2001; Meuleman 2000; Morris 1999; Mulrow 1994; Naso 1990; Ouslander 2005; Pomeroy 1993; Przybylski 1996; Rosendahl 2006; Sackley 2006). Fewer than half of the included studies reported the proportion of individuals who were eligible for their intervention compared to the total number of residents. Of the 19 studies that did provide this information, an average of just 48% of people residing in the home were eligible for intervention participation. Likewise, only 20 included studies reported the number of eligible individuals who agreed to participate and were randomised into the experimental conditions. Of these studies, the mean number of eligible individuals that ultimately participated was 62%. These two factors have an impact on the extent to which the experimental sample here is representative of the general long-term care population.
Several trials used standardised scales to quantify changes in ADL, for example, occupational therapy (Sackley 2006), functional exercise (Gillies 1999), or a weight training and nursing intervention (Morris 1999), strength training alone (Mihalko 1996), or combined with range of motion exercises (Baum 2003), all of these examples reported reduced general disability compared to controls. One trial observed the greatest improvements among those with the most severe baseline disability (Meuleman 2000). Improvements in specific areas of daily activity restriction were also reported. For example, self-care (Przybylski 1996; Stevens 2006; Tappen 1994); eating (Brown 2004; Karl 1982), and continence (Brown 2004; Ouslander 2005; Schnelle 2002; Schnelle 1996; Schnelle 1995). However, statistical significance was not always reached, for example, in self-care (Clark 1975), and in a performance test of activities of daily living (Karl 1982).

Of the trials selecting only participants with dementia (Buettner 1997; Cott 2002; Pomeroy 1993; Stevens 2006; Tappen 1994; Tappen 2000) it was observed that exercise arrested functional decline (Stevens 2006), and that physiotherapy was most beneficial to those with the most severe dementia (Pomeroy 1993). One study (Stevens 2006) also found that exercise prevented the decline observed among control participants. However, another study (Tappen 1994) failed to demonstrate clear experimental intervention superiority, despite concluding that functional skill training might be more effective than traditional exercise for helping those with advanced dementia.

Increased mobility was also reported (Alessi 1999; Baum 2003; Brill 1998; Brown 2004; Bruyere 2005 Buettner 1997; Choi 2005; Faber 2006; Fiatarone 1994; Gillies 1999; Hruda 2003; Karl 1982; Lazowski 1999; Meuleman 2000; Morris 1999; Mulrow 1994; Ouslander 2005; Rosendahl 2006; Schnelle 2002; Schnelle 1996; Schnelle 1995); increases in the distance travelled (Gillies 1999; Hruda 2003; Sauvage 1992 Schnelle 1995; Schnelle 2002); speed (Buettner 1997; Fiatarone 1994; Gillies 1999; Hruda 2003; Ouslander 2005; Rosendahl 2006; Sauvage 1992; Schnelle 1996); endurance (Morris 1999; Schnelle 1996; Schnelle 1995); gait (Bruyere 2005); stair climbing (Hruda 2003); and reduction in aid usage (Meuleman 2000; Nato 1990). An increase in the speed at which participants could rise from a chair was reported (Baum 2003; Brill 1998; Brown 2004; Bruyere 2005; Lazowski 1999; MacRitchie 2001; Meuleman 2000; Ouslander 2005). Six studies used the Timed Up and Go test (Au-Yeung 2002; Baum 2003; Bautmans 2005; Bruyere 2005; Lazowski 1999; MacRitchie 2001). One study (Au-Yeung 2002) did not report any improvements, and three studies (Brill 1998; Meuleman 2000; Ouslander 2005) used other measures of chair rising.

Effective interventions included indoor gardening (Brown 2004), Tai Chi (Choi 2005), those that included functional exercises (Buettner 1997; Gillies 1999; Lazowski 1999; Ouslander 2005; Przybylski 1996), strengthening and aerobic exercise (Sauvage 1992), physical and occupational therapy (Mulrow 1994; Przybylski 1996) and muscle power training (Hruda 2003). Aspects of mobility did not always improve significantly (Alessi 1999; Au-Yeung 2002; Brill 1998; Choi 2005; Faber 2006; Meuleman 2000; Nato 1990 Tappen 2000; Schoenfelder 2000; Schoenfelder 2004), for example where there was severe baseline disability (Meuleman 2000). Unsuccessful elements were reported after a physical activity programme (Alessi 1999); Tai Chi (Choi 2005); a walking and talking intervention (Tappen 2000); a treadmill/exercise bike programme (Nato 1990); functional exercise programme (Gillies 1999); walking and strength training (Schoenfelder 2000; Schoenfelder 2004); and occupational therapy (Sackley 2006).

Two trials contrasted the efficacy of different interventions on mobility: one found no difference between two programmes, both were superior to control (Faber 2006); the other found that a functional exercise programme led to significant increase in mobility, while mobility deteriorated among participants in a programme focused on range of motion (Lazowski 1999).

### Secondary outcomes

#### Strength

Strength was reported as an outcome in 22 studies. Almost all interventions with a strengthening component assessed it as an outcome measure; only two, where strengthening was a minor component, did not (Clark 1975; Grilly 1989). Intervention benefit, most often in terms of strength increase, rather than prevention of deterioration, was reported (Baum 2003; Brill 1998; Buettner 1997; Choi 2005; Fiatarone 1994; Hruda 2003; Lazowski 1999; MacRitchie 2001; McMurdo 1994; McMurdo 1993; Meuleman 2000; Mihalko 1996; Ouslander 2005; Rosendahl 2006; Sauvage 1992; Schnelle 2002; Schnelle 1996). Improvement sustainability was only addressed by four studies (Buettner 1997; Meuleman 2000; Mihalko 1996; Rosendahl 2006). Not all trials were successful (Lazowski 1999; Sauvage 1992). One study (Bruunsgaard 2004) found strength gains were related to blood plasma levels of an indicator of chronic inflammatory activity; patients with low levels significantly outperformed those with high levels. In one trial significant strength gains were observed in very frail participants during the first 20 weeks of the intervention, while strength deteriorated among controls. However, during the final 10 weeks of the intervention, strength deteriorated among all participants (Buettner 1997). One study (Meuleman 2000) found the ability of a participant to improve their strength was strongly correlated with improved functional outcomes; while another study (Mihalko 1996) found no benefit from strength gains on subjective wellbeing.

#### Flexibility

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While components targeting flexibility featured in 12 interventions, only eight studies assessed it as an outcome measure (Bautmans 2005; Buettner 1997; Choi 2005; Kinion 1993; Lazowski 1999; McMurdo 1993; Mulrow 1994; Schnelle 1996). All but one (Mulrow 1994) report successfully increasing flexibility. For example, rowing was found to increase range of motion in advanced dementia and frailty (Schnelle 1996), and exercise to music was related to improvement in spinal flexion, which deteriorated in the control group (McMurdo 1993). Only one study (Lazowski 1999) compared the effect of two types of physical rehabilitation on flexibility. They found their ‘functional fitness’ intervention significantly (P < 0.05) outperformed ‘range of motion’ exercises on several indices of flexibility. None of these studies made clear attempts to relate changes in flexibility to overall disability. No studies were identified which examined the effect of pre-existing patient condition on the potential for improvement. Flexibility was rarely assessed systematically by studies, and was not clearly linked with overall activity restriction.

Balance
Fifteen trials assessed balance as an outcome measure (Au-Yeung 2002; Baum 2003; Bautmans 2005; Bruyere 2005; Choi 2005; Clark 1975; Lazowski 1999; MacRitchie 2001; Morris 1999; Sauvage 1992; Schoenfelder 2004; Silhoven 2004; Tappen 1994; Urbach 2001). Most (12 trials) report successfully benefiting their participants’ balance. Successful interventions included ‘Mobility exercise’ (Au-Yeung 2002), ‘Whole body vibration’ (Bruyere 2005), and a force platform (Silhoven 2004). However, one study (Urbach 2001) was unable to demonstrate any effect of their Swiss ball exercise programme on balance. They suggested this was due to initial balance ability, with participants in poorer health unable to improve. One study (Choi 2005) found that balance improved significantly in both the Tai Chi and ‘usual care’ control group, meaning there was no significant difference between them. Two studies indicate a potential for harm in this population: one (Morris 1999) found their intervention led to poorer balance outcomes, while the other (Mulrow 1994) found the intervention group suffered more serious falls. Long-term sustainability was rarely investigated.

General physical condition
‘Physical condition’ includes reported outcomes that are not covered elsewhere, including standardised health scales, cardiac factors, activity level and weight (Alessi 1999; Baum 2003; Brown 2004; Bruyere 2005; Choi 2005; Clark 1975; Faber 2006; Fiatarone 1994; Gillies 1999; Lazowski 1999; Stamford 1972). Significant benefits were reported for blood pressure and heart rate (Clark 1975; Stamford 1972), intentional weight loss (Fiatarone 1994; Gillies 1999), and in scores on standardised health questionnaires (Baum 2003; Bruyere 2005; Faber 2006). Two trials found that physical activity increased among both intervention and control participants during the intervention period (Clark 1975; Schnelle 1996).

Mood and cognitive status
Mood or agitation was assessed by 16 studies (Alessi 1999; Brill 1998; Bruyere 2005; Buettner 1997; Choi 2005; Karl 1982; Kinion 1993; MacRitchie 2001; McMurdo 1994; Mihalko 1996; Morris 1999; Mulrow 1994; Ouslander 2005; Pomeroy 1993; Schoenfelder 2000; Stevens 2006). Cognitive performance was assessed by eight studies (Baum 2003; Buettner 1997; McMurdo 1994; Mulrow 1994; Pomeroy 1993; Przybylski 1996; Schoenfelder 2000; Stevens 2006). Mood related benefits included increased socialisation (Bruyere 2005; Karl 1982; Kinion 1993; Stevens 2006), reduced agitation (Alessi 1999), and reduced fear of falling (Choi 2005; Schoenfelder 2000). Significant benefits to cognitive performance were also identified (Baum 2003; Przybylski 1996; Stevens 2006). However, two trials reported improvements in all groups, suggesting that changes may not be due to the intervention (McMurdo 1993; McMurdo 1994). Pre-existing mental and cognitive state were proposed by some authors as an explanation of their findings. For example, one study (Mulrow 1994) suggested that greater baseline depression (among other factors) was related to greater improvement in response to physical therapy due to a process of regression to the mean. Conversely, another study (Ouslander 2005) reported that those who responded to their intervention were significantly less likely to be on antidepressant medication (P = 0.03).

Efforts to increase intervention compliance
Four trials investigated different ways of maximising compliance and/or the amount of exercise a participant takes. Two studies (Riccio 1990; Yoder 1989) found mental imagery promoted more exercise than rote repetitions (P < 0.05). However, two other studies (DeKuiper 1993; Lang 1992) found that participants exercised more when engaged in activity with a real object compared to an imaginary one. This suggests that asking participants to work with an actual object is an effective way of enhancing exercise quantity where rote repetition is required. Similarly, including a conversation element in walking exercise improved compliance (Tappen 1994; Tappen 2000), serving to prevent the physical decline observed in the conversation-only and walk-only groups. Perceived irrelevance of the intervention to participants’ lives was argued to be the key cause of lack of success by one study (Karl 1982), who proposed individualised interventions might have been more effective; ensuring that any intervention is perceived as relevant and important by participants may be crucial to its success.

Adverse events
Very few studies reported adverse events that were directly attributable to their intervention. Many reported morbidity and mortality for their participants over the duration of their trials, but...
one should expect morbidity and mortality among this population owing to their age and often poor physical condition causality is difficult to establish. The studies assessing whole body vibration do report some adverse events. Among one study (Bautmans 2005) reports one participant developing a phobia of the treatment room. Other adverse events included: one case of groin pain (Bautmans 2005), and two cases of lower limb tingling (Bruyere 2003). Among other intervention types, few reported any problems. One of the only other studies to report adverse events was in the study by Rosendahl et al (191 participants) of high intensity functional exercise and nutritional supplementation (Rosendahl 2006). They reported that adverse events occurred in 9% of 1906 sessions. Of these, only two were classified as major, one case of chest pain and another of loss of balance, neither of which led to manifest injury or disease.

**Morbidity and mortality**

Neither morbidity nor mortality were routinely reported. It should also be remembered that many trials included very frail elderly individuals, among whom relatively high rates of morbidity and mortality would be expected. The length of intervention also varied considerably between trials. Deaths were reported during the intervention period (Buettner 1997, 12 participants; Faber 2006, six participants; Rosendahl 2006, two participants; Sackley 2006, 10 participants). Hospitalisation or Illness were also reported (Bautmans 2005, three participants; Bruyere 2005, two participants; Buettner 1997, two participants; Faber 2006, seven participants).

**High quality trials**

To better investigate associations between intervention types, participants and outcomes, we reviewed the higher quality trials in which concealment of allocation was judged to be clearly adequate according to standard Cochrane procedure, and where outcome assessment was clearly carried out by fully blinded assessors. Six trials fitted this criteria (Baum 2003; Faber 2006; Mulrow 1994; Ouslander 2005; Rosendahl 2006; Sackley 2006). One trial (Faber 2006) concluded that both a Tai Chi-based and a mobility-based exercise programme reduced falling and improved physical performance only in non-frail participants. One study (Mulrow 1994) found that one-to-one physical therapy led to modest improvements in mobility among very frail participants. Similarly, another study (Ouslander 2005) found that FIT led to many physical benefits and reduced disability among dependent nursing home residents. Another study (Rosendahl 2006) also reports success with highly dependent participants, reporting that their high-intensity functional exercise programme delivered to individuals improved various indicators of physical condition. Finally, one study (Sackley 2006) found that occupational therapy prevented deterioration in ADL ability among stroke survivors in long-term care. Even in this small group, the variety of interventions and outcome measures meant a meta-analysis was not possible.

This much smaller group of studies seems to indicate that while a group exercise programme is successful with more physically able participants, those who are frail require individual attention for success.

**DISCUSSION**

The present studies provide evidence to suggest that several different physical rehabilitation interventions are associated with statistically significant improvements in various measures of physical and mental state. Isolation of the best studies suggests that frail participants may benefit from individualised interventions, while group interventions are successful for the less disabled. Many studies concluded that their intervention was both successful and safe, achieving their study goals. There seems to be sufficient evidence here to conclude that it is worthwhile providing physical rehabilitation to elderly people in long-term care. However, while there are successful interventions, they require replication and direct comparison. At present there is no clear indication of the optimum type of intervention.

Considerable literature was identified by this systematic review, providing confidence in our search strategy and indicating the wealth of innovative research. The 49 included studies included 3611 participants. Identification of this volume of literature created its own problems. The included studies present an almost overwhelming number of different interventions, ranging from traditional exercise programmes to those requiring access to machinery and the huge variety of outcome measures used precluded a meta-analysis. We have summarised the results around the predefined primary and secondary outcome measures for this review; however, the large number of studies and outcomes measures used are a potential source of bias both from the original studies where the authors may emphasise the particular outcomes they wish to present and in our narrative summation of these studies. Compliance and attrition due to poor health were confounding factors in many of the trials.

Extracting the six highest quality trials provided useful insight, in particular that individualised programmes for very dependent frail participants were successful, producing physical benefits and most importantly, reducing disability. However, the small number of trials reaching this standard makes it difficult to draw firm conclusions. Based on these studies, it seems reasonable to hypothesise that traditional regular group exercise interventions will be successful with less frail participants, but frail dependent participants will only benefit from frequent intensive individual sessions.

**Disability**
Many studies did not clearly link their findings with changes of clear clinical interest, in particular, reduction in disability. The supposition that physical rehabilitation interventions reduce disability still awaits emphatic empirical support.

**Quality of life**

Some trials were able to demonstrate that their intervention had a beneficial effect on their participants’ mental health and cognitive state. Such changes inevitably boost quality of life, with all of the benefits that entails, which would in turn, further justify the provision of interventions. Furthermore, these changes are likely to encourage and sustain enthusiasm for the programme among participants, perhaps engendering long-term success. Future research should aim to quantify the impact rehabilitation programmes have on measures of quality of life.

**Trial diversity**

It was disappointing that the huge variety of outcome measures used precluded a comprehensive meta-analysis. While creative variation in interventions is desirable for promoting innovation, the extent of the diversity among these trials, in both interventions and in the sheer number of outcome measures used, is highly problematic. A particular obstacle is the small number of trials constituting some sort of replication of previous work. Where replications have occurred, most often they were carried out by the same research group and in the same location.

**Trial quality**

While only two trials were judged to be of inadequate quality, the quality of the vast majority of included trials was unclear. Only six trials reached the highest standard. The lack of high quality research in this field is a serious problem, limiting both the strength and the usefulness of any conclusions drawn from their findings.

**Dominance of North American research**

Of the 49 included studies, 35 took place in North America. This may be problematic if there are large differences in the nature of long-term care in North America, or in the characteristics, such as age and physical condition, of the people who receive it when compared to Europe or the rest of the world. As a consequence there is a risk that the present findings may be difficult to apply to long-term care settings elsewhere. We have described the characteristics of the participants and the interventions. The interventions may be applicable to this frail elderly client group regardless of location of care, but this hypothesis remains to be tested.

**Participant representativeness**

The extent to which the participants in the present trials are representative of the wider population residing in long-term care is unclear. This is likely to present more of a problem where sample sizes were small or participant attrition was high, or both. It is notable that where studies did report the number of eligible individuals within the facility they used, on average they excluded more than half of its residents. This might suggest the present participant sample is not representative of the wider long-term care population.

**Participant variation**

There is huge variation in the physical condition and mental state of people aged over 65 in long-term care. It is improbable that the same intervention will be appropriate for all people. However, future research might perhaps be directed at the conclusions drawn from the high quality trials: some sort of individualised high intensity and frequent intervention for more dependent people; and more traditional, social group exercise sessions for more able residents.

**Participant compliance**

High levels of participant attrition and poor compliance with the intervention’s demands were a fairly frequent problem among these trials. This is understandable; many participants would be unused to activity and physically frail making them vulnerable to illness and limiting their life expectancy. Even where participants did not completely leave the trial, many researchers reported reluctance to comply with intervention demands, and felt this apathy adversely affected the trial. While it is impossible to prevent attrition through illness and death, it should be possible to improve motivation among participants to comply with interventions; enjoyment of, and satisfaction with the intervention among participants should be a priority, especially if long-term and widespread provision is ultimately intended. Ways of achieving this might include ensuring that participants perceive the intervention to be both relevant to their lives and beneficial to them. Many trials have included social elements in both the intervention and as a control group; the relationship between use of such methods and compliance requires further exploration. Another method may be incorporating the therapy into daily activities as opposed to discreet sessions, as investigated in the FIT trials, is also worthy of much closer attention.

**Long-term follow up**

The lack of post-intervention follow up is problematic. Among the 12 trials that did follow participants after the intervention (for a

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maximum of one year, most often three months), it was frequently found that intervention benefits were not sustained after the programme ended. It is hard to justify provision of any short-term rehabilitation intervention if any benefits the individual gains dissipate as soon as it ends. However, if benefits are sustained while the intervention remains in place, the economic and practical viability of long-term or indefinite provision need to be assessed. Future research should follow participants for a reasonable period after the intervention has ended to clarify the durability of improvements, and whether some participants require some type of long-term maintenance. If this is the case, interventions should be designed with long-term provision as a clear consideration.

**Economics**

The economic case for rehabilitation is yet to be convincingly made. Conceptually it seems reasonable: improving physical condition should reduce ill health, reducing the burden of the individual on health care, reducing the need for hospital treatment and increasingly intensive personal care. Evidence for this would have to demonstrate that the absolute cost of the intervention is less than the amount the individual would cost if they remained in the same condition, or if they deteriorated. Due to the variation between individuals in the amount of resources they use, large trials will be required support economic arguments. Widespread provision of interventions, however effective they are in practical terms, will only occur once it has been convincingly demonstrated that they are economically viable.

Research conducted among the long-term care population may also be informative and applicable to similarly frail elderly people residing in the community. While none of the present trials investigated this, it is reasonable to include it in future research.

**Authors’ Conclusions**

**Implications for practice**

The included studies provide evidence that physical rehabilitation interventions for elderly people residing in long-term care can be both safe and successful, improving both physical and mental state. However the size and duration of the effects of physical rehabilitation interventions is unclear.

**Implications for research**

Further research is needed to establish the sustainability of any improvements, to demonstrate the effect of interventions on quality of life and caregiver satisfaction, to optimise interventions, to establish how individual differences (for example age, gender, frailty, mental state) may affect treatment outcomes, and whether different interventions should be applied to disability-based subgroups. The provision of rehabilitation services to this client group requires robust health economic evaluation. We have described the characteristics of the participants and the interventions. The interventions may be applicable to this frail elderly client group regardless of location of care but this hypothesis requires testing in future research.

**Acknowledgements**

The review authors would like to thank the Physiotherapy Research Foundation for providing the funding for this review. Thanks to Brenda Thomas and Hazel Fraser from the Cochrane Stroke Group and Pat Spoor and Rosemary Campbell-Blair, University of Leeds, for assistance with developing the search strategy and undertaking searches.

**References**

References to studies included in this review

- Alessi 1999 (published data only)

- Au-Yeung 2002 (published data only)

- Baum 2003 (published data only)

- Bautmans 2005 (published data only)

- Brill 1998 (published data only)

- Brown 2004 (published data only)
Karl 1982 [published data only]

Kinjon 1993 [published data only]

Lang 1992 [published data only]

Lazowski 1999 [published data only]

MacRitchie 2001 [unpublished data only]
MacRitchie RF. Reducing the incidence of falls among nursing home residents: an evaluation of an ameliorative program. MSc Thesis 2001.

McMurdo 1993 [published data only]

McMurdo 1994 [published data only]

Meuleman 2000 [published data only]

Mihalko 1996 [published data only]

Morris 1999 [published data only]

Mulrow 1994 [published data only]

Naso 1990 [published data only]

Ousland 2005 [published data only]
References to studies excluded from this review

Alessi 1995b [published data only]

Alexander 2001 [published data only]

Backman 1986 [published data only]

Becker 2003 [published data only]

Binder 1995 [published data only]
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References to studies awaiting assessment

O'Hagan 1994 {published data only}

Ray 1997 {published data only}

Remsburg 1999 {published data only}

Rydwik 2004 {published data only}

Sherrington 1997 {published data only}

Shimada 2003 {published data only}


Shumway-Cook 1997 {published data only}

Stasi 2004 {published data only}

Steffen 1995 {published data only}

Stones 1993 {published data only}

Tan 2004 {published data only}

Van Heugten 2000 {published data only}

Wolf 2001 {published data only}

Yip 2004 {published data only}

Copyright © 2009 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
References to ongoing studies

Frandin 2007  [published data only]

Grant 2007  [published data only]

Underwood 2007  [published data only]

Additional references

Cameron 2005

DoH 2001

Gillespie 2003

Higgins 2008

RevMan 2008

Sahayoun 2001

Ward 2003

WHO 1998

* Indicates the major publication for the study
Characteristics of included studies  [ordered by study ID]

Alessi 1999

Methods

Design: randomised controlled trial
Duration: 14 weeks
Method of randomisation: not described
Concealment of allocation: unclear
Outcome assessor blinding: unclear
Group comparability at entry: yes, no significant differences P > 0.05
Losses to follow up: none

Participants

Country: USA
Setting: Community nursing home
Randomised = 29
% Female = 90
Age: mean: 88.3 5.7 years, range: not reported
Consent: assent accepted
Inclusion criteria: urinary incontinence
Exclusion criteria: cognitive: comatose, severe physical aggression; medical: life expectancy < 3 months Length of stay < 3 months
% Eligible within home: 49.6
% Eligible that participate: 45.3
Intervention: N = 15; % female = 92.9; age (mean): 88.6 years 10.4
Control: N = 14; % female = 92.9; age (mean): 88.3 years 5.7

Interventions

Study aim or objective: to test whether an intervention combining increased daytime physical activity with improvement in the night-time environment improves sleep and decreases agitation in nursing home residents
Intervention group: Functional Incidental Training programme, individualised intervention, session duration: n/a, number of sessions per week: maximum of 20
Exercise features: upper limb and lower limb exercises, walking/wheelchair propulsion delivered by research personnel twice hourly up to a maximum of 4 sessions per day, 5 days a week for 14 weeks
Non-exercise features: night-time program commenced in 14th week for 5 nights, reduction of noise, reducing sleep-disruptive nursing care practices, night-time incontinence care
Control group: usual care for 14 weeks, then 1 week of night-time programme

Outcomes

Function: mobility (maximum distance walked/wheeled in 10 minutes), activity levels (K/cal per hour)
Co-morbidity: cumulative Illness Rating Scale (CIRS-G)
Other: daytime sleeping/ agitation, night-time sleep (wrist actigraphy, Observational Sleep Assessment Index), cognition (MMSE)
Key findings: no effect on physical function, significantly more night time sleep in the intervention group (P = 0.045), significantly less day time sleep in the intervention group (P = 0.029)
### Notes

Funding: not reported

### Risk of bias

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors' judgement</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
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</tbody>
</table>

### Au-Yeung 2002

#### Methods

- **Design:** randomised, assessor blind trial, matched pairs
- **Duration:** 18 sessions over 2 months, 3 month follow up
- **Method of randomisation:** drawing lots - matched according to age, sex, ambulatory status, medical history, length in home, each pair randomly allocated to control or intervention by physiotherapist not involved in the exercise programme by drawing lots
- **Concealment of allocation:** assessors blinded to allocation of participants
- **Intra and inter-rater reliability established before study**
- **Group comparability at entry:** yes, no significant differences P > 0.05
- **Losses to follow up:** 31 consented, 13 dropped out due to lack of interest, medical problems or personal reasons

#### Participants

- **Country:** Hong Kong
- **Setting:** 3 private old age homes
- **Randomised = 31**
- **% Female = 78**
- **Age:** mean: approximately 80 years, range: not reported
- **Consent:** fully informed consent
- **Inclusion criteria:** able to understand and follow verbal instructions, ambulate independently (with or without aids), tolerate standing and walking for at least 5 minutes
- **Exclusion criteria:** medical: acute musculoskeletal pain, neurological signs and symptoms not under medication control, unstable medical conditions, complaint of dizziness and blurred vision leading to difficulty walking, medical conditions contraindicative to physical activity
- **% Eligible within home:** not reported
- **% Eligible that participate:** not reported
- **Intervention:**
  - **N = baseline not reported**
  - **% Female = not reported**
  - **Age:** mean: 79.1 years 8.41
- **Control:**
  - **N = baseline not reported**
  - **% Female = not reported**
  - **Age:** mean: 81.0 years 7.45
**Interventions**

<table>
<thead>
<tr>
<th>Study aim or objective: To examine the effects of a short-term mobility programme on the balance and mobility of elderly residents of private old age homes in Hong Kong.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of experimental groups: 2</td>
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<tr>
<td>Groups: 2 exercise programmes</td>
</tr>
<tr>
<td>Group intervention delivery</td>
</tr>
<tr>
<td>Session duration: 45 minutes</td>
</tr>
<tr>
<td>Number of sessions per week: 3; 18 sessions over 2 months conducted in the home conducted by qualified physiotherapist or two students</td>
</tr>
<tr>
<td>Intervention: M programme (N = 10): lower limb strengthening and balance training based on the overloading principle for strengthening and specificity for challenging balance in the upright position</td>
</tr>
<tr>
<td>Control: C programme (N = 8): general light exercises performed while sitting without progression</td>
</tr>
<tr>
<td>Training session adherence: 98%</td>
</tr>
<tr>
<td>Mobility: 17.2 ± 1.4</td>
</tr>
<tr>
<td>Control: 18 ± 1.07 of 18 sessions</td>
</tr>
</tbody>
</table>

**Outcomes**

<table>
<thead>
<tr>
<th>Baseline: age, gender, medical history, ambulatory status, length of time in the home, modified abbreviated mental test (AMT).</th>
</tr>
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<tbody>
<tr>
<td>Baseline measures: participants given practice trial prior to baseline measurement</td>
</tr>
<tr>
<td>All participants had balance and mobility assessments in two sessions one to two weeks apart before the start of the programme to determine repeatability of performance, the second session 3 to 5 days before beginning of programme</td>
</tr>
<tr>
<td>4 metre walk test (4MW)</td>
</tr>
<tr>
<td>Timed up and go (TUG) test</td>
</tr>
<tr>
<td>Berg balance scale (BBS)</td>
</tr>
<tr>
<td>Interim assessment: participants mobility and balance assessed 3 to 4 weeks after the beginning of the programme</td>
</tr>
<tr>
<td>End-programme assessment: within one week of the end</td>
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<tr>
<td>Follow-up assessment: 3 months after the programme ended</td>
</tr>
<tr>
<td>Intention-to-treat analyses: no</td>
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<tr>
<td>Attrition:</td>
</tr>
<tr>
<td>N = 13 (of 44)</td>
</tr>
<tr>
<td>% = 41.9</td>
</tr>
<tr>
<td>Compliance:</td>
</tr>
<tr>
<td>Intervention: 95.6%</td>
</tr>
<tr>
<td>Control: 100%</td>
</tr>
<tr>
<td>Key findings:</td>
</tr>
<tr>
<td>(1) M programme did not significantly improve mobility and balance</td>
</tr>
<tr>
<td>(2) For both groups the 4MW and TUG tests did not change from baseline</td>
</tr>
<tr>
<td>(3) Only the control group showed significant decrease in the BBS at the end of the programme</td>
</tr>
<tr>
<td>(4) M group maintained their performance for 3 months after the intervention.</td>
</tr>
<tr>
<td>Adverse events: none reported</td>
</tr>
</tbody>
</table>

**Notes**

<table>
<thead>
<tr>
<th>Funding: not reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot study</td>
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</table>
### Risk of bias

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors’ judgement</th>
<th>Description</th>
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<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
</tr>
</tbody>
</table>

### Baum 2003

#### Methods
- **Design:** randomised controlled semi-cross-over trial
- **Duration:** 12 months (control group joined exercise group at 6 months)
- **Method of randomisation:** after baseline assessments, randomisation was determined by computer-generated algorithm stratified by place of residence (nursing home or assisted living)
- **Concealment of allocation:** unclear - all patients had been promised they would receive the intervention eventually
- **Outcome assessor blinding:** yes - all performance tests carried out by occupational therapists and physiotherapists blinded to allocation
- **Group comparability at entry:** yes, no significant differences P > 0.05
- **Losses to follow up:** 2 patients non-compliant with their assignment - one switched to exercise immediately and another assigned to exercise refused to attend - some analyses included them, 13% missing measurements

#### Participants
- **Country:** USA
- **Setting:** 50 bed long-term care facility comprising 32 nursing home beds and 18 assisted living beds
- **Randomised:** 21
  - 21 met criteria and 20 consented (5 from nursing home, 15 from assisted living)
  - % Female = 75
  - Age: mean = 88 years, range = 75 to 99 years
  - Consent: not specified
  - Inclusion criteria: age > 65, residence at facility > 3 months, ability to ambulate alone (included with assistive devices or carer).
  - Exclusion criteria: cognitive: inability to follow 2-step command; medical: acute unstable illness (e.g. pneumonia); chronic illness (e.g. uncompensated congestive heart failure); functional: assaultive behaviour pattern, unwillingness to discontinue current physical therapy
  - % Eligible within home: 42
  - % Eligible that participate: 95.2
- **Intervention:**
  - N = 11
  - % Female = 82
  - Age: mean = 88 years, range = 75 to 96 years
- **Control:**
  - N = 9
  - % Female = 67
  - Age: mean = 88 years, range = 78 to 99 years
Interventions

Study aim or objective: to determine whether a strength and flexibility programme in frail long-term care facility (LTC) residents would result in improved function.

Number of experimental groups: 2

Group intervention delivery

Session duration: 60 minutes

Number of sessions per week: 3

Seated: yes

Attendance records kept.

Intervention: conducted by exercise physiologist in the lounge, exercises done in seated position (frailty), warm-up; upper body strengthening; lower-body strengthening; cool down, soft ankle and wrist weights (2 to 4 lbs), therabands (resistance 2.5 to 9 lbs), weighted hand-sized balls, beach balls for kicking and throwing, weekly evaluations of progress.

Control: art therapist or social worker, sessions of drawing, painting, puzzles or cards, encouraged to continue normal activities, discouraged from joining exercise regime during the intervention.

Outcomes

Baseline: all tests below and the Functional independence measure (FIM) was administered only at baseline, Folstein mini-mental status exam (MMSE), Timed up and go (TUG) test, Berg balance scale (BBS), Physical performance test (PPT).

Functional outcomes measured at 3, 6, 9 and 12 months.

Intention-to-treat analyses: yes.

Attrition:

N = 2

% = 10

Compliance: 2 patients non-compliant with their assignment - one switched to exercise immediately and another assigned to exercise refused to attend - some analyses included them.

Intervention: 80% attendance.

Control: 56% attendance.

13% missing measurements.

Key findings:

(1) Significant impact on all 4 measures of the exercise intervention (P = 0.013):

(2) Reduction in TUG test of 18 seconds

(3) Increase in PPT of 1.3

(4) Increase in Berg of 4.8

(5) Increase in MMSE by 3.1

Frail elderly people were able to participate in and benefit from a strength-training programme.

Adverse events: none reported.

Notes

Funding: not reported.

Risk of bias

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
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</table>

[Continued]
**Bautmans 2005**

### Methods

<table>
<thead>
<tr>
<th>Design</th>
<th>randomised controlled trial</th>
</tr>
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<tbody>
<tr>
<td>Duration</td>
<td>6 week intervention</td>
</tr>
<tr>
<td>Follow up</td>
<td>none</td>
</tr>
<tr>
<td>Method of randomisation</td>
<td>done by lottery at the same time, stratification was applied for gender, ADL dependence, age</td>
</tr>
<tr>
<td>Concealment of allocation</td>
<td>yes - participants in the control group thought they were also receiving the vibration treatment</td>
</tr>
<tr>
<td>Outcome assessor blinding</td>
<td>yes - all functional assessments done by assessors blind to allocation</td>
</tr>
<tr>
<td>Group comparability at entry</td>
<td>yes, no significant differences P &gt; 0.05</td>
</tr>
<tr>
<td>Losses to follow up</td>
<td>3 (13%)</td>
</tr>
</tbody>
</table>

### Participants

| Country | Belgium |
| Setting | nursing home with capacity 102 beds |
| Randomised | 24 |
| % Female | 63 |
| Age | mean: 77.5 years 11.0, range: not given |
| Consent | informed consent |
| Inclusion criteria | dependent in no more than 2 of 6 ADL categories (Katz Scale). |
| Exclusion criteria | cognitive: cognitive dysfunction interfering with test and training procedures; medical: presence of infectious disease, insulin dependent diabetes mellitus, endogenous osteosynthetic material, knee or hip prosthesis, pacemaker, epilepsy, musculoskeletal disorders |
| % Eligible within home | 33.7 |
| % Eligible that participate | 72.7 |
| Intervention: |
| N | 13 |
| Male:female ratio | 5:8 |
| Age | mean: 76.6 years 11.8 |
| Control: |
| N | 11 |
| Male:female ratio | 4:7 |
| Age | mean: 78.6 years 10.4 |

### Interventions

| Study aim or objective | to investigate the feasibility of whole body vibration in the institutionalised elderly and its impact on functional capacity and muscle performance |
| Number of experimental groups | 2 |
| Individualised intervention delivery | |
| Session duration | not reported |
| Number of sessions per week | 3 |
| Seated | no |
| Both groups attended 2-weekly seated gymnastic sessions together with other residents of the nursing home organised by independent physical therapists unaware of the participants group |
| Targeted social interaction | |
| Intervention: | Used Power-plate vibration platform, sessions 3 times a week with at least one day of rest between, 6 static exercises targeting lower limb muscles, exercise volume and intensity gradually increased |
| Control: | the same exercise regimen on the same vibration platform but machine switched off, sound produced by tape recorder |
### Outcomes

Baseline: height, weight, BMI, muscle mass, number of diagnoses, medications, etc.
Outcome: Timed up and go (TUG) test, Tinetti Test, Back scratch and chair sit and reach test, grip strength (Martin Vigorimeter device), closed chain bilateral leg extension - Aristokin, a linear isokinetic multi joint dynameter
Intention-to-treat analyses: yes
Attrition:
N = 3
% = 12.5
Compliance:
Intervention: 86%
Control: 96%
Key findings:
1. WBV beneficial to balance and mobility: supplementary benefit on muscle performance
2. WBV TUG better (P = 0.029)
3. WBV Tinetti better (P = 0.002)
Adverse events:
1. groin pain
2. 1 was afraid to continue
3. 1 airway infection - bed rest

### Notes

Funding: not reported, were given the loan of the vibration platform by ‘Power-Plate Belgium’

### Risk of bias

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors’ judgement</th>
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<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
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</tbody>
</table>

### Brill 1998

#### Methods

Design: randomised controlled trial
Duration: 8 weeks
Follow up: none
Method of randomisation: random numbers table
Concealment of allocation: unclear
Outcome assessor blinding: unclear
Group comparability at entry: yes, no significant differences P > 0.05
Losses to follow up: none

#### Participants

Country: USA
Setting: integrated health services of Dallas multi-level assisted living facility
Randomised = 16
% Female = 87
Age: 25% older than 90 years, mean: approximately 82 years, range: 69 to 96
Consent: fully informed consent
| Inclusion criteria: residential status, > 65 years old, ambulatory (assistive device) |
| Exclusion criteria: medical: history of heart attack/stroke within previous 6 months, unstable angina, any condition which the physician felt might be worsened by exercise |
| % Eligible within home: not reported |
| % Eligible that participate: not reported |
| Training group 1: N = 8 |
| Mean age: 84 years 9.6, range 71 to 96 years |
| 6 females: 2 males |
| Training group 2: N = 8 |
| Mean age: 80 years 6.6, range: 69 to 90 years |
| All female |

### Interventions

**Study aim or objective:** evaluate the effect of an 8 week progressive functional fitness strength programme using dumbbells and ankle weights on strength, functional capability, balance, and selected psychological variables in residents of an assisted living facility

**Number of experimental groups:** 2

**Group intervention delivery**

- **Session duration:** 30 minutes
- **Number of sessions per week:** 3
- **Seated:** unclear

**Intervention:** both groups followed the same exercise routine, only the weights varied (see notes), the exercise routine comprised 5 upper and 5 lower body strengthening exercises targeting the major muscle groups, using different weights of dumbbells as resistance, cadence exercises wearing ankle weights were also performed, a gerontologist specialising in exercise training for older adults led the exercise sessions which included all of the participants in one large group (see notes)

**Training group 1:** the dumbbell and ankle weights, and number of exercise repetitions, were gradually increased over the course of the study

**(Control) Training group 2:** used 1 lb dumbbells throughout the study, and cadence exercises were performed wearing ankle straps without the addition of weights

### Outcomes

**Function:** general (5 point scale), plus each ADL was broken down into specific functional performance tests - timed chair stand, 6 metre walk, number of steps required to walk 6 metres, stair climbing test

**Muscle power:** upper body (Cybex seated chest press machine), lower body (Cybex leg extension machine), isometric hand grip strength (both dominant and non-dominant - dynamometer)

**Balance:** 3 stances (parallel, semi-tandem, tandem, x maximum of 10 seconds)

**Mood:** depression (Beck Depression Inventory), trait anxiety (State Trait Anxiety Inventory)

**Falls data:** falls history in previous year, number of falls, falls-related injuries, fear of falling, incidence of near-falls.

**Intention-to-treat analyses:** no

**Attrition:** none

N = 0

% = 0

**Compliance:**

- **Intervention:** not reported
- **Control:** not reported
Key findings:

(1) Improvement in functional performance measures was related to gains in muscular strength in the intervention group.

(2) The control group (which also exercised but not with progressively increasing resistance) also showed improvements in functional performance but not gains in strength.

(3) Participants in this study fell within age-group norms for depression and anxiety.

(4) There was a significant reduction in depression symptoms in the intervention group with no changes in the control group.

Notes

Funding: University of North Texas Research and Professional Development Grant

An issue arose when the participants refused to serve as controls, all wanted to participate in the strength-training programme.

In addition to this, the facility would only permit use of one time period and one room.

The investigators resolved these issues by combining the two treatment groups together.

Cross-over was prevented by the exercise leader handing out the appropriate weights to each participant.

Risk of bias

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<tr>
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<th>Authors’ judgement</th>
<th>Description</th>
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<tbody>
<tr>
<td>Allocation concealment?</td>
<td>No</td>
<td>C - Inadequate</td>
</tr>
</tbody>
</table>

Brown 2004

Methods

Design: Cluster randomised controlled trial.

Duration: 9 weeks; 2 week baseline, 5 week intervention for experimental group 1 followed by 2 week intervention for experimental group 2.

Follow up: none.

Method of randomisation: coin toss.

Concealment of allocation: unclear.

Outcome assessor blinding: unclear - pretest and post-test data collected by the same person for consistency.

Group comparability at entry: yes, no significant differences P > 0.05.

Losses to follow up: none reported for phase one, of group B, 21 did not enter the second phase.

Participants

Country: USA.

Setting: 2 rural public nursing homes, home A was 98 beds; home B had 100.

Randomised = 66.

% Female = 82.

Age: mean: approximately 82 years, range: 60 to 96 years.

Consent: assent accepted.

Inclusion criteria: their current health status did not preclude participation, aged ≥ 60, could speak and understand English, could cognitively comprehend and answer questions, could communicate verbally or in writing, were willing to participate in indoor gardening activities for 6 weeks.

Exclusion criteria: see inclusion criteria.
Brown 2004  *(Continued)*

<table>
<thead>
<tr>
<th>% Eligible within home: not reported</th>
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</thead>
<tbody>
<tr>
<td>% Eligible that participate: not reported</td>
</tr>
<tr>
<td>Experimental group 1: N = 33, males = 6</td>
</tr>
<tr>
<td>Experimental group 2: N = 33, males = 6</td>
</tr>
<tr>
<td>Experimental group 3: N = 12, males = 6</td>
</tr>
</tbody>
</table>

### Interventions

- **Study aim or objective:** The effects of indoor gardening on socialisation, activities of daily living and perceptions of loneliness.
- **Number of experimental groups:** 3
- **Group intervention delivery:**
  - **Session duration:** 20 minutes
  - **Number of sessions per week:** 2
- **Seated:** Yes
- **Phase 1:** Residents of home A comprised experimental group 1 and participated in an indoor gardening project once a week for 5 weeks; home B was the control group and received 20 minute visits over the same 5 week period.
- **Phase 2:** Residents of home B became experimental group 2 and participated in indoor gardening twice a week for 2 weeks.
- **Intervention:** Decorating flowerpots and planting bulbs of their choice, choosing and transplanting colorful flowering plants, discussing proper care of plants, viewing video on gardening, arranging plants in a hanging basket, arranging fresh cut flowers and greenery.
- **Control:** 20 minute visits during the 5 week intervention period to control for social interaction and changes due to the presence of experimenters, control group then invited to participate in the gardening (phase 2).

### Outcomes

- **Measures:** Collected at baseline (2 week period where consent etc were obtained) and at post-intervention.
- **Demographic data sheet, UCLA loneliness scale (version 3), revised social provisions scale, minimum data sheet for ADLs (minimum data set physical functioning scale).**
- **Intention-to-treat analyses:** No
- **Attrition:** N = 0
- **Compliance:**
  - Intervention: not reported
  - Control: not reported
- **Key findings:**
  1. No significant differences found between groups in socialisation or perception of loneliness.
  2. Significant pretest-posttest differences within groups on loneliness and guidance, reassurance of worth, social integration and reliable alliance.
  3. Gardening had a significant effect on 3 ADLs: transfer, eating and toileting.
  4. The 5 week programme was more effective in increasing socialisation and physical functioning.

### Adverse events

- None reported.

### Notes

- **Funding:** Not reported.
Brown 2004  (Continued)

Risk of bias

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
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Bruunsgaard 2004

Methods

<table>
<thead>
<tr>
<th>Design: randomised controlled trial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration: 12 weeks</td>
</tr>
<tr>
<td>Follow up: none</td>
</tr>
<tr>
<td>Method of randomisation: not specified</td>
</tr>
<tr>
<td>Concealment of allocation: not specified</td>
</tr>
<tr>
<td>Outcome assessor blinding: not specified</td>
</tr>
<tr>
<td>Group comparability at entry: yes, no significant differences P &gt; 0.05</td>
</tr>
<tr>
<td>Losses to follow up: 18 (46%)</td>
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</tbody>
</table>

Participants

<table>
<thead>
<tr>
<th>Country: Denmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting: nursing homes</td>
</tr>
<tr>
<td>Randomised = 39</td>
</tr>
<tr>
<td>% Female = 99</td>
</tr>
<tr>
<td>Age: mean: approximately 89 years, range: 85 to 95 years</td>
</tr>
<tr>
<td>Consent: not specified</td>
</tr>
<tr>
<td>Inclusion criteria: see exclusion criteria</td>
</tr>
<tr>
<td>Exclusion criteria: cognitive: moderate/severe cognitive impairment; medical: acute illness, hypertension, severe cardio-vascular disease, severe impairment of motor function, neurological disorder</td>
</tr>
<tr>
<td>% Eligible within home: not reported</td>
</tr>
<tr>
<td>% Eligible that participate: 53.8</td>
</tr>
<tr>
<td>Intervention:</td>
</tr>
<tr>
<td>N = 10</td>
</tr>
<tr>
<td>Male:female ratio 1:9</td>
</tr>
<tr>
<td>Age: 88.6 years (86 to 95 years)</td>
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<tr>
<td>Control:</td>
</tr>
<tr>
<td>N = 11</td>
</tr>
<tr>
<td>Male:female ratio 1:10</td>
</tr>
<tr>
<td>Age: 90.6 years (86 to 95 years)</td>
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Interventions

| Study aim or objective: to test the hypothesis that physical exercise induces an antiinflammatory response that is associated with reduced chronic activation of the tumour necrosis factor (TNF)-alpha system in frail elders and that the increase in muscle strength after resistance training is limited by systemic low-grade inflammation |
| Number of experimental groups: 2 |
| Unclear whether intervention delivery was group or individual |
| Session duration: 45 minutes |
| Number of sessions per week: 3 |
Seated: yes  
3 exercise sessions a week for 12 weeks, low repetitions with high weight resistance, seated upright in training chair  
3 sets of 8 knee extensions  
Non-exercise features: sub-group of patients gave blood samples for examining inflammatory marker  
Control: occupational therapist supervised social activities twice a week for 12 weeks; no physical training

Outcomes

Measures: measured at baseline and at the end of the intervention  
Muscle strength (maximum amount that could be lifted), plasma levels of TNF-, soluble TNF receptor (sTNFR)-1  
Interleukin (IL)-6  
Intention-to-treat analyses: no  
Attrition:  
N = 18  
% = 46.2  
Compliance:  
Intervention: 84% (72 to 97%)  
Control: 97% (79 to 100%)  
Key findings:  
(1) sTNFR-I at baseline were inversely correlated with the increase in muscle strength.  
(2) Training programme improved muscle strength but did not affect plasma levels of TNF-a and sTNFR-I or IL-6.  
(3) Low grade TNF activation could limit the increase in muscle strength after resistance training in the oldest old.  
Adverse events: none reported

Notes

Funding: Danish Medical Research Council, and NOVO foundation

Risk of bias

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors' judgement</th>
<th>Description</th>
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<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
</tr>
</tbody>
</table>
| Methods | Design: randomised controlled trial  
Duration: 6 weeks  
Follow up: none  
Method of randomisation: not specified  
Concealment of allocation: unclear  
Outcome assessor blinding: unclear  
Group comparability at entry: no, significant group differences \( P < 0.05 \)  
Treatment group significantly older than control group \( (P = 0.03) \)  
Treatment group had significantly better TUG scores at baseline \( (P = 0.04) \)  
Losses to follow up: 6 (14%) |
|---|---|
| Participants | Country: Belgium  
Setting: nursing home in Liège, Belgium  
Randomised = 42  
\% Female = 73  
Age: mean: 81.9 ± 6.9 years, range: 63 to 98 years  
Consent: not specified  
Inclusion criteria: ambulatory, no major cognitive disorders that would effect their ability to complete questionnaires  
Exclusion criteria: medical: patients with a high risk or thromboembolism, history of hip or knee replacement  
\% Eligible within home: not reported  
\% Eligible that participate: 87.5  
Intervention: vibration therapy plus PT  
N = 22  
\% Female = 81  
Age: mean: 83.6 years ± 4.8 years  
Control: PT alone  
N = 20  
\% Female = 65  
Age: mean: 78.9 years ± 6.9 years |
| Interventions | Study aim or objective: to investigate the effects of whole body vibration in the elderly  
Number of experimental groups: 2  
Individual intervention delivery  
Session duration: 10 minutes  
Number of sessions per week: 3  
Seated: no  
Groups: randomised to receive vibration intervention plus a standard physical training regimen or physical training alone.  
Exercise features: intervention - controlled whole body vibration: at each session stood on vertical vibrating platform for 4 series of 1 minute of vibration alternating with 90 seconds rest, vibration set at 10 Hz for the first and third series with peak to peak amplitude of 3 mm, for second and fourth series, vibration set at 26 Hz with peak to peak 7 mm, blood pressure and pulse were taken before the first series, immediately after the second and fourth series, and 2 minutes after the fourth series in each session |
Physical therapy: standard exercise programme, gait and balance exercises, training in transfer skill, strengthening exercises with resistive mobilization of lower limbs, 3 times weekly for 10 minutes during the 6 week study, provided by only 1 physical therapist.

Outcomes

Measures: assessed at baseline and 6 weeks for all patients
Tinetti test, Timed up and Go test, quality of life measured using 9 subscales of the Medical Outcome Study 36-item Short-Form Health Survey (SF-36)

Attrition:
N = 6
% = 14
Compliance: not reported

Key findings:
1. Improvement in gait score in intervention group, no change in control group (P < 0.001)
2. Improvement in intervention group balance scores, deterioration in control group (P < 0.001)
3. Improvement in TUG scores of intervention group, control group deteriorated (P < 0.001)
4. Intervention group's SF-36 scores improved compared to control group (P < 0.001)

Adverse events: no serious events, 2 patients dropped out due to lower limb tingling, changes in blood pressure and heart beat during sessions were clinically insignificant.

Notes
Funding: not reported, no commercial party had any financial interests

Risk of bias

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<thead>
<tr>
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<th>Description</th>
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<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Yes</td>
<td>A - Adequate</td>
</tr>
</tbody>
</table>

Buettner 1997

Methods

Design: randomised controlled trial
Duration: 30 weeks
Method of randomisation: name draw
Concealment of allocation: unclear
Outcome assessor blinding: yes - evaluators blind to participant assignment
Group comparability at entry: yes, no significant differences P > 0.05
Losses to follow up: N = 14 (21%), 12 deaths, 2 became unstable on their medications, does not report which group(s) they were from

Participants

Country: USA
Setting: Nursing home
Randomised: N = 66
% Female = 88
Age: mean: 86.2 years, range: 54 to 100 years
MMSE score range: 0 to 19, mean score: 7.5
Buettner 1997  (Continued)

| Consent: assent accepted  
Inclusion criteria: diagnosis of dementia, family consent, stable on medications, resident in the home for 3 months  
Exclusion criteria: medical: use of Tacrine, a drug used in the treatment of Alzheimer's disease (centrally acting anticholinesterase)  
% Eligible within home: not reported  
% Eligible that participate: not reported |

| Interventions | Study aim or objective: to assess the impact of a highly structured interdisciplinary programme of sensorimotor activities on the function and behaviour of nursing home residents with dementia  
Number of experimental groups: 2  
Both small groups and personalised interventions  
Session duration: n/a  
Number of sessions per week: n/a  
Seated: unclear  
Intervention: first 10 week period: Intervention provided by certified therapeutic recreation specialists in collaboration with the unit managers; designed based on level of functioning, personal care schedule, and interests; small group activities among people of similar functioning; co-ordinated schedule of care established for the treatment group including all aspects of care and therapeutic programming; staff were encouraged to walk with residents, interact socially, and promote functional independence during activities; all intervention participants received therapeutic programming and diversional stimulatory activities throughout the day and evening; every aspect of the day considered programming and outcome-based - all sensory motor activities, no matter how mundane (e.g. hand washing, waking to meals); cooking, herb gardening, group cognitive therapy, fitness sessions, various sensory (water, relaxation activities); second 10-week period: home staff took over 50% of the programming; third 10 week period: nursing home staff took over all aspects of the programming  
Control: usual care: same schedule of regular nursing home activities and standard nursing care |

| Outcomes | Measures:  
Baseline, completed by nurse practitioner and therapeutic recreation students from outside facility  
Grip strength - hand dynometer, expressed in pounds of pressure  
Timed 50 feet walk  
Flexibility: modified Well's sit and reach test  
Cognitive status - mini mental status examination  
Depression - Geriatric depression scale  
Overall functioning (unit managers assessed) - Timed Manual Performance test (TMP) 'doors test' (Williams & Jones 1990)  
Agitation (unit managers assessed) - Cohen-Mansfield's Agitation Inventory (CMAI)  
All measures re-assessed at end of weeks 10, 20 and 30  
Intention-to-treat analysis: no  
Attrition:  
N = losses to follow up: N = 14 (21%), 12 deaths, 2 became unstable on their medications  
Does not report which group(s) they were from  
Compliance: not reported  
Key findings: |
Buettner 1997  

(Continued)

|   | (1) No significant differences between groups at baseline
|   | (2) Generally improvements on all measures among the intervention group and deterioration among the control group, this plateaued or reversed as the home's staff took over from the experts
|   | (3) Explain the lack of improvement/decline at 30 weeks as being the consequence of care being taken over by home staff rather than the specialist therapists
|   | Adverse events: none reported, 12 deaths during study period

Notes

Funding: National Alzheimer's Association
Evaluators were unit managers; all participants came from the same home and it must have been impossible for them not to get some idea of allocation over a 30 week period

Risk of bias

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<tr>
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<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
</tr>
</tbody>
</table>

Choi 2005

Methods

Design: cluster randomised controlled trial
Duration: 12 weeks
Follow up: none
Method of randomisation: randomly assigned to either the experimental or control group by coin tossing, cluster allocation of the 2 homes
Concealment of allocation: no
Outcome assessor blinding: not possible because of the non-random participant assignment (homes were allocated)
Group comparability at entry: no, significant differences P < 0.05
Strength of ankle dorsiflexors (control group stronger)
Balance (Control group had better balance both with eyes open and eyes closed)
Mobility (Control group more mobile)
Losses to follow up: 9 (13.2%)

Participants

Country: South Korea
Setting: unclear - based on the number of residents, location and facilities, 2 facilities with similar characteristics were selected from list provided by Korean Council on social welfare
Randomised = 68
% Female = 75
Age: mean: 77.86 years, range: 61 to 91 years
61% fall in the previous year
Consent: assent accepted
Inclusion criteria: ambulatory adults aged over 60 with at least one of the following: impaired gait (score of < 10 on gait subscale (max score of 12) of the Performance Orientated Assessment of Mobility (POAM)), impaired balance (Score of < 14 on POAM balance subscale (Max 16), history of falling in the previous
year, postural hypotension (drop in systolic blood pressure of 20 mmHg from lying to standing, use of 4 or more prescription medications which may affect balance. Exclusion criteria: cognitive: severe dementia (score < 20 on Folstein Mini-Mental state examination); medical: inability to complete 12 weeks of exercise due to physical illness; functional: current involvement in any type of regular exercise
% Eligible within home: not reported
% Eligible that participate: not reported
Intervention:
N = 29
% Female = 79
Age: mean: 76.96 years 7.7 years
Control:
N = 30
% Female = 70
Age: mean: 78.73 years 6.9 years

Interventions
Study aim or objective: determine changes in physical fitness (knee and ankle muscle strength, balance, flexibility and mobility) fall avoidance efficacy and fall episodes of institutionalised adults after participating in a 12 week Sun-style Tai Chi exercise programme
Number of experimental groups: 2
Group intervention delivery:
Session duration: 35 minutes
Number of sessions per week: 3
Seated: unclear
Exercise features: Sun style Tai Chi, 10 minutes warming up, 20 minutes of 12 Tai Chi movements, 5 minutes of cooling down, done to music for soothing effect
Control: maintained routine activities; did not participate in any regular exercise classes

Outcomes
Measures:
Muscle strength: manual muscle tester - extension and flexion of knees and ankles
Balance: how long the person could stand on one foot either with eyes closed or eyes open
Flexibility: bend forward at the waist and stretch both hands toward the feet without bending the knees - distance from floor of hands
Mobility: time taken to walk 6 metres
Fall episode: sudden and unintentional change in position from an upright posture - with or without loss in consciousness - that caused the person to land on the floor
Fall avoidance efficacy: Tinetti scale (1990) of confidence that the person could avoid falling
Intention-to-treat analyses: no
Attrition:
N = 9, 13.2%
14.7% Tai Chi; 11.8% control
Tai Chi: 1 hospitalisation, 2 transfers to another facility, 2 had less than 70% attendance at exercise sessions
Control: 1 death, 2 admissions to hospital, 1 transfer to another facility
Compliance:
Intervention: 80.3%
Choi 2005  (Continued)

Control: n/a
Key findings:
(1) Tai Chi: improved muscle strength in knee and ankle flexors (P < 0.001) and extensors (P < 0.01) and improved flexibility (P < 0.01) and mobility (P < 0.001) compared to control group
(2) No significant difference in number of fall episodes
(3) Tai Chi group more confident about not falling than control group
Adverse events: none reported

Notes
Funding: not reported

Risk of bias

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<thead>
<tr>
<th>Item</th>
<th>Authors' judgement</th>
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<tbody>
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</tbody>
</table>

Clark 1975

Methods
Design: randomised controlled trial
Duration: 12 weeks
Follow up: 4 weeks
Method of randomisation: not described
Concealment of allocation: unclear
Outcome assessor blinding: not described
Group comparability at entry: unclear
Losses to follow up: 2 participants (8.7%) failed to complete the study, both in the social activity group

Participants
Country: USA
Setting: 4 long-stay psychiatric wards, of which 3 were secure.
Randomised = 23
% Female = 52
Age: mean: 69 years, range: 50 to 77 years
Consent: assent accepted
Inclusion criteria: capable of communicating and following simple instructions
Exclusion criteria: medical: hypertension, debilitating arthritic impairment, requiring cardiac medication
% Eligible within home: not reported
% Eligible that participate: not reported
Activity group: N = 10
5 females
Social group: N = 6
4 females
Control group: N = 7
3 females
Clark 1975  (Continued)

<table>
<thead>
<tr>
<th>Interventions</th>
<th>Study aim or objective: hypothesised that 12 week physical activity programme would: (1) increase total daily activity level, (2) upgrade patient self-care, (3) increase activity tolerance levels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of experimental groups: 3</td>
</tr>
<tr>
<td></td>
<td>Group intervention delivery</td>
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<tr>
<td></td>
<td>Session duration: 60 minutes</td>
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<tr>
<td></td>
<td>Number of sessions per week: 5</td>
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<tr>
<td></td>
<td>Seated: no</td>
</tr>
<tr>
<td></td>
<td>Activity group: stretching and postural exercise, modified weight and circuit training, dancing and walking; led by a therapist trained in physical education instruction and an assistant, for 1 hour, 5 sessions per week for 12 weeks</td>
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<tr>
<td></td>
<td>Social group: recreational activities involving no physical exertion e.g. board games, arts and crafts; led by a recreational therapist and an assistant, for 1 hour, 5 sessions per week for 12 weeks</td>
</tr>
<tr>
<td></td>
<td>Control group: usual care</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Measures:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Function: (self care &amp; personal neatness evaluation - NOSIE)</td>
</tr>
<tr>
<td></td>
<td>Balance: (toe stand, one foot stand, beam stand)</td>
</tr>
<tr>
<td></td>
<td>Other: cardiovascular efficiency (resting, exercise induced, and recovery heart rates), total daily activity level assessment</td>
</tr>
<tr>
<td></td>
<td>Intention-to-treat analyses: no</td>
</tr>
<tr>
<td></td>
<td>Attrition:</td>
</tr>
<tr>
<td></td>
<td>N = 2</td>
</tr>
<tr>
<td></td>
<td>% = 8.7</td>
</tr>
<tr>
<td></td>
<td>Compliance: not reported</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Key findings:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) No significant difference between intervention and control group for total daily activity level - both groups increased</td>
</tr>
<tr>
<td>(2) Best gender discrimination on the heart rate and balance tasks - men performed better than women, but it is noted that the males were more motivated and the women were not concerned about their performance</td>
</tr>
<tr>
<td>(3) Males recovered better after exercise indicating better fitness</td>
</tr>
</tbody>
</table>

| Adverse events: none reported |

| Notes | Funding: NIMH and DHEW Hospital improvement grant and NICHD grant |

<table>
<thead>
<tr>
<th>Risk of bias</th>
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<tr>
<td>Item</td>
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<tr>
<td>Allocation concealment?</td>
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</tbody>
</table>
**Cott 2002**

| Methods | Design: randomised controlled trial  
|---------|--------------------------------------  
|         | Duration: 16 weeks  
|         | Follow up: none  
|         | Method of randomisation: randomly assigned to 1 of 3 groups using a table of random numbers  
|         | Concealment of allocation: yes  
|         | Outcome assessor blinding: yes, maintained  
|         | Group comparability at entry: yes, no significant differences P > 0.05  
|         | Losses to follow up: N = 12 (8.7%), 5 lost from talk-only group and 7 lost from control group  
|         | Reasons stated: death and surgery, no separate data given  
|          |  
| Participants | Country: Canada  
|              | Setting: 3 long-term care facilities  
|              | Randomised = 86  
|              | % Female = 53  
|              | Age: mean: 82 years 8 years, range: not reported  
|              | Consent: assent accepted  
|              | Inclusion criteria: diagnosis of Alzheimer’s disease, MMSE less than 20, MMSE item 8 score of less than 3, ability to walk 5 metres with or without walking aid or supervision  
|              | Exclusion criteria: medical: cardiac conditions precluding ambulation  
|              | % Eligible within home: not reported  
|              | % Eligible that participate: 81.5  
|              | Walk and talk group: N = 30  
|              | Mean age: 83.23 years (SD 8.34)  
|              | 16 females  
|              | Talk only group: N = 30  
|              | Mean age: 81.68 years (SD 7.36)  
|              | 15 females  
|              | Control group: N = 26  
|              | Mean age: 79.78 years (SD 8.30)  
|              | 8 females  
|          |  
| Interventions | Study aim or objective: investigate the effects of a walking/talking programme on communication, ambulation and level of function on people with Alzheimer’s disease  
|               | Number of experimental groups: 3  
|               | Group intervention delivery  
|               | Session duration: 30 minutes  
|               | Number of sessions per week: 5  
|               | Seated: no  
|               | Exercise features: walking  
|               | Non-exercise features: talking  
|               | Walk and talk group: to walk and talk as much as possible with rest as necessary (guided conversation), 30 minute sessions, 5 sessions per week for 16 weeks, led by a research assistant  
|               | Talk only group: guided conversation only, 30 minutes, 5 sessions per week for 16 weeks, led by a research assistant  
|               | Control group: usual care  

Rehabilitation for older people in long-term care (Review)

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### Outcomes

<table>
<thead>
<tr>
<th>Measures:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function status: general (London Psychogeriatric Rating Scale), ambulation (2 minute walk test)</td>
</tr>
<tr>
<td>Other: communication (functional assessment of communication skills for adults)</td>
</tr>
</tbody>
</table>

**Intention-to-treat analyses:** no

**Attrition:**
- N = 12 dropped out, 14%
- Compliance: not reported

**Key findings:** no significant between group differences, no overall intervention benefit

**Within-group differences:**
1. Control and talk-only groups improved communication scores, maintained in the talk and walk group, only significant in control group P = 0.018
2. Control and talk-only groups improved communication of basic needs scores, decreased in the talk and walk group, significant in control group P = 0.022 and talk-only P = 0.046
3. Control and talk-only groups showed significant improvement in overall communication scores P = 0.012 and P = 0.046 respectively
4. No significant differences in ambulation
5. All 3 groups showed increase in disability at post-test, only significant for the talk-and-walk group P = 0.029
6. Cognitive impairment had a direct effect on outcomes - more impaired participants performed much worse
7. High levels of score variability explained through cognitive impairment

**Adverse events:** none reported

### Notes

**Funding:** Alzheimer's Society of Canada

### Risk of bias

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</tbody>
</table>

### Crilly 1989

**Methods**

- Design: Randomised controlled trial
- Duration: 12 weeks
- Follow up: none
- Method of randomisation: not described
- Concealment of allocation: unclear
- Outcome assessor blinding: not described
- Group comparability at entry: yes, no significant differences P > 0.05
- Losses to follow up: N = 3 (6%)
### Participants

| Country: Canada |
| Setting: Sheltered apartments, rest homes, and nursing homes |
| Randomised = 50 |
| % Female = 100 |
| Age: mean: 82.2 years, range: 71 to 91 years |
| Consent: fully informed consent |
| Inclusion criteria: ability to ambulate independently without walking aid, eyesight sufficiently good to read large new print, hearing sufficiently good to hear instructions in normal speaking voice, ability to understand instructions and ability to participate in exercise programme. |
| Exclusion criteria: see inclusion criteria |
| % Eligible within home: 69 |
| % Eligible that participate: 43 |
| Intervention: N = 25 |
| Control: N = 25 |

### Interventions

| Study aim or objective: hypothesise that increase in postural sway is due to nervous system deterioration and as a consequence, no improvement is possible - irreversible loss of function |
| Number of experimental groups: 2 |
| Group intervention delivery |
| Session duration: 25 minutes |
| Number of sessions per week: 3 |
| Seated: no |
| Exercise features: exercise class delivered by physiotherapists, activities conducted aim to improve breathing, single and double limb balance, co-ordination, flexibility, antigravity strength, trunk and ankle strength, and promote general relaxation |
| Control: usual care |

### Outcomes

| Measures: Balance: (Postural sway measured by Steel force platform) |
| Other measures of physical function and gait analysis were carried out and reported elsewhere |
| Intention-to-treat analyses: no |
| Attrition: N = 2 from exercise group and N = 1 from control |
| Compliance: 15 exercisers attended at least 24 of possible 36 classes |
| Key findings: there was no improvement in postural sway in any group |
| Adverse events: none reported |

### Notes

| Funding: Canadian Geriatrics Society |

### Risk of bias

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<tr>
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<tbody>
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</tbody>
</table>
### Methods

Design: randomised controlled trial, repeated measures cross-over design  
Duration: n/a - one off intervention  
Follow up: n/a  
Method of randomisation: not described  
Concealment of allocation: unclear  
Outcome assessor blinding: no  
Group comparability at entry: n/a  
Losses to follow up: none

### Participants

Country: USA  
Setting: Nursing home and retirement home  
Randomised = 28  
% Female = not reported  
Age: mean: 84.86 years 6.08 years, range: 76 to 98 years  
Consent: unspecified  
Inclusion criteria: score of 25 to 40 points on the Paracheck Geriatric rating scale  
Exclusion criteria: see inclusion criteria  
% Eligible within home: not reported  
% Eligible that participate: not reported  
Group 1: N = 10  
Group 2: N = 8  
Group 3: N = 10

### Interventions

Study aim or objective: (1) materials-based intervention would elicit more repetitions and greater distance of movement than imagery-based occupation and rote exercise, (2) imagery-based occupation would elicit more repetitions and greater distance of movement during physical activity than rote exercise  
Number of experimental groups: 3  
Single, individual session  
Session duration: not reported  
Number of sessions per week: n/a  
Seated: yes  
Exercise features: materials-based occupation involved kicking a balloon, imagery-based occupation involved kicking an imaginary balloon, rote exercise involved being asked to kick your foot as in a demonstration, participants were asked to kick with the same foot as many times as possible before becoming tired  
Group 1: materials-based occupation, followed by imagery-based occupation, followed by rote exercise  
Group 2: imagery-based occupation, followed by rote exercise, followed by materials-based occupation  
Group 3: rote exercise, followed by materials-based occupation, followed by imagery-based occupation

### Outcomes

Measures:  
Function (kicking distance)  
Endurance (number of repetitions, speed of kicking)  
Other (vocalisations)  
Intention-to-treat analyses: no  
Attrition:  
N = 0
Compliance:
Intervention: 100%
Control: 100%

Key findings:
(1) Materials-based intervention led to significantly more repetitions than rote exercise or imagery
(2) No difference between rote exercise and imagery

Adverse events: none reported

Notes
Funding: not reported
Replication and extension of Lang 1992

Risk of bias

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</table>

Faber 2006

Methods
Design: cluster randomised controlled trial
Duration: 20 weeks
Follow up: 52 weeks
Method of randomisation: participating homes allocated to one of the two exercise interventions using sealed envelopes
Participants in those homes were then randomly assigned to exercise programme or control using computer generated random numbers
Maximum size of exercise group at each home is 12 and control at least 5
Concealment of allocation: yes
Outcome assessor blinding: not specified
Group comparability at entry: yes, no significant differences P > 0.05
Losses to follow up: recruited 278 participants, 40 (14.4%) dropped out immediately after randomisation (equally distributed across both groups), 6 excluded from fall analyses because no reliable data, 30 excluded from physical function and disability analyses because they did not come to the post-intervention assessment, 4 perceived their health to be too poor, 4 lost interest, 1 suffered fracture, 5 hospitalised > 2 weeks; 4 died and 6 were ill

Participants
Country: The Netherlands
Setting: 15 homes for the elderly
Randomised = 278
% Female = 79
Age: mean: 84.9 years, range: 63 to 98 years
Consent: fully informed
Inclusion criteria: see exclusion criteria
<table>
<thead>
<tr>
<th>Exclusion criteria: cognitive: impaired cognition to the extent that they could not process information provided during the testing and exercising; medical: GP judged whether there was a medical contraindication to exercising; functional: unable to walk more than 6 metres independently (aids allowed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Eligible within home: not reported</td>
</tr>
<tr>
<td>% Eligible that participate: not reported</td>
</tr>
<tr>
<td>Functional walking: N = 130 (7 residences)</td>
</tr>
<tr>
<td>80 allocated intervention</td>
</tr>
<tr>
<td>50 allocated control</td>
</tr>
<tr>
<td>In balance: N = 148 (8 residences)</td>
</tr>
<tr>
<td>94 allocated intervention</td>
</tr>
<tr>
<td>54 allocated control</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Interventions</th>
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</thead>
<tbody>
<tr>
<td>Study aim or objective: to determine the effects of moderate intensity group-exercise programme on falls, functional performance and disability in older adults, and to investigate the effect of frailty on outcome</td>
</tr>
<tr>
<td>Number of experimental groups: 4</td>
</tr>
<tr>
<td>Group intervention delivery</td>
</tr>
<tr>
<td>Session duration: 90 minutes</td>
</tr>
<tr>
<td>Number of sessions per week: 2</td>
</tr>
<tr>
<td>Seated: no</td>
</tr>
<tr>
<td>All participants (including control) required to report levels of physical activity to monitor and control contamination from the intervention</td>
</tr>
<tr>
<td>Interventions: 2 exercise programmes, both with evidence that they were effective in preventing falls, 1 session per week for 4 weeks followed by bi-weekly sessions for 16 weeks, 90 minute sessions including 30 minute social element intended to increase motivation, all groups had their own instructor and assistant</td>
</tr>
<tr>
<td>Functional walking: 10 exercises: balance, mobility and transfer training</td>
</tr>
<tr>
<td>In balance: (derived from Tai Chi) elements of tai chi most beneficial to elderly people</td>
</tr>
<tr>
<td>Control: there was a control group for each exercise type, but what it did is not specified</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Outcomes</th>
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<tbody>
<tr>
<td>Assessments:</td>
</tr>
<tr>
<td>Baseline: assessments made by 2 research physical therapists not involved in any other aspect of the study, demographics, BMI, lifestyle variables, physical status, health status, cognitive status (mini-mental status)</td>
</tr>
<tr>
<td>Frailty indicators: (1) unintentional weight loss; (2) weakness; (3) exhaustion; (4) slowness; (5) low physical activity</td>
</tr>
<tr>
<td>Outcome measures:</td>
</tr>
<tr>
<td>Falls: any event which results into the person coming to rest unintentionally on the ground, registered from beginning of intervention to 52 week follow up</td>
</tr>
<tr>
<td>Mobility: performance orientated mobility assessment (POMA)</td>
</tr>
<tr>
<td>Performance-based physical function: walking speed test (6 metre walk), timed chair stands test (time to stand up and sit down 5 times), Timed get up and go test, FICSIT-4 balance test</td>
</tr>
<tr>
<td>Disability: Groningen Activity Restriction Scale (GARS) ADLs</td>
</tr>
<tr>
<td>Intention-to-treat analyses: yes</td>
</tr>
<tr>
<td>208 analysed for physical performance</td>
</tr>
<tr>
<td>232 analysed for falls</td>
</tr>
<tr>
<td>Attrition:</td>
</tr>
<tr>
<td>N = 70</td>
</tr>
<tr>
<td>% = 25.2</td>
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</tbody>
</table>
40 immediately after randomisation
6 because no reliable fall data available
30 because they were unable to participate in the post intervention assessment
232 participants entered into evaluation of intervention effect on falls
Compliance:
Functional walking = 88%
In balance = 84%
Key findings:
(1) Effect on falls: 62.5% of functional walking and 53.3% of in balance suffered at least 1 fall
(2) Risk of falling was higher in exercise groups in frail participants
(3) Exercise increased POMA
(4) Effects were more positive in pre-frail elderly
Adverse events: 4 decline in perceived health, 4 loss of interest, 1 fracture, 5 hospitalisations of = 2 weeks, 4 deaths, 6 ill

Notes
Funding: not reported, no commercial party had any financial interests

Risk of bias

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<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>D - Not used</td>
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</tbody>
</table>

Fiatarone 1994

Methods
Design: randomised controlled trial
Duration: 10 weeks
Follow up: none
Method of randomisation: unclear
Concealment of allocation: unclear
Outcome assessor blinding: partial - measurements of muscle function were made by a single observer who was aware of group assignments, but not involved in training, CT evaluation of the mid-thigh was conducted by a single investigator in a blinded fashion, no details of blinding were described for the other outcomes
Group comparability at entry: no, significant differences P < 0.05
Baseline difference in strength: exercise + nutrition participants significantly weaker than exercise alone participants.
Losses to follow up: 3 lost from exercise only group (one lack of interest, one musculoskeletal pain, one pneumonia), 2 from supplement only group (one death, one lack of interest), 1 lost from control group due to death

Participants
Country: USA
Setting: Elderly long-term care facility
Randomised = 100
% Female = 63
Age: 38% older than 90 years, mean: 87.1 years 0.6 years, range: not reported
Consent: not specified
Inclusion criteria: aged over 70 years, residential status, ability to walk 6 metres
Exclusion criteria: cognitive: severe cognitive impairment; medical: rapidly progressive or terminal illness, acute illness, unstable chronic illness, myocardial infarction, fracture of a lower extremity within 6 months before the study, insulin-dependent diabetes mellitus, if they were on a weight loss diet or undergoing resistance training at the time of enrolment, if test of muscle strength revealed a musculoskeletal or cardiovascular abnormality
% Eligible within home: 26.7
% Eligible that participate: 28.7
Exercise only group: N = 25
Mean age: 86.2 years 1.0 mean SE, range: 72 to 95 years
64% female
Supplement only group: N = 24
Mean age: 85.7 years 1.2 mean SE, range: 75 to 97 years
71% female
Exercise and supplement group: N = 25
Mean age: 87.2 years 1.2 mean SE, range: 76 to 98 years
64% female
Control group: N = 26
Mean age: 89.2 years 0.8 mean SE, range: 78 to 98 years
54% female

Interventions
Study aim or objective: hypothesis: physical frailty is partially mediated by skeletal-muscle disuse and marginal nutritional intake, and should therefore be reduced by interventions designed to reverse those deficits
Number of experimental groups: 4
Individualised intervention
Session duration: 45 minutes
Number of sessions per week: 3
Seated: no
A therapeutic recreation specialist delivered the exercise components
Exercise only group: high intensity progressive resistance training of the hip and knee extensors, commencing at 80% of one repetition max and progressing as able
Supplement only group: 240 ml Exceed micronutrient supplement drink daily, representing 360 kilocalories, delivered in an unmarked container
Exercise and supplement group: comprised both interventions
Control group: 240 ml of a minimally nutritive liquid delivered in the same way, plus three activities of the patients' choice offered by the same service, but excluding resistance training

Outcomes
Measures:
Function: gait velocity (over 6.1 metres), stair climbing power (times by 4 with banisters)
Muscle power: hip and knee extensors (one repetition max)
Other: muscle cross-sectional area (CT scan), nutritional intake (calculated to the nearest 0.1 grams), overall level of physical activity (calculated by measuring lower limb spontaneous movements), body composition (anthro-pometric measurements, whole body potassium, CT scan of the mid thigh)

Intention-to-treat analyses: yes

Attrition: 2 unrelated deaths, 2 dropped out prior to start of trial, 2 during the trial

N = 6
% = 6

Compliance:
97% compliance with exercise sessions
100% compliance with control
99% compliance with nutritional drink
100% compliance with placebo drink

Key findings:
(1) Exercise significantly increased muscle strength and size
(2) Significant increase in body weight due to supplement
(3) 4 exercise participants who needed a walker only needed a frame at post-test
(4) Exercise significantly increased habitual gait velocity, stair climbing ability and overall physical activity levels
(5) The nutritional supplement had no effect on mobility
(6) The nutritional supplement has neither an independent or an additive effect on muscle strength or size outcomes

Adverse events: diarrhoea in 2 nutritional participants, joint pain in 2 exercisers

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### Risk of bias

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<td>Unclear</td>
<td>B - Unclear</td>
</tr>
</tbody>
</table>
**Methods**

- **Design**: cluster randomised controlled trial
- **Duration**: 12 weeks
- **Follow up**: none
- **Method of randomisation**: by residential home
- **Concealment of allocation**: unclear
- **Outcome assessor blinding**: no
- **Group comparability at entry**: yes, no significant differences $P > 0.05$
- **Losses to follow up**: $N = 5$ (25%)
  - **Intervention group**: $N = 4$ (2 due to illness, 1 loss of interest, 1 out with relatives on day of classes)
  - **Control group**: $N = 1$ (refused test)

**Participants**

- **Country**: UK
- **Setting**: 2 residential homes
- **Randomised**: 20
- **% Female**: 95 (only data from females analysed)
- **Age**: mean: approximately 88 years, range: not reported
- **Consent**: fully informed
- **Inclusion criteria**: > 70 years, mobile, able to participate in test battery, no medical conditions which would interfere with safety regarding training program
- **Exclusion criteria**: 6 participants were excluded but no reasons given
- **% Eligible within home**: 76.9
  - **% Eligible that participate**: not reported
  - **Intervention group**: $N = 10$
  - **Mean age**: 88 5 years
  - **All female**
  - **Control group**: $N = 10$
  - **Mean age**: 87 years 4 years
  - **9 females**

**Interventions**

- **Study aim or objective**: study question: is it possible to improve functional ability in older people by getting them to practise the functional tasks themselves?
- **Number of experimental groups**: 3
- **Group intervention delivery**
  - **Session duration**: unclear
  - **Number of sessions per week**: 2
  - **Seated**: unclear
  - **Exercise features**: circuit of 8 functional exercises for 30 seconds initially progressing to a maximum of 1 minute, then increasing difficulty of task
  - **Control**: reminiscence and recreational sessions, gentle, seated range of movement exercises (trunk and upper limbs only)
  - **Personnel delivering interventions** not specified

**Outcomes**

- **Measures**:
  - **Function**: chair rise, stair ascent and descent, walking test
  - **Intention-to-treat analyses**: no
  - **Attrition**:
    - **Intervention group**: $N = 4$, 2 due to illness, 1 loss of interest, 1 out with relatives on day of classes
Control group: N = 1, refused test
N = 5
% = 25
Compliance: not reported
Key findings:
(1) Control group significantly slower than exercisers on the chair-rise test
(2) Significant increase in body mass in control group, no change in exercisers
(3) Exercise group significantly improved on walking tests P = 0.002
(4) Both groups improved in single chair rise, no significant difference between the groups
(5) Both groups significantly improved in the stair ascent test, no significant difference between the groups
Adverse events: 2 cases of minor illness

Notes
Funding: not reported

Risk of bias

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors’ judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
</tr>
</tbody>
</table>

Hruda 2003

Methods
Design: randomised controlled trial
Duration: 10 weeks
Follow up: none
Method of randomisation: randomly assigned using a 1:2 ratio in a lottery format to control group or exercise group
Concealment of allocation: unclear
Outcome assessor blinding: unclear
Group comparability at entry: yes, no significant differences P > 0.05
Losses to follow up: N = 5 (17%), dropped out due to health reasons (E2, C3)

Participants
Country: Canada
Setting: Long-term care facility
Randomised = 30
% Female = 80
Age: mean: approximately 83 years, range: 75 to 94 years
Consent: assent accepted
No participants were currently involved in any physical exercise programme or had any recent exercise history
Inclusion criteria: ability to follow directions, ability to walk across a room (with or without assistive device), no recent history of cardiovascular, cerebral vascular, respiratory, systemic, muscular or uncontrolled metabolic disease
Exclusion criteria: see inclusion criteria
Study aim or objective: examine the effect of an onsite and simple progressive lower body training programme designed to improve muscle power on functional abilities in frail older adults.

Number of experimental groups: 2

Group intervention delivery:
- Session duration: 20-60 minutes
- Number of sessions per week: 3
- Seated: if necessary

Exercise features:
- 10 minute warm-up and stretch,
- Strengthening components utilised seated and standing components focusing in lower body muscle groups,
- Therabands gradually introduced to increase resistance,
- Number of exercise repetitions were gradually increased and a speed element introduced,
- 10 minute cool-down,
- Personnel delivering interventions not specified

Control: no active or placebo intervention, asked to perform no more or no less activity than normal on a daily basis.

Outcomes:

Measures:
- Biodex multi-joint testing and exercise dynamometer used to measure isokinetic knee extension contractions at an angular velocity of 180°/s
- Peak torque and average power were calculated by the on-line microsystem inherent to the dynamometer
- Eccentric (ecc) and concentric (conc) contractions
- To minimise fatigue non-dominant leg used for testing of ecc contractions and the dominant leg for conc contractions
- 3 repetitions for each legs and best torque and power recorded
- 8-foot up-and-go timed test
- 30 second chair stand test
- 6 metre walk timed test

Intention-to-treat analyses: no

Attrition:
- N = 5, 2 exercisers and 3 controls dropped out due to health reasons

Compliance:
- Intervention: 71%
- Control: n/a

No baseline differences in age, height or weight, but strong trend for control group to be younger than the exercisers

Key findings:
1. At baseline, control group significant stronger concentric leg power, significant better performance on 8-foot timed up-and-go tests and 30 second chair stand tests
2. Performance at baseline was strongly correlated with average concentric power
(3) In the exercise group, there was significant improvement in muscle power, compared to no change in controls.
(4) Participants in the experimental group improved their performance in all functional tests ($P < 0.05$).
(5) These improvements correlated with average power and knee extensor torque.
(6) No change in the control group.

Adverse events: none reported.

Notes: Funding: not reported.

Risk of bias

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
</tr>
</tbody>
</table>

Karl 1982

Methods
Design: randomised controlled trial
Duration: 4 weeks
Follow up: none
Method of randomisation: not described
Concealment of allocation: unclear
Outcome assessor blinding: unclear
Group comparability at entry: unclear
Losses to follow up: none stated

Participants
Country: USA
Setting: Long-term residents of an intermediate care facility
Randomised = 19
% Female = 16
Age: mean: not reported, median: 73 years, range: 62 to 95 years
Consent: assent accepted
Inclusion criteria: > 65 years old, some deficits in self care - requiring assistance with dressing, grooming and feeding
Exclusion criteria: see inclusion criteria
% Eligible within home: not reported
% Eligible that participate: 47.5

Interventions
Study aim or objective: to test the assumption that elderly individuals participating in a range of motion exercise programme will show more of an increase in self care in hygiene and eating than those who do not
Number of experimental groups: 2
Group intervention sessions
Session duration: 30 minutes
Number of sessions per week: 2
### Karl 1982

(Continued)

<table>
<thead>
<tr>
<th>Seated: if necessary</th>
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</thead>
<tbody>
<tr>
<td>Exercise features: upper limb and lower limb range of movement exercises, personnel delivering the intervention were not described</td>
</tr>
<tr>
<td>Control: movies only</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Function: general (Performance Test of Activities of Daily Living)</td>
</tr>
<tr>
<td></td>
<td>Intention-to-treat analyses: no</td>
</tr>
<tr>
<td></td>
<td>Attrition: not reported, but states it was a problem</td>
</tr>
<tr>
<td></td>
<td>Compliance: not reported</td>
</tr>
<tr>
<td></td>
<td>Key findings:</td>
</tr>
<tr>
<td></td>
<td>(1) 2 exercisers went from moderately dependent to independent</td>
</tr>
<tr>
<td></td>
<td>(2) Increased socialisation among exercisers noted by staff</td>
</tr>
<tr>
<td></td>
<td>(3) No overall improvement in the status of the exercise group or control group</td>
</tr>
<tr>
<td></td>
<td>Adverse events: none reported</td>
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</tbody>
</table>

| Notes                     | Funding: not reported                         |

### Risk of bias

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors’ judgement</th>
<th>Description</th>
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<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
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</tbody>
</table>

### Kinion 1993

<table>
<thead>
<tr>
<th>Methods</th>
<th>Design: randomised controlled trial</th>
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<tbody>
<tr>
<td></td>
<td>Duration: 8 weeks</td>
</tr>
<tr>
<td></td>
<td>Follow up: none</td>
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<tr>
<td></td>
<td>Method of randomisation: Not described</td>
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<tr>
<td></td>
<td>Concealment of allocation: unclear</td>
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<tr>
<td></td>
<td>Outcome assessor blinding: unclear</td>
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<tr>
<td></td>
<td>Group comparability at entry: unclear</td>
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<tr>
<td></td>
<td>Losses to follow up: none</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Participants</th>
<th>Country: USA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Setting: assisted-living home for the aged</td>
</tr>
<tr>
<td></td>
<td>Randomised = 24</td>
</tr>
<tr>
<td></td>
<td>% Female = 75</td>
</tr>
<tr>
<td></td>
<td>Age: mean: approximately 85 years, range: 72 to 101 years</td>
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<tr>
<td></td>
<td>Consent: fully informed consent</td>
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<tr>
<td></td>
<td>Inclusion criteria: permission of participants’ physicians was sought, no participants had any acute illness</td>
</tr>
<tr>
<td></td>
<td>Exclusion criteria: see inclusion criteria</td>
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<tr>
<td></td>
<td>% Eligible within home: not reported</td>
</tr>
</tbody>
</table>
### Interventions

Study aim or objective: the programme addressed physical activity and psychosocial needs, such as learned helplessness and sadness without placing additional strain on the hectic schedules of staff

- Number of experimental groups: 2
- Group session delivery
  - Session duration: 30 minutes
  - Number of sessions per week: 3
  - Seated: yes
- Exercise features:
  - Sit and get fit group: performed seated range of movement exercises, included measures to promote psychosocial well-being, programme was delivered by a paraprofessional
  - Control: participated in usual home activities, with opportunity to participate in sit and get fit programme after the study period

### Outcomes

Measures:
- Function: range of movement - shoulder, elbow, hip, knee, ankle (goniometry)
- Other: subjective experience data
- Intention-to-treat analyses: no
- Attrition:
  - N = 0
- Compliance: not reported
- No baseline differences

Key findings:
1. Joint motion generally increased for the experimental group and decreased for the control
2. Significant improvement in exercisers for L and R shoulder flexion, abduction, L shoulder extension, R elbow extension, L and R hip flexion and extension, L knee extension
3. Many participants requested the programme to continue after the end
4. Even participants with chronic illnesses like diabetes and arthritis were able to participate

Adverse events: none reported

### Notes

- Funding: not reported

### Risk of bias

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors' judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
</tr>
</tbody>
</table>
| **Methods** | Design: randomised controlled trial  
Duration: n/a (one-off intervention)  
Follow up: n/a  
Method of randomisation: unclear - according to a counter-balanced design  
Concealment of allocation: unclear  
Outcome assessor blinding: unclear  
Group comparability at entry: n/a  
Losses to follow up: none |
|---|---|
| **Participants** | Country: USA  
Setting: 2 nursing homes  
Randomised = 15  
% Female = not reported  
Age: mean: 76.3 ± 9.95 years, range: 56 to 93 years  
Consent: not specified  
Inclusion criteria: Parachek score > 25  
Exclusion criteria: see inclusion criteria  
% Eligible within home: not reported  
% Eligible that participate: not reported |
| **Interventions** | Study aim or objective: tested the hypothesis that materials-based occupation elicits a greater number of repetitions during physical activity in elderly persons than rote exercise  
Number of experimental groups: 3  
Delivered to groups of participants  
Session duration: n/a  
Number of sessions per week: n/a  
Exercise features: materials-based occupation (kicking balloon); imagery-based occupation (kicking imaginary balloon); rote exercise (kicking foot as demonstrated)  
Group 1: materials-based occupation, then imagery-based occupation, then rote exercise  
Group 2: imagery-based occupation, then rote exercise, then materials-based occupation  
Group 3: rote exercise, then materials-based occupation, then imagery-based occupation  
Participants were instructed to kick as many times as possible, and stop when too tired to continue  
All interventions were supervised by a research assistant, and conducted in one-off sessions, with 3 days in between each one |
| **Outcomes** | Measures:  
Endurance: number of kick repetitions  
Intention-to-treat analyses: no  
Attrition:  
N = 0  
Compliance:  
Intervention: 100%  
Control: 100%  
Key findings:  
Materials-based condition elicited significantly more repetitions than the rote exercise or imagery conditions |
**Lang 1992**  (Continued)

<table>
<thead>
<tr>
<th>Item</th>
<th>Adverse events: none reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notes</td>
<td>Funding: not reported</td>
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</tbody>
</table>

### Risk of bias

<table>
<thead>
<tr>
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<th>Authors’ judgement</th>
<th>Description</th>
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<tbody>
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<td>B - Unclear</td>
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</tbody>
</table>

**Lazowski 1999**

### Methods

- Design: randomised controlled trial
- Duration: 4 months
- Follow up: none
- Method of randomisation: table of random numbers; participants were stratified into two levels of mobility, based on their scores and the Timed Up and Go Test. Within each mobility category at each site, residents were randomly assigned to either the functional fitness for long term care (FFLTC) or range of motion (ROM) condition
- Concealment of allocation: yes - maintained
- Outcome assessor blinding: yes - maintained
- Group comparability at entry: unclear
- Losses to follow up: N = 28 (29%): FFLTC group N = 19, ROM group N = 9
- Similar reasons for both groups: too busy N = 15, medical reasons N = 8, unable to follow exercise N = 3, moved away N = 2

### Participants

- Country: Canada
- Setting: long-term care institution
- Randomised = 96
- % Female = 84
- Age: mean: 80 years ± 0.9 years, range: not reported
- Consent: assent accepted
- Inclusion criteria: able to stand with minimal assistance, ability to follow simple instructions
- Exclusion criteria: medical: recent cardiovascular event, vestibular disorder, uncontrolled hypertension, uncontrolled epilepsy, fracture within 4 months, total blindness/deafness, surgery planned for within the next four months; functional: holidays planned for within the next 4 months, recent admission (less than 3 months)
- % Eligible within home: not reported
- % Eligible that participate: not reported
- FFLTC (functional fitness for long term care) group N = 55
  - Mean age: 79.7 years
  - 29 females
- ROM (range of motion) group N = 41
  - Mean age: 80.4 years
Lazowski 1999  (Continued)

<table>
<thead>
<tr>
<th></th>
<th>30 females</th>
</tr>
</thead>
</table>
| **Interventions** | Study aim or objective: this study compared traditional range of motion to a ‘functional fitness for long-term care’ programme designed to improve strength, balance, flexibility, gait, functional capacity and strength  
Number of experimental groups: 2  
Group intervention delivery  
Session duration: 45 minutes  
Number of sessions per week: 3  
Seated: not specified  
Exercise features:  
FFLTC group: comprised walking, strengthening and balance exercises, tailored to meet each of the two groups (high mobility/low mobility), conducted by recreation staff  
ROM group: comprised seated exercise to improve range of movement (fingers, hands, arms, knees, ankles), relaxation, vocal exercise, and word/memory games  
Groups were of mixed ability, supervised by recreation staff |
| **Outcomes** | Measures:  
Function: general (functional independence measure), mobility (Timed Up and Go Test), stair climbing ability (climb 3 steps with handrail and aid), lower body flexibility (modified sit and reach test), upper body flexibility (shoulder flexion in supported sitting, Leighton flexometer)  
Muscle power: upper limb and lower limb, grip strength (dynamometer)  
Endurance: gait speed (self selected normal pace and fast pace)  
Balance: Berg Balance Scale  
Intention-to-treat analyses: no  
Attrition:  
N = 28 (29%)  
FFLTC group N = 19  
ROM group N = 9  
Similar reasons for both groups: too busy N = 15, medical reasons N = 8, unable to follow exercise N = 3, moved away N = 2  
Compliance:  
Intervention: attendance averaged 86% (FFLTC)  
Control: 79% for ROM  
Key findings:  
(1) Significant improvement in mobility, balance, flexibility, and knee and hip strength in the FFLTC  
(2) Shoulder strength was the only improvement in the ROM group  
(3) The ROM group deteriorated significantly for hip strength, mobility and functional ability  
Adverse events: none reported |
| **Notes** | Funding: grants from the Canadian Fitness and Lifestyle Research Institute, The Walter, J Blackburn Family Foundation, The Richard Ivey Foundation, the Ontario Ministry of Health Long-term Care Division |
| **Risk of bias** | |
### MacRitchie 2001

#### Methods
- **Design:** randomised controlled trial
- **Duration:** 54 weeks
- **Follow up:** none
- Method of randomisation: participants were stratified by every 5 years of age and then randomly assigned by computer
- Concealment of allocation: unclear
- Outcome assessor blinding: no, but objective assessments were performed (assessors were unaware of pre-test scores when collecting post-test data)
- Group comparability at entry: yes, no significant differences $P > 0.05$
- Losses to follow up: $N = 6$ (7%)

#### Participants
- **Country:** USA
- **Setting:** 2 nursing homes
- **Randomised = 88**
- **% Female = 80.7**
- **Age:** mean: 84.1 years, 6.9 years, range: 65 to 98 years
- **Consent:** informed consent from participant or relative and from their doctor
- **Inclusion criteria:** nursing home long-term care resident, physically capable of safe bilateral lower extremity weight-bearing with supervision or minimal assistance, cognitively able to follow simple directions
- **Exclusion criteria:** cognitive: unable or generally unwilling to follow simple directions; medical: inability or medical restriction to bear weight on both lower extremities, less than 65 years of age; functional: participating in skilled rehabilitation (PT or OT) immediately prior to study
- **% Eligible within home:** unclear
- **% Eligible that participate:** unclear, possibly $N = 88$ of 294 residents (30%)
- **Group breakdown:** not given, 29 to 30 participants in each group

#### Interventions
- **Study aim or objective:** investigation of the effect of a standing exercise programme on the number of falls, and the severity of intrinsic fall risk factors (functional losses of strength, balance and endurance, depression and number of infections)
- **Number of experimental groups:** 3
- **One-to-one sessions with each participant being supervised by a care assistant ‘buddy’**
- **Session duration:** 20 minutes
- **Number of sessions per week:** 5 - both interventions were conducted daily Monday to Friday, for 54 weeks.
- **Seated:** No
- **Intervention group:** (group 1): comprised exercises in standing, and walking activities, triggered when energetic music was played over intercom
- **Control group (group 2):** consisted of talking and listening to music only
- **Control group (group 3):** listened to the music alone
MacRitchie 2001 (Continued)

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Measures:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Muscle power: Timed Up and Go Test, time to walk 30 feet</td>
</tr>
<tr>
<td></td>
<td>Balance: Duncan Functional Reach Test</td>
</tr>
<tr>
<td></td>
<td>Exercise tolerance: Time to walk 30 feet</td>
</tr>
<tr>
<td></td>
<td>Mood: Geriatric Depression Scale</td>
</tr>
<tr>
<td></td>
<td>Falls data: number of falls</td>
</tr>
<tr>
<td></td>
<td>Intention-to-treat analyses: no</td>
</tr>
<tr>
<td></td>
<td>Attrition: 6 participants were unable to complete post-test assessments, 2 were transferred from the nursing home, 2 died, 2 were too ill to assess (no separate data were given for the two groups)</td>
</tr>
<tr>
<td></td>
<td>N = 6</td>
</tr>
<tr>
<td></td>
<td>% = 7</td>
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<tr>
<td></td>
<td>Compliance: not reported</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Key findings:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Residents enjoyed the programme, 85% of volunteers reported enjoying implementing it</td>
</tr>
<tr>
<td>(2) Functional strength improved by 33% and functional balance increased by 19% and functional endurance increased by 23% in the standing exercise group</td>
</tr>
<tr>
<td>(3) In practical terms this meant it was easier for participants to get out of a chair, to turn, to reach and to walk further and faster without tiring</td>
</tr>
<tr>
<td>(4) The comparison groups also showed a reduction in fall risk factors</td>
</tr>
<tr>
<td>(5) There were reductions in depression, but no significant differences between groups</td>
</tr>
<tr>
<td>Adverse events: none reported</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Notes</th>
<th>Funding: unclear</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unpublished PhD thesis</td>
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<table>
<thead>
<tr>
<th>Risk of bias</th>
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</thead>
<tbody>
<tr>
<td>Item</td>
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<tr>
<td>------</td>
</tr>
<tr>
<td>Allocation concealment?</td>
</tr>
</tbody>
</table>
McMurdo 1993

<table>
<thead>
<tr>
<th>Methods</th>
<th>Design: cluster randomised controlled trial</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Duration: 7 months</td>
</tr>
<tr>
<td></td>
<td>Follow up: none</td>
</tr>
<tr>
<td></td>
<td>Method of randomisation: Sealed envelopes supplied in sequence by the study co-ordinator, and prepared from a computer generated random numbers table</td>
</tr>
<tr>
<td></td>
<td>Concealment of allocation: yes - maintained</td>
</tr>
<tr>
<td></td>
<td>Outcome assessor blinding: no</td>
</tr>
<tr>
<td></td>
<td>Group comparability at entry: unclear</td>
</tr>
<tr>
<td></td>
<td>Losses to follow up: N = 8 (16.3%): intervention group: N = 5 (3 deaths, 2 loss of interest), control group: N = 3 (3 deaths)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Participants</th>
<th>Country: Scotland, UK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Setting: 4 residential homes</td>
</tr>
<tr>
<td></td>
<td>Randomised = 49</td>
</tr>
<tr>
<td></td>
<td>% Female = 80 (of completers)</td>
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<tr>
<td></td>
<td>Age: mean: 81 years, range: 64 to 91 years</td>
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<tr>
<td></td>
<td>Consent: assent accepted</td>
</tr>
<tr>
<td></td>
<td>Inclusion criteria: see exclusion criteria</td>
</tr>
<tr>
<td></td>
<td>Exclusion criteria: cognitive: severe communication difficulties</td>
</tr>
<tr>
<td></td>
<td>Residential homes all had identical entrance criteria, namely that residents should be able to toilet, dress, and walk independently</td>
</tr>
<tr>
<td></td>
<td>% Eligible within home: not reported</td>
</tr>
<tr>
<td></td>
<td>% Eligible that participate: not reported</td>
</tr>
<tr>
<td></td>
<td>Intervention group: N = 20</td>
</tr>
<tr>
<td></td>
<td>Mean age: 82.3 years (SD 6.9)</td>
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<tr>
<td></td>
<td>12 females</td>
</tr>
<tr>
<td></td>
<td>Control group: N = 29</td>
</tr>
<tr>
<td></td>
<td>Mean age: 79.3 years (SD 6.2)</td>
</tr>
<tr>
<td></td>
<td>21 females</td>
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</table>

<table>
<thead>
<tr>
<th>Interventions</th>
<th>Study aim or objective: intended to evaluate whether participation in regular exercise was acceptable to residents of old people's homes, and whether it produced significant improvements in balance, flexibility, strength or functional capacity compared with a control group who participated in reminiscence sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of experimental groups: 2</td>
</tr>
<tr>
<td></td>
<td>Group intervention delivery</td>
</tr>
<tr>
<td></td>
<td>Session duration: 45 minutes</td>
</tr>
<tr>
<td></td>
<td>Number of sessions per week: 2</td>
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<tr>
<td></td>
<td>Seated: yes</td>
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<tr>
<td></td>
<td>Personnel delivering the interventions were not described</td>
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<tr>
<td></td>
<td>Exercise features: full upper limb and lower limb range of movement, seated exercises to music, intended to promote strengthening, exercise groups lasted for 45 minutes and were conducted twice weekly for 7 months</td>
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<tr>
<td></td>
<td>Control: music and reminiscence therapy designed to prompt social interaction</td>
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</tbody>
</table>
Outcomes

<table>
<thead>
<tr>
<th>Measures:</th>
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<tbody>
<tr>
<td>Spinal flexion (tape measure, erect standing position)</td>
</tr>
<tr>
<td>Muscle power: grip strength (dynamometer)</td>
</tr>
<tr>
<td>Balance: Wright’s ataximeter</td>
</tr>
<tr>
<td>Perceived health status: Life Satisfaction Index</td>
</tr>
<tr>
<td>Mood: Geriatric Depression Scale</td>
</tr>
<tr>
<td>Other: cognition (MMSE)</td>
</tr>
<tr>
<td>Intention-to-treat analyses: no</td>
</tr>
<tr>
<td>Attrition: 3 exercisers got bored and 2 died; 3 controls died</td>
</tr>
<tr>
<td>N = 8</td>
</tr>
<tr>
<td>% = 16.3</td>
</tr>
<tr>
<td>Compliance:</td>
</tr>
<tr>
<td>Intervention: 91%</td>
</tr>
<tr>
<td>Control: 86%</td>
</tr>
<tr>
<td>Key findings:</td>
</tr>
<tr>
<td>Exercise significantly better than control for grip strength, spinal flexion, chair to stand time, ADLs, and depression</td>
</tr>
<tr>
<td>Adverse events: none reported</td>
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</tbody>
</table>

Notes

- Funding: The Mathew Trust and the ICL Discretionary Trust
- All of the residential homes exhibited identical admission criteria

### Risk of bias

<table>
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<tr>
<th>Item</th>
<th>Authors’ judgement</th>
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<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Yes</td>
<td>A - Adequate</td>
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</table>

McMurdo 1994

Methods

- Design: cluster randomised controlled trial
- Duration: 6 months
- Follow up: none
- Method of randomisation: sealed envelopes supplied in sequence by the study co-ordinator, prepared from a computer generated random number table.
- Concealment of allocation: yes - maintained
- Outcome assessor blinding: partial
- Group comparability at entry: yes, no significant differences P > 0.05
- Losses to follow up: N = 10 (15.4%): intervention group: N = 4 (3 deaths, 1 fractured neck of femur); control group N = 6 (4 deaths, 2 hospital admissions)

Participants

- Country: Scotland, UK
- Setting: 4 residential homes
- Randomised = 65
- % Female = 83%
### Interventions

Study aim or objective: (1) what are the mechanisms of improvement seen in McMurdo 1993? (2) in the institutionalised elderly, does participation in regular seated exercise strengthen the quadriceps muscles? (3) is participation in such exercise associated with improved psychomotor or cognitive function?

- Number of experimental groups: 2
- Group intervention sessions
  - Session duration: 45 minutes
  - Number of sessions per week: 2
- Seated: yes
- Exercise features: performed seated exercise to music, number of repetitions and gravity-resisted exercises were increased during the course of the study, group format, supervised by research physiotherapist
- Control group: reminiscence therapy designed to prompt social interaction and group discussion, 45 minutes in duration, conducted twice weekly for 6 months, facilitated by research physiotherapist

### Outcomes

Measures:
- Function: stair-climbing ability (step test), reaction time (speed of response to a visual stimulus- Leeds psychomotor test)
- Muscle power: quadriceps (strain gauge)
- Other: cognition (MMSE)
- Intention-to-treat analyses: no
- Attrition: 4 drop outs from exercise group and 6 from reminiscence
- N = 10
- % = 15.4

Compliance:
- Intervention: 72%
- Control: 62%

Key findings:
1. Exercise group significantly different from control group in quadriceps strength (exercise group increased, control group decreased)
2. Both groups improved equally in terms of ability to climb up steps
(Continued)

<table>
<thead>
<tr>
<th>McMurdoo 1994</th>
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<tbody>
<tr>
<td>(3) Neither cognitive function or reaction time altered significantly</td>
<td></td>
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<tr>
<td>Adverse events: none related to intervention, reports 7 deaths and 2 hospitalisations</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Notes</th>
<th>Funding: not reported</th>
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### Meuleman 2000

#### Methods

- Design: randomised controlled trial
- Duration: 4 to 8 weeks
- Follow up: 1 year
- Method of randomisation: groups were determined by computer algorithm stratified by site of care (GEM or nursing home); assignments were in sealed envelopes that were opened after the pretest was completed (see notes).
- Concealment of allocation: yes - maintained
- Outcome assessor blinding: yes
- Group comparability at entry: no, significant differences P < 0.05
- Significantly more training participants had their primary medical problem disability from cerebrovascular accident
- Losses to follow up: N = 20 (25.6%) (At initial post-test): training group N = 13 (6 discharged home, 4 due to illness, 2 deaths, 1 withdrew due to shoulder strain); control group N = 7 (4 discharged home, 1 due to illness, 2 deaths)

#### Participants

- Country: USA
- Setting: 1 Veteran's Affairs nursing home and geriatric evaluation and management unit, and 1 community nursing home
- Randomised = 78
- % Female = 12
- Age: mean: 75 years, range: 60 to 97 years
- Consent: assent accepted
- Inclusion criteria: > 60 years, impaired functional status (requiring assistance with one or more physical activities of daily living) with potential for improvement, able to follow simple commands, wheelchair participants must be able to transfer with modest assistance at most, Veteran's Affairs participants must have an expected length of stay > 4 weeks
- Exclusion criteria: cognitive: severe dementia; medical: uncontrolled hypertension, unstable angina, medical condition that would interfere with safety of training protocol, stroke in previous 3 weeks, pacemaker, chronic atrial fibrillation
- % Eligible within home: not reported
% Eligible that participate: not reported  
Training group: N = 39  
Mean age: 74.1 years, range: 60 to 90 years  
2 females (7.7%)  
Control group: N = 39  
Mean age: 76.9 years, range: 60 to 97 years  
7 females (21.9%)

<table>
<thead>
<tr>
<th>Interventions</th>
<th>Study aim or objective: to establish whether moderate-intensity endurance training results in short-term improvements in strength, endurance and function</th>
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</thead>
</table>
|               | Number of experimental groups: 2  
|               | Group intervention delivery  
|               | Session duration: 30  
|               | Number of sessions per week: 2  
|               | Seated: no  
|               | All participants participated in training for 4 to 8 weeks, and a minimum of 10 resistance sessions in the 4-week period were ensured  
|               | The interventions were delivered in-group format, and led by a physiotherapist and an aide  
|               | Exercise features:  
|               | Training Group: progressive resistance and endurance training regime, comprised a minimum of 10 minutes endurance training, up to a maximum of 30 minutes before resistance was increased, endurance training took place on a Tuesday and Thursday, resistance training occurred on Monday, Wednesday and Friday, and comprised 15 repetitions for each muscle group  
|               | Control: Usual care |

| Outcomes | Measures  
|----------|----------------------------------------------------------------------------------------------------------------------------------|
|          | Function: general (6-item Physical ADL Scale, 7-item Instrumental ADL Scale), mobility (self-selected walk speed over 20 feet)  
|          | Muscle power: dominant upper limb and lower limb isometric strength (dynamometer)  
|          | Exercise tolerance: cardiovascular fitness (heart rate)  
|          | Mood: Geriatric Depression Scale  
|          | Intention-to-treat analyses: no  
|          | Attrition:  
|          | End of intervention N = 20 (25.6%) (N = 13 dropped out from exercise group, N = 7 dropped out from controls)  
|          | 6 month follow up completed: N = 16 from exercise, N = 18 control  
|          | 12 month follow-up N = 14 exercise, N = 10 control  
|          | Compliance:  
|          | Intervention: attendance average 19.8 sessions ranging from 10 to 24 (10 was the minimum for inclusion)  
|          | Control: n/a  
|          | Key findings:  
|          | (1) Training significantly increased strength and functional activity compared to controls  
|          | (2) Those who were most impaired benefited the most from the intervention  
|          | Adverse events: 1 participant experienced shoulder strain, 4 unrelated deaths during the intervention period |
Meuleman 2000  (Continued)

### Notes

Funding: Veterans affairs health services research and development service
Transportation logistics precluded more than 2 participants from the community nursing home from training at any given time. As a result, the randomisation scheme for these participants was done using a flip coin every time 2 participants had completed the pretest. Though the assessor was blinded to the participants’ group assignment, the assessor was not questioned to ascertain the success of blinding

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Mihalko 1996

### Methods

- Design: cluster randomised controlled trial
- Duration: 8 weeks
- Follow up: 1 week
- Method of randomisation: randomised by residence - no further details given
- Concealment of allocation: unclear
- Outcome assessor blinding: unclear
- Group comparability at entry: no, significant differences P < 0.05
- Participants in the strength training programme had significantly greater strength and ADL scores.
- Losses to follow up: none

### Participants

- Country: USA
- Setting: senior citizen or residential nursing home
- Randomised = 58
  - % Female = 83%
- Age: mean: 82.67 years 7.72 years, range: 71 to 101 years
- Consent: not specified
- Inclusion criteria: sedentary for at least 6 months prior to commencing programme
- Exclusion criteria: none stated
- % Eligible within home: not reported
- % Eligible that participate: not reported
- Experimental group: N = 29
- Control group: N = 29

### Interventions

- Study aim or objective: (1) effects of upper body high-intensity training on muscular strength, ADLs and subjective well-being (2) whether changes in strength were related to subsequent changes in subjective well-being and ADLs
- Number of experimental groups: 2
- Group intervention delivery
- Session duration: 30 minutes
- Number of sessions per week: 3
- Seated: yes
Exercise features:
Experimental group: progressive resistance exercise regime targeting five upper body muscle groups, led by an exercise specialist
Control group: comprised fluid movements that incorporated non-stress exercise and mild stretching activities
Groups were led by the same exercise specialist

Outcomes
Measures:
Function: general (Instrumental ADL scale)
Muscle power: upper body - 5 muscle groups (1 repetition maximum)
Perceived health status: positive and negative affect schedule, Satisfaction With Life scale
intention-to-treat analyses: no
Attrition:
N = 0
Compliance: not reported
Key findings:
(1) Significant baseline difference - those in the strength training group were significantly stronger and had better ADL scores than the control group
(2) Strength training led to significantly greater increases in strength than the control programme
(3) No difference in positive/negative affect
(4) Strength training led to significantly greater life satisfaction
(5) Significant effect on ADLs: decrease in control group, increase in training group
Adverse events: none reported

Notes
Funding: not reported

Risk of bias

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### Morris 1999

#### Methods
- **Design:** Cluster randomised controlled trial
- **Duration:** 10 months
- **Follow up:** 40 weeks
- Method of randomisation: 2 nursing homes were randomly assigned to be control sites, 4 as experimental sites. Homes were matched into sets of triplets, from which sites were randomised to the three study conditions. Randomisation procedure not detailed
- **Concealment of allocation:** unclear
- **Outcome assessor blinding:** unclear
- **Group comparability at entry:** yes
- **Losses to follow up:** 76 (16.2%): Fit For Your Life Group N = 18 (12 deaths, 6 refusals), Self Care for Seniors Group N = 27 (deaths), control group N = 31 (28 deaths, 3 refused)

#### Participants
- **Country:** USA
- **Setting:** 6 nursing homes
- **Randomised = 468**
- **% Female = 79**
- **Age:** mean: 84.7 years, range: not reported
- **Consent:** assent accepted
- **Inclusion criteria:** See exclusion criteria
- **Exclusion criteria:** cognitive: severe cognitive disability (Cognitive Performance Scale < 5); medical: unstable cardiac condition (excluded from exercise component only), terminal prognosis, length of stay < 90 days, health complications that prohibited contact
- **% Eligible within home:** 55.1
- **% Eligible that participate:** not reported
- **Fit for your life group:** N = 142
- **Self care for seniors group:** N = 171
- **Control group:** N = 155

#### Interventions
- **Study aim or objective:** to evaluate how weight training or nursing-based rehabilitation programmes in nursing homes impact on resident performance of ADLs and objective tests of physical performance
- **Number of experimental groups:** 3
- **Individualised intervention delivery**
- **Session duration:** 20 minutes
- **Number of sessions per week:** 3
- **Seated:** unclear
- **Fit for your lift group:** progressive resistance training of major muscle groups related to function and mobility, led by staff, family and volunteers, walking for 1 to 5 minutes initially, up to a maximum of 20 minutes continuous walking, resistance training comprised two sets of 8 repetitions, with progressively heavier weights, resistance training was conducted 3 times per week, non-consecutive days, with walking on alternate days, for a minimum of 4 months out of a 10-month study period
- **Self care for seniors group:** nursing rehabilitation intervention tailored to individual, with aim of maintaining function or preventing decline
- **Control group:** usual care
### Morris 1999  (Continued)

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Measures:</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Function: ADL and MDS measurement summary (Kinder-Richardson-20)</td>
</tr>
<tr>
<td></td>
<td>Muscle power: Timed sit-stand</td>
</tr>
<tr>
<td></td>
<td>Endurance: number of feet walked in 6 minutes</td>
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<td></td>
<td>Balance: time standing in 5 foot positions</td>
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<tr>
<td></td>
<td>Mood: Geriatric Depression Scale.</td>
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<tr>
<td></td>
<td>Intention-to-treat analyses: no</td>
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<tr>
<td></td>
<td>Attrition:</td>
</tr>
<tr>
<td></td>
<td>N = 76</td>
</tr>
<tr>
<td></td>
<td>% = 16.2</td>
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<td></td>
<td>Compliance: not reported</td>
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<tr>
<td></td>
<td>Key findings:</td>
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<tr>
<td></td>
<td>(1) Those in the nursing rehabilitation programme were significantly less likely to decline in ADLs than controls</td>
</tr>
<tr>
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<td>Adverse events: none reported</td>
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### Notes

- Funding: grant from National Institute of Health, National Institute on Ageing

### Risk of bias

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### Mulrow 1994

**Methods**

- Design: randomised controlled trial
- Duration: 1 year
- Follow up: none
- Method of randomisation: performed by calling a central number, randomisation was blocked into groups of 4, and stratified by nursing homes site
- Concealment of allocation: unclear
- Outcome assessor blinding: unclear
- Group comparability at entry: yes
- Losses to follow up: N = 14 (7.2%); intervention group N = 5 (deaths); control group: N = 9 (7 deaths)

**Participants**

- Country: USA
- Setting: 1 academic nursing home, and 8 community nursing homes
- Randomised = 194
- % Female = 71
- Age: mean: approximately 80 years, range: not reported
- Consent: not specified
- Inclusion criteria: > 60 years of age, residence in nursing home > 3 months, dependent in 2 or more activities of daily living
| Exclusion criteria: cognitive: severe dementia, inability to follow 2 step command; medical: terminal illness/acute medical condition; functional: assaultive behaviour, receiving physiotherapy currently, or within last 2 months |
| % Eligible within home: 7.3 |
| % Eligible that participate: 77 |
| Intervention group N = 97 |
| Mean age: 79.7 years (8.5) |
| 70% female |
| Control group N = 97 |
| Mean age: 81.4 years (7.9) |
| 71% female |
| Interventions |
| Study aim or objective: to assess whether a PT programme tailored to long-stay residents' disabilities improved their physical function and long-term health |
| Number of experimental groups: 2 |
| Individualised intervention delivery |
| Session duration: 30 minutes |
| Number of sessions per week: 3 |
| Seated: unclear |
| Exercise features: |
| Intervention group: physical therapy tailored to the individual, incremental programme, used algorithm for treatment priorities, a specific number of repetitions were performed for each exercise category, sessions conducted on an individual basis, in either Spanish or English, by a physiotherapist |
| Control group: friendly visits, reading to patients in language of their choice, activities avoided exercise and psychosocial interventions, personnel not described |
| Outcomes |
| Measures: |
| Function: general (Katz ADL Scale, Physical Disability Index), range of movement (goniometer), mobility assessment (various transfers) |
| Muscle power: upper and lower limb (muscle tester and dynamometer) |
| Perceived health status: Sickness Impact Profile |
| Mood: Geriatric Depression Scale |
| Other: falls data, cognition (MMSE), adverse effects |
| Intention-to-treat analyses: yes |
| Attrition: |
| N = 14 (7.22%) |
| Drop out of 5% from exercise and 9% of control |
| Compliance: |
| Intervention: 89% |
| Control: 92% |
| Key findings: |
| (1) Compared to the control, the exercise group experienced no significant improvements in the physical disability index, sickness impact profile or ADL scores |
| (2) The exercise group used fewer assistive devices than the control group |
| (3) There were fewer falls in the control group |
Mulrow 1994  (Continued)

Adverse events: none reported during sessions, but some participants complained of muscle soreness after 7% of sessions, fatigue and bruising were more commonly reported among intervention participants than controls
12 deaths, 44 hospitalisations

Notes
Funding: grants from the National Institute on Ageing and Veterans Affairs Health Services Research and Development
San Antonio nursing home policy routinely prohibits independent bathing, which results in de facto classification of all residents as dependent in at least one ADL

Risk of bias

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Naso 1990

Methods
Design: Randomised controlled trial
Duration: 1 year
Follow up: none
Method of randomisation: not described
Concealment of allocation: unclear
Outcome assessor blinding: unclear
Group comparability at entry: unclear
Losses to follow up: N = 4 (26.7%)

Participants
Country: USA
Setting: Nursing home
Randomised = 15
% Female = not reported
Age: mean: not reported, range: (range 64 to 97)
Consent: fully informed
Inclusion criteria: see exclusion criteria
Exclusion criteria: cognitive: mental impairment (unable to understand programme description); medical: serious cardiac disease (CCF, angina), other active illness, significant
% Eligible within home: 10
% Eligible that participate: 100
Intervention group: N = 8
Age range: 66 to 97 years
Control group: N = 7
Age range: 64 to 87 years
### Interventions

| Study aim or objective: to examine the effectiveness of an upper extremity and lower extremity exercise programme on endurance |
| Number of experimental groups: 2 |
| Individual session delivery |
| Session duration: 15 minutes |
| Number of sessions per week: 3 |
| Seated: unclear |
| Exercise features: Intervention group: upper and lower body endurance programme based on target heart rates, personnel not described |
| Control group: usual care |

### Outcomes

| Measures: |
| Endurance: duration of exercise, submaximal heart rates at 2 minutes (symptom limited exercise test - ergonometry) |
| Intention-to-treat analyses: yes |
| Attrition: N = 4 |
| % = 26.7 |
| Compliance: not reported |

#### Key findings:

1. There was a small but significant training effect in the arms but not in the legs
2. The training was low-intensity because of the poor physical condition of the participants

#### Adverse events:

- 4 exercise participants developed 5 complications (shoulder pain, anaemia, toe infection, olecranon bursitis and cellulites of left leg), but these were mild or unrelated to the exercise programme; the olecranon bursitis was a complication of the exercise

### Notes

- Funding: not reported

### Risk of bias

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### Methods

**Design:** randomised controlled crossover trial  
Four phases: (1) participant screening and enrolment; (2) baseline assessment and randomisation by computer generated random numbers into immediate intervention (group 1) or delayed intervention (group 2); (3) immediate intervention phase for which group 2 acted as group 1’s control; (4) delayed intervention phase - group 2 receive the intervention and group 1 cross over to no intervention to assess the durability of the intervention's effects  
**Duration:** 16 weeks - after 8 weeks the groups switched  
**Method of randomisation:** computer generated random numbers  
**Concealment of allocation:** A  
**Outcome assessor blinding:** assessor masked to treatment group; but at some treatment sites the group assignment became apparent in a small number of participants  
**Group comparability at entry:** yes  
**Losses to follow up:** (N = 29, 27%) 61 of 107 allocated and 178 eligible completed all assessments

### Participants

**Country:** USA  
**Setting:** 4 Veterans Affairs medical centre nursing homes in the South-East of the USA (Atlanta, Georgia; Durham, North California; Salisbury, North Carolina; West Palm Beach, Florida) selected because of their proximity to the researcher’s home institution in Atlanta, willingness to participate and size of potential population  
All residents at each facility screened  
Randomised = 107  
% Female = 10  
**Age:** mean: approximately 78 years, range: not reported  
**75% Caucasian**  
More than three-quarters of participants had at least one psychiatric diagnosis  
**Consent:** Informed consent from patient where capable, if not, from facility staff nor from a responsible party - assent  
**Inclusion criteria:** long-stay resident (at least 30 days and non-initially admitted for short-term care), able to state their name, or in the presence of aphasia, capable of reliably pointing to two objects, required assistance by two or fewer people for transfer from bed to chair, incontinent of urine or stool, or would be without assistance from staff, not severely behaviourally disturbed, not known to be terminally ill, life expectancy of at least 6 months, not receiving active physical therapy, aged 60 and older  
**Exclusion criteria:** see inclusion criteria  
% Eligible within home: 44  
% Eligible that participate: 60  
**Intervention:**  
N = 52  
% Female = 53  
**Age:** mean: 77.8 years 7.6 years  
**Control:**  
N = 55  
% Female = 50  
**Age:** mean: 78.8 years 6.3 years  
N = 528 assessed for eligibility  
N = 350 did not meet criteria  
Unable to obtain consent for N = 21  
**Attrition before assessment complete N = 50**
N = 107 randomised
Allocated to intervention (group 1) N = 52
Allocated to delayed intervention (group 2) N = 55

Interventions
Study aim or objective: to test the effects of a rehabilitative intervention directed at continence, mobility, endurance, and strength (FIT) in older people living in nursing homes
Number of experimental groups: 2
Individualised intervention delivery
Session duration: n/a
Number of sessions per week: n/a
Seated: yes
Functional incidental training intervention: trained research aides provided opportunities to participate in FIT for 4 to 5 participants every 2 hours between 8 am and 4 pm Monday to Friday for 8 weeks, so each participant could participate in four FIT sessions a day; the intervention included prompted voiding and functionally orientated endurance and strengthening exercises; individualised exercise programmes created from baseline data and modified every 2 weeks; goal for 3 sessions of FIT to involve endurance exercise (sit to stands, walking or wheelchair mobility to a goal time) and 4 sessions to involve strengthening exercises (bicep curls, straight arm exercises, knee extensions and hip abductions and flexions); daily adherence recorded; supervisors conducted periodic process observations and provided additional training and reinforcement on the protocol where needed to endure quality and consistency
Control: usual care

Outcomes
Outcome measures:
Endurance is primary outcome measure
Demographic and clinical data collected, diagnoses and medications
MMSE: cognitive function and affect
Geriatric depression scale
Mobility, endurance, strength and continence
Collected over a 2 day period for each participant
Outcome data collected for group 1 at end of intervention and group 2 at end of cross over period
Mobility dependence rated on 7-point Functional Independence Measures Scale (FIM) for locomotion and toileting/continence
Endurance measured using observations of walking (or wheeling a wheelchair), transfers, and sit-to-stands, average distance and time walked or wheeled during four trials of up to 10 minutes (each with up to three 30 second rest breaks) during the 10 minutes on each of the two days were calculated as was the time to cover six metre in the middle of a 9 metre span during each trial; transfer from chair to chair and back was averaged over four trials; sit-to-stands assessed over four trials per day for the 2-day assessment period with the average time to complete the first, number completed in 30 seconds, and maximum number completed in one trial
For all endurance trials, participants had to be complete at least half of the sessions, if they didn't, their data were considered missing
Strength assessed by highest weight lifted on one complete repetition maximum
Continence assessed using physical checks - % incontinent
Completed phase 1 intervention (group 1: N = 35; group 2: N = 43)
Completed phase 2 intervention (group 1: N = 32; group 2: N = 29)
Intention-to-treat analyses: no
Attrition:
Phase 1: (N = 29) 27%; phase 2: 43%
Compliance:
Intervention: completion of at least one component of FIT in an average of 76% (range 16% to 90%) of FIT sessions
Control: n/a
Key findings:
(1) Baseline significant difference between the intervention and control group in number of sit-to-stand exercises, with immediate intervention group able to do more
(2) Significant effect of the FIT intervention on all measures of endurance, strength and urinary continence, but not on the measures for locomotion or toileting
(3) Group 1 deteriorated during the 8-week cross over period
(4) 67% of completing participants were classed as responders based on maintenance or improvement in at least one measure of endurance, strength and urinary incontinence
Adverse events: none reported

Notes
Funding: grant from the department of veterans affairs rehabilitation services research service
Baseline significant difference between the intervention and control group in number of sit-to-stand exercises, with immediate intervention group able to do more

Risk of bias

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</tbody>
</table>
### Methods
- **Design:** randomised controlled trial
- **Duration:** 15 weeks
- **Follow up:** none
- **Method of randomisation:** randomised cross-over design, using a random numbers table, participants were allocated to either group 1 or group 2 until one group contained 12 participants, the remaining participants were then allocated to the other group
- **Concealment of allocation:** unclear
- **Outcome assessor blinding:** unclear
- **Group comparability at entry:** n/a
- **Losses to follow up:** N = 8 (33%) Group 1: N = 4 (1 discharge home due to improvement with treatment, 2 deaths, 1 hip fracture during control phase); Group 2: N = 4 (2 general deteriorations, 1 circulation problems, 1 death)

### Participants
- **Country:** UK
- **Setting:** long-stay psychiatric hospital patients.
- **Randomised:** 24
- **% Female:** 67
- **Age:** mean: not reported, range: 61 to 91 years
- **Consent:** not specified
- **Inclusion criteria:** diagnosis of dementia, resident of facility, requiring assistance of 1 to 2 persons for transfers, weight-bearing not precluded by hip/knee contractures, < 18 mobility score, unable to stand/mobilise independently, medically fit to participate
- **Exclusion criteria:** medical: signs of severe osteoarthritis, cardiovascular disease, alcoholism, neurological pathology
- **% Eligible within home:** not reported
- **% Eligible that participate:** not reported
- **Group 1:** N = 12
- **Group 2:** N = 12

### Interventions
- **Study aim or objective:** does provision of physiotherapy input improve or maintain mobility skills in elderly people with dementing illness?
- **Number of experimental groups:** 2
- **Individual sessions**
  - **Session duration:** 30
  - **Number of sessions per week:** 3
  - **Seated:** yes
- **Group 1:** physiotherapy followed by no intervention
- **Group 2:** no intervention followed by physiotherapy
- **Physiotherapy comprised movement, music, body awareness and individual functional mobility training, sessions were conducted by a physiotherapist in individual format, 3 times per week for 12 weeks, followed by 3 weeks of videoing**

### Outcomes
- **Measures:**
  - Function: mobility.
  - Other: cognition (CAPE score).
- **Intention-to-treat analyses:** no
**Pomeroy 1993 (Continued)**

<table>
<thead>
<tr>
<th>Attrition: N = 8 (33%)</th>
<th>Group 1: N = 4 (1 discharge home due to improvement with treatment, 2 deaths, 1 hip fracture during control phase)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 2: N = 4 (2 general deteriorations, 1 circulation problems, 1 death)</td>
<td>Compliance: not reported</td>
</tr>
<tr>
<td>Key findings:</td>
<td>(1) 8 of 24 participants did not complete all phases of the experiment, equally distributed across all groups</td>
</tr>
<tr>
<td></td>
<td>(2) There were baseline differences in mobility between the groups, but the cross-over format meant each participant acted as their own control, eliminating any impact of this difference</td>
</tr>
<tr>
<td></td>
<td>(3) There was a significant improvement in mobility during the treatment phase (P = 0.043)</td>
</tr>
<tr>
<td>Adverse events: none related to the intervention, 3 deaths and 2 injuries during the trial period</td>
<td></td>
</tr>
</tbody>
</table>

**Notes**
Funding: Research into Ageing grant
Pilot study

**Risk of bias**

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors’ judgement</th>
<th>Description</th>
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<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - unclear</td>
</tr>
</tbody>
</table>

**Przybylski 1996**

**Methods**
Design: randomised controlled trial
Duration: 2 years
Follow up: none
Method of randomisation: not described, but participants were stratified a priori by severity of their condition using the resident classification system (RCS)
Concealment of allocation: unclear
Outcome assessor blinding: yes - maintained
Group comparability at entry: unclear
Losses to follow up: N = 52 (45%) (29 deaths/discharges, 3 unable to complete tests, 20 insufficient test results)
Individual group data not described

**Participants**
Country: Canada
Setting: nursing Home
Randomised = 115
% Female = approximately 77
Age: mean: approximately 85 years (for original participants), range: 62 to 101 years
Consent: fully informed consent
Inclusion and exclusion criteria: not reported
% Eligible within home: not reported
% Eligible that participate: not reported
### Przybylski 1996  
(Continued)

<table>
<thead>
<tr>
<th><strong>Intervention group</strong></th>
<th>N = 58</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age range: 62 to 97 years</td>
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<tr>
<td>Female/male ratio 3.5:1</td>
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</table>

<table>
<thead>
<tr>
<th><strong>Control group</strong></th>
<th>N = 57</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age range: 63 to 101</td>
<td></td>
</tr>
<tr>
<td>Female/male ratio 3.1:1</td>
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</tbody>
</table>

#### Interventions

- **Study aim or objective:** To determine whether there is a difference in functional status among residents receiving 1 full-time physiotherapist and occupational therapist per 50 beds (enhanced) or per 200 beds (control).
- **Number of experimental groups:** 2
- **Individualised intervention delivery:** Not reported
- **Session duration:** Not reported
- **Number of sessions per week:** Not reported
- **Seated:** Not available

**Intervention group:** Enhanced therapy (physiotherapy/occupational therapy) i.e. increased hours of service on a 1:50 FTE/50 bed ratio, therapy tailored to individual, content/frequency not described.

**Control group:** usual treatment comprising minimal therapy input on a 1:200 FTE/200 bed ratio, no further details given.

#### Outcomes

- **Measures:**
  - Function: general (Functional Independence Measure, Functional Assessment Measure, Clinical Outcome Variables)
  - Other: a cost analysis was also conducted
- **Intention-to-treat analyses:** No
- **Attrition:** (29 deaths/discharges, 3 unable to complete tests, 20 insufficient test results)
- **Individual group data not described**
- **N = 52**
- **% = 45**
- **Compliance:** Not reported

**Key findings:**

The enhanced (1:50) PT/OT was more effective at promoting, maintaining or limiting functional status, especially at 6, 12, and 18-month periods compared to PT/OT provided at 1:200 ratio.

**Adverse events:** None reported.

#### Notes

- **Funding:** Not reported, states that no commercial parties had any interest
- **Physical and occupational therapists and their assistants operated conjointly on the programmes in question.** No differentiation between these two disciplines was made in this study. Treatment was offered in a restorative, consultative, monitoring, low/high maintenance programme format, as suited each participant’s needs.

### Risk of bias

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<thead>
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<tr>
<td></td>
<td>Description</td>
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</table>
### Riccio 1990

<table>
<thead>
<tr>
<th><strong>Methods</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Design: randomised controlled trial</td>
<td></td>
</tr>
<tr>
<td>Duration: n/a (one off intervention)</td>
<td></td>
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<tr>
<td>Follow up: n/a</td>
<td></td>
</tr>
<tr>
<td>Method of randomisation: in accordance with a counterbalanced design no further details given</td>
<td></td>
</tr>
<tr>
<td>Concealment of allocation: unclear</td>
<td></td>
</tr>
<tr>
<td>Outcome assessor blinding: no</td>
<td></td>
</tr>
<tr>
<td>Group comparability at entry: n/a</td>
<td></td>
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<tr>
<td>Losses to follow up: none</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Participants</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Country: USA</td>
<td></td>
</tr>
<tr>
<td>Setting: nursing home, residential retirement home, foster care home</td>
<td></td>
</tr>
<tr>
<td>Randomised = 30</td>
<td></td>
</tr>
<tr>
<td>% Female = 100</td>
<td></td>
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<tr>
<td>Age: mean: 80.9 years 9.2 years, range: 62 to 96 years</td>
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</tr>
<tr>
<td>Consent: not specified</td>
<td></td>
</tr>
<tr>
<td>Inclusion criteria: Parachek score &gt; 25</td>
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<tr>
<td>Exclusion criteria: see inclusion criteria</td>
<td></td>
</tr>
<tr>
<td>% Eligible within home: not reported</td>
<td></td>
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<tr>
<td>% Eligible that participate: not reported</td>
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</table>

<table>
<thead>
<tr>
<th><strong>Interventions</strong></th>
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<tbody>
<tr>
<td>Study aim or objective: to examine the effects of verbally elicited imagery in the encouragement of exercise in elderly women</td>
<td></td>
</tr>
<tr>
<td>Number of experimental groups: 4</td>
<td></td>
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<tr>
<td>Group intervention delivery</td>
<td></td>
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<tr>
<td>Session duration: not reported</td>
<td></td>
</tr>
<tr>
<td>Number of sessions per week: n/a</td>
<td></td>
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<tr>
<td>Seated: yes</td>
<td></td>
</tr>
<tr>
<td>Exercise features:</td>
<td></td>
</tr>
<tr>
<td>Order 1: control condition followed by imaging</td>
<td></td>
</tr>
<tr>
<td>Order 2: imaging followed by control condition</td>
<td></td>
</tr>
<tr>
<td>Imaging: added-purpose activity, e.g. reach down as if you are picking up something from the floor</td>
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<tr>
<td>Control: rote exercise activity, e.g. reach down to the floor with both hands</td>
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<tr>
<td>Two exercises were performed as above - a reaching up exercise, and a reaching down exercise. Interventions were one-offs, supervised by a researcher</td>
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<table>
<thead>
<tr>
<th><strong>Outcomes</strong></th>
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<tbody>
<tr>
<td>Measures:</td>
<td></td>
</tr>
<tr>
<td>Exercise tolerance: number of repetitions, duration of exercise</td>
<td></td>
</tr>
<tr>
<td>Intention-to-treat analyses: no</td>
<td></td>
</tr>
<tr>
<td>Attrition: 3 did not complete all conditions and were excluded from all analysis</td>
<td></td>
</tr>
<tr>
<td>N = 3</td>
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<tr>
<td>% = 10</td>
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</table>
Riccio 1990  (Continued)

<table>
<thead>
<tr>
<th>Compliance: n/a</th>
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<tbody>
<tr>
<td>Key findings:</td>
</tr>
<tr>
<td>(1) Imagery led to significantly more repetitions of the reaching up exercise than the control condition of rote repetition exercise</td>
</tr>
<tr>
<td>(2) Results for reaching down were in the same direction</td>
</tr>
<tr>
<td>Adverse events: none reported</td>
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</table>

Notes
- Funding: not reported

Risk of bias

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</table>

Rosendahl 2006

Methods
- Design: cluster randomised controlled trial
- Duration: approximately 3 months (13 weeks) - 29 occasions
- Follow up: 12 weeks
- Method of randomisation: after inclusion of participants and baseline assessments, 34 clusters of 3 to 9 participants living on the same floor, wing or unit, were randomly assigned to exercise or control activity
- Randomisation was stratified in order to have both groups in each facility; within each cluster the nutrition intervention was randomised individually
- Randomisation using lots in sealed envelopes
- Concealment of allocation: yes
- Outcome assessor blinding: yes, checked at 3 months - if they correctly guessed the participant’s group they were replaced - the case for 11% of participants; checked again at 6 months (1%)
- Group comparability at entry: no, significant differences P < 0.05 for perception of health and prescriptions for proton pump inhibitors
- Losses to follow up: 28 (15%)

Participants
- Country: Sweden (Umeå) - frail older people - activity and nutrition study (FOPANU study)
- Setting: 9 residential care facilities
- Randomised = 191 (of 487 screened)
- % Female = 73
- Age: mean: 84.7 years  6.5 years, range: 65 to 100 years
- Consent: assent accepted
- Inclusion criteria: aged = 65 years, dependent on assistance from a person in one or more ADL according to the Katz index, able to stand up from a chair with arm rests with help from no more than one person, mini-mental state examination score of 10 or higher, approval from the resident’s physician
- Exclusion criteria: see inclusion criteria
- % Eligible within home: 39
- % Eligible that participate: not reported
Interventions

Study aim or objective: to determine whether a high-intensity functional exercise programme improves balance, gait ability, and lower limb strength in activities of daily living, and if an intake of protein-enriched energy supplement immediately after the exercise increases the effects of the training

Number of experimental groups: 4
Group intervention delivery
Session duration: no longer than 45 minutes
Number of sessions per week: 5
Seated: unclear

Groups: both an exercise intervention compared with control activity and a nutrition intervention compared with a placebo in a 2x2 factorial model
Both exercise and control held within the facility, similar distance from where participants stayed where a participant did not attend the session individual activity was offered where possible

Exercise features: groups of 3 to 9 participants, supervised by 2 physiotherapists
Exercise intervention: based on the high intensity functional exercise programme (HIFE programme of Littbrand 2006), functional exercises consisting of every day tasks challenging leg strength, postural stability and gait ability; exercises selected for each participant according to their deficits; all performed in weight bearing positions; encouraged to exercise at high intensity and to increase load and difficulty progressively, considering changes in function and health status; tasks followed up after 3 months by asking staff about compliance during the previous 2 weeks
Control: developed by occupational therapists and involved activities while sitting - watching films, reading, singing, and conversation; groups of 3 to 9 participants, supervised by 1 occupational therapist; based on themes - the old country shop, famous persons, games from the past; designed to be stimulating, even to people with cognitive impairment

Non-exercise features:
Nutrition intervention: protein enriched energy supplement, placebo drink control packaged in the same way as the intervention drink and had similar flavours

Outcomes

Measures:
Descriptive measures taken at baseline - Barthel index, mini mental state examination, Geriatric depression scale, Philadelphia geriatric centre morale scale, functional ambulation categories scale, mini nutritional assessment, diagnoses, drug treatments etc
Assessed at baseline, 3 months and 6 months by physiotherapist
Berg balance scale
Gait ability - 2.4m timed test
Lower-limb strength - 1 maximum repetition in a leg press machine - bilaterally where possible, the heaviest the participant can manage
Modified chair stand test
Intention-to-treat analyses: yes
Attrition:
At 3 months 175 of the 191 followed up; at 6 months 163
drop outs due to death, 2 during the intervention
N = 28
% = 15
Compliance:
72% exercise group;
70% control group
Nutrition drink 82%
Control drink 78%
Key findings:
(1) Exercise group improved significantly in self paced gait speed, and one repetition maximum in lower limb strength
(2) No interaction between exercise and nutrition intervention
(3) High intensity exercise programme has positive long-term effects in balance, gait ability, and lower limb strength for older people dependent in ADL
Adverse events: none led to manifest injury or disease, no further details
There were two deaths during the intervention period

Notes
Funding: grants from the City Council of Västerbotten, the Vårdal foundation, the Magnus Bergvalls Foundation, the Äldrecenterum Västerbotten, the Umeå University Foundation for Medical research, the Gun and Bertil Stohne Foundation, Erik and Anne-Marie Detløf’s foundation, the Loo and Hans Ostermans Foundation, the Borgerskapet in Umeå Research foundation, the Swedish Research Council and the Swedish Council for Working Life and Social Research and Norrmejerier

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<td>A - Adequate</td>
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</table>
**Sackley 2006**

| Methods | Design: cluster randomised controlled trial  
Duration: 12 weeks  
Follow up: 12 weeks  
Method of randomisation: carried out independently by a statistician, homes grouped into 4 strata, using combinations of type (residential, nursing, both), funding source (private or local authority) and setting (urban or rural). Within each stratum, pairs of homes were allocated randomly, using computer-generated random numbers  
Concealment of allocation: yes  
Outcome assessor blinding: yes  
Group comparability at entry: yes  
Losses to follow up: N = 13 (11%) |
| --- | --- |
| Participants | Country: UK  
Setting: 12 care homes, (approached the managers of 14 homes, 1 refused, 1 home used as a pre-pilot) 12 entered into the study in 3 groups of 4 to control therapists’ workload  
Randomised = 118  
% Female = 82  
Age: mean: approximately 87 years, range: 44 to 102 years  
Consent: not specified  
Inclusion criteria: residents with stroke, staff asked to screen patients with the Barthel Index of Daily Living (BI), information on stroke history and cognitive status for the purpose of consent  
Exclusion criteria: medical: acute illness, terminally ill  
% Eligible within home: 46  
% Eligible that participate: 61.8  
Intervention: 88.6 years 6.5 years (62 to 102 years), 83% women  
Control: 86.3 years 8.8 years (44 to 99 years); 82% female  
Intervention: 6 homes; 63 residents, (3 months: 59 assessed, 3 died; before OT: 1 died during/after treatment; 6 months: 53 assessed, 6 died) lost 10 to follow up.  
Control: 6 homes; 55 residents (3 months: 46 assessed, 9 died; 6 months: 35 assessed, 11 died) lost 20 to follow up. |
| Interventions | Study aim or objective: evaluation of occupational therapy intervention to improve self-care independence for residents with stroke related disability living in care homes  
Number of experimental groups: 2  
Individualised intervention delivery  
Session duration: n/a  
Number of sessions per week: n/a  
Seated: n/a  
Intervention: provided by experienced occupational therapist delivered to the individual, targeted at improving independence in personal activities of daily living, frequency and duration dependent on resident’s and therapist’s agreed goals, took place over a 3-month period, intervention group given interview of 1 hour to establish functional ability and agree goals  
Control: usual care |
### Outcomes

| Measures: | Assessments made at baseline, 3 months (intervention end) and 6 months by one of four research staff masked to allocation. Primary outcome was the Barthel Index. Secondary outcomes: Rivermead mobility index (RMI) and the short orientation-memory-concentration test. Intention-to-treat analyses: yes. Attrition at three months: N = 13, % = 11. Compliance: not reported. Key findings: Residents who completed the intervention were less likely to deteriorate in ADLs. 3 months: intervention +0.6, control -0.9; 6 months: intervention -0.3, control -2.1. Poor global outcome: 3 months: intervention N = 20 (32%) control N = 31 (56%); 6 months: intervention N = 32 (51%) control N = 42 (76%). Adverse events: none reported due to the intervention, but 10 died during the intervention period, but only 1 was in the intervention group. |

### Notes

The Stroke Association, Health Foundation, Department of Health Research Capacity Development Program. Pilot study.

### Risk of bias

<table>
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<tr>
<td>Allocation concealment?</td>
<td>Yes</td>
<td>A - Adequate</td>
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</table>

### Sauvage 1992


| Participants | Country: USA. Setting: VA medical centre nursing unit. |
Sauvage 1992  (Continued)

<table>
<thead>
<tr>
<th>Study aim or objective: determine whether a moderate to high intensity strengthening and aerobic exercise programme can improve the strength, exercise capacity, gait, and balance of deconditioned nursing home residents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of experimental groups: 2</td>
</tr>
<tr>
<td>Group intervention delivery</td>
</tr>
<tr>
<td>Session duration: 60 minutes</td>
</tr>
<tr>
<td>Number of sessions per week: 3</td>
</tr>
<tr>
<td>Seated: unclear</td>
</tr>
<tr>
<td>Intervention group: progressive resistance lower limb weight training and aerobic conditioning, group format: 20 minutes of aerobic exercise, 10 repetitions per lower limb exercise, conducted 3 times per week for 12 weeks, personnel not described</td>
</tr>
<tr>
<td>Control group: usual care with maintenance physiotherapy when indicated</td>
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<table>
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<tr>
<th>Interventions</th>
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<tbody>
<tr>
<td>Number of experimental groups: 2</td>
</tr>
<tr>
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</tr>
<tr>
<td>Session duration: 60 minutes</td>
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<tr>
<td>Number of sessions per week: 3</td>
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<tr>
<td>Seated: unclear</td>
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<tr>
<td>Control group: usual care with maintenance physiotherapy when indicated</td>
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<table>
<thead>
<tr>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function: mobility (Tinetti, observation), gait (modified Murray score)</td>
</tr>
<tr>
<td>Muscle power: manual muscle testing, isometric strength test - quadriceps and hamstrings (Cybex)</td>
</tr>
<tr>
<td>Endurance: exercise stress testing (2 mph Balke protocol - treadmill/ bike), muscle endurance (number of repetitions at 180° per sec before decreasing strength to &lt; 50 % peak torque)</td>
</tr>
<tr>
<td>Balance: Tinetti and modified Murray score</td>
</tr>
<tr>
<td>200 people resided in the home, 112 did not meet inclusion criteria and a further 60 were omitted due to significant illness or disability, 5 further because they scored above the mobility criteria and were deemed too functional to benefit from the programme</td>
</tr>
<tr>
<td>Of the remaining 23, only 15 provided informed consent</td>
</tr>
<tr>
<td>Because of resource limitations, only 3 to 4 could exercise at the same time, therefore, only 12 participated 6 allocated to exercise and 6 to control</td>
</tr>
</tbody>
</table>
After completion of the control protocol, 4 control participants also completed the intervention. 2 exercise participants withdrew due to illness. Data for 8 exercise and 6 control participants. Intention-to-treat analyses: no. Attrition: N = 2, % = 16.7. Compliance: Intervention: 95%, Control: n/a. Key findings: (1) Significant increase in Tinetti mobility (P < 0.05). (2) Significant increase in strength (P < 0.01). (3) Balance increases did not reach significance (P = 0.06). (4) Significant improvements in some gait and stride length measurements (P < 0.05). (5) There were no significant improvements in the control group at the end of 12 weeks with the exception of combined hamstring strength P < 0.05.

Notes: Funding: Department of Veterans Affairs Medical Research Service and Rehabilitation Research and Development Service. Due to resource limitations it was not possible for all outcome measures to be assessed by blinded raters. However, raters who did not know the residents’ group assignment did blinded ratings of FIT assessment performance during approximately 10% of the post-intervention assessments in order to help minimize potential bias of un-blinded raters.

Risk of bias:

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<tr>
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<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
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</tbody>
</table>

Schnelle 1995

Schnelle 1995  

Continued

| Participants | Country: USA  
Setting: 5 proprietary nursing facilities  
Randomised = 94  
% Female = 78  
Age: mean: 85.1 years  8.2 years, range: not reported  
Consent: assent acceptable  
Inclusion criteria: incontinent of urine, passing basic cognitive screen  
Exclusion criteria: cognitive: severe cognitive impairment which precluded participation; medical: indwelling catheters; functional: unable to weight bear, unable to propel wheelchairs due to irreversible physical limitations e.g. paralysis  
% Eligible within home: 75  
% Eligible that participate: 34.6  
Intervention group: N = 36  
Control group: N = 40 |
|---|---|

| Interventions | Study aim or objective: to determine if an exercise intervention (FIT) results in improvements in mobility, endurance and physical activity when compared to prompted voiding among cognitively and mobility impaired residents  
Number of experimental groups: 2  
Individualised intervention delivery  
Session duration:  
Number of sessions per week: 20  
All components were conducted after each of 4 prompted voiding episodes per day, 5 days per week, and progressed over the 8 week study period  
Seated: unclear  
Intervention group: prompted voiding and FIT exercise intervention, comprised incontinence care and social interaction, 1 to 2 stands, 1 transfer, walking/wheeling exercises, and sit to stand  
Intervention group received approximately two times greater input than the control group, delivered by research staff on an individual basis over 8 weeks  
Control group: prompted voiding only, comprised incontinence care and social interaction, 1 to 2 stands, and 1 transfer, conducted every 2 hours, 4 times per day, 5 days a week for the 8-week period, delivered by research staff on an individual basis |
|---|---|

| Outcomes | Measures:  
Function: sit to stand  
Endurance: walking/ wheelchair endurance and speed  
Other: overall activity levels (kilo-calories per hour), adherence, and agitation  
Intention-to-treat analyses: no  
Attrition:  
N = 18  
% = 19.1  
Compliance:  
Intervention: 75%  
Control: n/a  
Key findings: |
Schnelle 1995  (Continued)

(1) Only the FIT group showed significant ($P < 0.05$) improvement in walking, wheelchair, and standing endurance
(2) Agitation dropped in both groups - there was no significant difference between them
Adverse events: None reported

Notes
NIA Pepper Centre grant
Ratings of FIT assessment performance during approximately 10% of the post-intervention assessments in order to help minimize potential bias of un-blinded raters

Risk of bias

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<tr>
<th>Item</th>
<th>Authors’ judgement</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
</tr>
</tbody>
</table>

Schnelle 1996

Methods
Design: randomised controlled trial
Duration: 9 weeks
Follow up: none
Method of randomisation: not described
Concealment of allocation: unclear
Outcome assessor blinding: partial (50% of assessments were blind)
Group comparability at entry: yes
Losses to follow up: 26 (26.8%): intervention group N = 12 (8 deaths/ transfers, 4 refused to comply); control group N = 14

Participants
Country: USA
Setting: 5 proprietary nursing facilities
Randomised = 97
% Female = not reported
Age: mean: 84 years, range: not reported
Consent: not specified
Inclusion criteria: > 65 years of age, medical order for physical restraint or visual documentation of restraint use by research staff, basic cognitive and behavioural responsiveness
Exclusion criteria: medical: paralysis, contracture, foot drop, severe arthritic pain
% Eligible within home: 94
% Eligible that participate: 80.7
Intervention group: N = 47
Control group: N = 50

Interventions
Study aim or objective: to evaluate an exercise protocol designed to improve strength and mobility and decrease injury risk factors in physically restrained nursing home residents
Number of experimental groups: 2
Schnelle 1996  (Continued)

<table>
<thead>
<tr>
<th>Individual intervention delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session duration: not reported</td>
</tr>
<tr>
<td>Number of sessions per week: 3</td>
</tr>
<tr>
<td>Seated: if necessary</td>
</tr>
<tr>
<td>Intervention group: exercise safety intervention protocol, comprised mobility exercise, safety practice, rowing endurance and strengthening exercises, targeted pre-set goals and progressed by 10% each week, conducted on an individual basis by a research staff member, 3 times per week for 9 weeks</td>
</tr>
<tr>
<td>Control group: usual care</td>
</tr>
</tbody>
</table>

### Outcomes

<table>
<thead>
<tr>
<th>Measures:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function: mobility and SAFE assessment (standard protocols)</td>
</tr>
<tr>
<td>Muscle power: upper body strength and endurance (rowing assessment), handgrip strength (dynamometer)</td>
</tr>
<tr>
<td>Endurance: mobility endurance (timed walk), lower body muscle endurance (sit to stand)</td>
</tr>
<tr>
<td>Other: physical activity levels, restraint usage</td>
</tr>
</tbody>
</table>

| Intention-to-treat analyses: no |

<table>
<thead>
<tr>
<th>Attrition:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention group N = 12 (8 deaths/ transfers, 4 refused to comply)</td>
</tr>
<tr>
<td>Control group: N = 14</td>
</tr>
<tr>
<td>N = 26</td>
</tr>
<tr>
<td>% = 26.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Compliance:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention: 92%</td>
</tr>
<tr>
<td>Control: n/a</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key findings:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Exercisers showed significant improvement in injury risk and measures related to upper body strength</td>
</tr>
<tr>
<td>(2) Those relate to lower body strength did not improve</td>
</tr>
</tbody>
</table>

| Adverse events: None reported |

### Notes

<table>
<thead>
<tr>
<th>NIA Pepper Centre grant</th>
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Blinded evaluation on all mobility assessments was accomplished in more than 50% of the observations in all homes but the first site; no significant inter-site difference in outcome data was identified as a result of this

### Risk of bias

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<td>Unclear</td>
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</tbody>
</table>
### Schnelle 2002

#### Methods
- **Design:** randomised controlled trial
- **Duration:** 8 months
- **Follow up:** none
- **Method of randomisation:** computerised randomisation program
- **Concealment of allocation:** unclear
- **Outcome assessor blinding:** partial - one of two observers was blind
- **Group comparability at entry:** yes
- **Losses to follow up:** at 8 weeks N = 18 (22%)

#### Participants
- **Country:** USA
- **Setting:** 4 nursing homes (long-stay beds)
- **Randomised = 190**
- **N = 330 met inclusion criteria**
- **N = 257 gave informed consent**
- **N = 190 Baseline assessments completed**
- **% Female = approximately 84**
- **Age:** mean: 87 years, range: not reported
- **Consent:** Assent accepted
- **Inclusion criteria:** incontinent of urine (free of a catheter), able to follow a one-step instruction
- **Exclusion criteria:** medical: residents of post-acute skilled care units, terminal illness, catheterised
- **% Eligible within home:** 73
- **% Eligible that participate:** 57.6
- **Intervention group N = 9**
- **Age range:** 71 to 95 years
- **8 females**
- **Control group: N = 7**
- **Age range:** 65 to 70 years, 76 to 95 years
- **4 females**

#### Interventions
- **Study aim or objective:** to examine clinical outcomes and describe the staffing requirements of an incontinence and exercise intervention
- **Number of experimental groups:** 2
- **Individualised intervention delivery**
- **Session duration:** not reported
- **Number of sessions per week:** every 2 hours up to a maximum of 4 episodes per day, 5 days per week for 32 weeks
- **Seated:** where necessary
- **Intervention group:** prompted voiding, walking/wheeling, sit-stands, supervised by research staff, once daily upper limb resistance training
- **Control group:** usual care

#### Outcomes
- **Measures:**
  - Muscle power: upper body (1 repetition maximum, arm raise/curl with weight)
  - Endurance: standing, walking, wheelchair (protocol)
- **Other:** activity levels, resource analysis
- **Intention-to-treat analyses:** no
- **Attrition:**
Schnelle 2002  (Continued)

N = 18 (9%) at 8 weeks
N = 42 (22%) at 32 week post test
Death N = 28 (14 from each group)
Prolonged illness N = 10
Compliance:
Intervention: n/a
Control: n/a
Key findings:
(1) Improvement or prevention in decline in mobility, upper body strength, and continence in the majority of intervention participants
(2) Intervention residents maintained or improved performance whereas the control group’s performance declined on 14 of 15 outcome measures
(3) One member of staff to 5 residents needed for the programme
Adverse events: None reported

Notes
Grants from the NIH mobility and Incontinence Management Effects on Sickness and National Institute on Ageing UCLA Claude D. Pepper Older Americans Independence Center

Risk of bias

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Schoenfelder 2000

Methods
- Design: randomised controlled trial
- Duration: 12 weeks
- Follow up: 12 weeks
- Method of randomisation: participants were matched in pairs according to their Risk Assessment for Fall Scale II, and then randomly assigned within each pair to the intervention or control group
- Concealment of allocation: unclear
- Outcome assessor blinding: unclear
- Group comparability at entry: yes
- Losses to follow up: N = 0 at 12 weeks, at follow up: intervention group N = 2 (illness/death); control group: none

Participants
- Country: USA
- Setting: 2 long-term care facilities
- Randomised = 16
- % Female = 75
- Age: mean: 82.8 years, range: 65 to 95 years
- Consent: fully informed consent

Schoenfelder 2000

Design: randomised controlled trial
Duration: 12 weeks
Follow up: 12 weeks
Method of randomisation: participants were matched in pairs according to their Risk Assessment for Fall Scale II, and then randomly assigned within each pair to the intervention or control group
Concealment of allocation: unclear
Outcome assessor blinding: unclear
Group comparability at entry: yes
Losses to follow up: N = 0 at 12 weeks, at follow up: intervention group N = 2 (illness/death); control group: none
Inclusion criteria: > 65 years of age, independently mobile (+/- aid), able to speak/understand English, MMSE score > 20
Exclusion criteria: medical: unstable physical condition, terminal illness; functional: abusive behaviour
% Eligible within home: not reported
% Eligible that participate: not reported
Intervention group: N = 9
 Age range: 71 to 95 years
 8 females
 Control group: N = 7
 Age range: 65 to 95 years
 4 females

Interventions
Study aim or objective: to explore the role of exercise in preventing falls, specifically assessing the effectiveness of an ankle strengthening and walking programme to improve balance, ankle strength, walking speed, and falls efficacy and to decrease falls and fear of falling
Number of experimental groups: 2
Unclear whether intervention delivery is group or individualised
Session duration: 20 minutes
Number of sessions per week: 3
Seated: no
Intervention group: ankle strengthening programme (heel raises), walking programme (increasing speed/distance), intervention delivered by a researcher
Control group: usual care

Outcomes
Measures:
Function: level of mobility, assistive devices used, walk frequency, exercise class attendance, participation in other activities or exercises
Muscle power: ankle strength (number of heel raised x 30 seconds), exercise tolerance (walking speed over 6 metres)
Balance: in 3 stances
Other: fear of falling (subjective score and falls efficacy scale), falls data (history, risk assessment - RAWS 2), activity levels during day, cognition (MMSE)
Intention-to-treat analyses: no
Attrition: N = 0 during intervention period
N = 2 (12.5%) at 6 month post test due to illness/death, both from intervention group
Compliance: not reported
Key findings:
(1) Ankle strengthening and walking improved balance, ankle strength, walking speed, and falls efficacy and prevented deterioration
(2) Well received by participants
Adverse events: none reported

Notes
Funding: Gerontological Nursing Interventions Research Center grant

Risk of bias
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</table>

**Schoenfelder 2004**

**Methods**
- Design: randomised controlled trial, matched pairs design
- Duration: 3 months
- Follow up: 3 months
- Method of randomisation: matched in pairs by Risk Assessment for Falls Scale II scores (RAFS II)
- Concealment of allocation: yes - where participants were roommates or spouses they were assigned to the same group to lessen the possibility of contamination
- Outcome assessor blinding: yes - no contact with participants other than assessments
- Group comparability at entry: yes
- Losses to follow up: at 3 months N = 15 (18.5%)
- Intervention:
  - Baseline N = 42
  - 3 months N = 33
  - 6 months N = 30 (-12)
- Control:
  - Baseline N = 39
  - 3 months N = 33
  - 6 months N = 28 (-11)

**Participants**
- Country: USA
- Setting: 10 private urban nursing homes in Eastern Iowa, ranging from 68 beds to 178 beds
- Randomised = 81
- % Female = 77
- Age: mean: 84.1 years, range: 64 to 100 years
- Consent: fully informed
- Inclusion criteria: = 65 years, able to ambulate independently or with an assistive device (so they could take part in an ankle strengthening and walking programme), could speak English, did not have an unstable physical condition, did not have evidence of an end-stage terminal illness, no history of acting out or abusive behaviour, had score of 20 or above on MMSE, doctor's consent sought
- Exclusion criteria: see inclusion criteria
- % Eligible within home: not reported
- % Eligible that participate: not reported
- Intervention: N = 42, female N = 30
- Control: N = 39, female N = 32

**Interventions**
- Study aim or objective: to test a 3-month ankle strengthening and walking programme designed to improve or maintain fall related outcomes
- Number of experimental groups: 2
- Individualised programme delivery
- Session duration: 15-20 minutes
Number of sessions per week: 3
Seated: No
Intervention: 3-month ankle strengthening and walking programme, 3 times weekly, 15 to 20 minutes, programme tailored to individual ability
Control: attention placebo to control for effects of attention and motivation, visited weekly by same research team member who conducted the exercise programme, devoted 30 minutes to an activity such as book reading or 'friendly visiting'

**Outcomes**

<table>
<thead>
<tr>
<th>Measures</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(before intervention, end of intervention (3 months) and 6 month follow up: demographics, mobility/activity information</td>
<td></td>
</tr>
<tr>
<td>Balance: 3 stances</td>
<td></td>
</tr>
<tr>
<td>Ankle strength: mechanical force transducer, walking speed - 6 metre walk</td>
<td></td>
</tr>
<tr>
<td>Fall risk data: Risk Assessment for Falls Scale II scores (RAFS II)</td>
<td></td>
</tr>
<tr>
<td>Fear of falling: own questionnaire</td>
<td></td>
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<tr>
<td>Falls efficacy: falls efficacy scale (FES)</td>
<td></td>
</tr>
<tr>
<td>Cognition: MMSE at baseline</td>
<td></td>
</tr>
<tr>
<td>Intention-to-treat analyses: no</td>
<td></td>
</tr>
<tr>
<td>Attrition:</td>
<td></td>
</tr>
<tr>
<td>Intervention:</td>
<td></td>
</tr>
<tr>
<td>Baseline N = 42, 3 months N = 33 (-9), 6 months N = 30 (-12)</td>
<td></td>
</tr>
<tr>
<td>Control:</td>
<td></td>
</tr>
<tr>
<td>Baseline N = 39, 3 months N = 33 (-6), 6 months N = 28 (-11)</td>
<td></td>
</tr>
<tr>
<td>N = 15 % = 18.5</td>
<td></td>
</tr>
<tr>
<td>Compliance:</td>
<td></td>
</tr>
<tr>
<td>Intervention: not reported</td>
<td></td>
</tr>
<tr>
<td>Control: not reported</td>
<td></td>
</tr>
<tr>
<td>Key findings:</td>
<td></td>
</tr>
<tr>
<td>Balance and fear of falling were maintained or improved for the exercise group in comparison to the control group</td>
<td></td>
</tr>
<tr>
<td>Adverse events: none reported</td>
<td></td>
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</tbody>
</table>

**Risk of bias**

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<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
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</tr>
<tr>
<td>Methods</td>
<td></td>
<td></td>
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<tr>
<td>---------</td>
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<td></td>
</tr>
<tr>
<td>Design: Randomised controlled trial</td>
<td></td>
<td></td>
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<tr>
<td>Duration: 4 weeks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow up: 8 weeks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method of randomisation: blocks due to 2 sites, randomised unequally into EG and CG in anticipation of greater drop-out from exercise group, done by drawing lots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concealment of allocation: unclear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome assessor blinding: not specified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group comparability at entry: yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Losses to follow up: 1 at 4 weeks due to illness, 3 at 18 weeks (total 18%)</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Participants</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Country: Finland</td>
<td></td>
</tr>
<tr>
<td>Setting: 2 care homes for older people with 79 inhabitants (72 female, 7 male)</td>
<td></td>
</tr>
<tr>
<td>Randomised = 28</td>
<td></td>
</tr>
<tr>
<td>% Female = 100</td>
<td></td>
</tr>
<tr>
<td>Age: mean: approximately 81 years, range: not reported</td>
<td></td>
</tr>
<tr>
<td>Consent: fully informed consent</td>
<td></td>
</tr>
<tr>
<td>Inclusion criteria: ≥ 70, able to stand without a walking aid, able to see visual feedback from a computer screen, able to follow instructions for testing and training</td>
<td></td>
</tr>
<tr>
<td>Exclusion criteria: see inclusion criteria</td>
<td></td>
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<tr>
<td>% Eligible within home: 41% volunteered</td>
<td></td>
</tr>
<tr>
<td>% Eligible that participate: 88% of volunteers able to participate</td>
<td></td>
</tr>
<tr>
<td>Exercise group: N = 20, 80.7 years ± 6.1 years</td>
<td></td>
</tr>
<tr>
<td>Control group: N = 8, 82.9 years ± 4.2 years</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Interventions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Study aim or objective: to investigate the effects of a 4-week visual feedback-based balance training on the postural control of frail elderly women living in residential care</td>
<td></td>
</tr>
<tr>
<td>Number of experimental groups: 2</td>
<td></td>
</tr>
<tr>
<td>Individual session delivery</td>
<td></td>
</tr>
<tr>
<td>Session duration: 20 to 30 minutes</td>
<td></td>
</tr>
<tr>
<td>Number of sessions per week: 3</td>
<td></td>
</tr>
<tr>
<td>Seated: no</td>
<td></td>
</tr>
<tr>
<td>Exercise features: 20 to 30-minute individualised dynamic balance exercise sessions on a force platform balance measurement and training device (Good Balance), 3 times a week for 4 weeks</td>
<td></td>
</tr>
<tr>
<td>Goal: teach participants to control the movement of the centre of pressure during dynamic weight shifting, leaning and stepping tasks and to manage these tasks in different stances, with higher spatial and temporal demands</td>
<td></td>
</tr>
<tr>
<td>Control: not specified</td>
<td></td>
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<tr>
<td>Groups: both groups told to continue their normal daily routines and not to change their physical activity</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcomes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measures: Baseline: anthropomorphic measurements, structured health interview</td>
<td></td>
</tr>
<tr>
<td>Measures: Balance measurements: good balance system (Metitue, Jyväskylä, Finland), standing balance tests, dynamic balance tests, Berg balance scale</td>
<td></td>
</tr>
<tr>
<td>Intention-to-treat analyses: no</td>
<td></td>
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</tbody>
</table>
Silhoven 2004  (Continued)

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors' judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attrition:</td>
<td></td>
<td>1 at 4 weeks (control); 3 from exercise group and 1 from control group at 8 weeks, 18%</td>
</tr>
<tr>
<td>Compliance:</td>
<td></td>
<td>Intervention: 97.5% participation rate, only 6 sessions cancelled, mostly because of other appointments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control: n/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Key findings: Exercise group showed significant improvement in balance functions not seen in controls</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adverse events: none reported, one death during the trial period</td>
</tr>
</tbody>
</table>

Notes
- Funding: Ministry of Education and Juhno Vainio Foundation in Finland

Risk of bias

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<tr>
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<tbody>
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<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
</tr>
</tbody>
</table>

Stamford 1972

Methods
- Design: randomised controlled trial
- Duration: 12 weeks
- Follow up: none
- Method of randomisation: not described
- Concealment of allocation: unclear
- Outcome assessor blinding: unclear
- Group comparability at entry: unclear
- Losses to follow up: none

Participants
- Country: USA
- Setting: 2 ambulatory geriatric mental wards at Woodville State Hospital
- Randomised = 17
- % Female = 0
- Age: mean: 69 years, range: not reported
- Consent: assent accepted
- Inclusion criteria: must be ambulatory, medical screening prior to inclusion
- Exclusion criteria: medical: cardiovascular abnormality - ECGs carried out prior to inclusion
- % Eligible within home: not reported
- % Eligible that participate: not reported
- Experimental group: N = 9
- Mean age: 71.5 years
- Control group: N = 8
- Mean age: 65.2 years
**Interventions**

- **Study aim or objective:** to investigate the effects of physical training on institutionalised old men
- **Number of experimental groups:** 2
- **Unclear if group or individual intervention delivery**
- **Session duration:** 9 minutes +
- **Number of sessions per week:** 5
- **Seated:** No
- **Experimental group:** performed treadmill walking with speed and gradient adjustment to maintain heart rate at 70% of age-adjusted maximum, sessions lasted 9 minutes for the first 3 weeks, and increased by 3 minutes every subsequent 3 weeks, sessions were conducted daily, Monday to Friday for 12 weeks, persons delivering the intervention were not described
- **Control group:** usual care

**Outcomes**

- **Measures:**
  - Exercise tolerance: blood pressure, heart rate (bicycle and treadmill ergometer tests)
- **Intention-to-treat analyses:** no
- **Attrition:**
  - N = 0
- **Compliance:**
  - Intervention: not reported
  - Control: n/a
- **Key findings:**
  - (1) Heart rates and blood pressure responses to exercise significantly reduced after training
  - (2) No change in the control group
- **Adverse events:** none reported

**Notes**

- **Funding:** not reported

**Risk of bias**

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</table>
### Methods

**Design:** randomised controlled trial  
**Duration:** 12 weeks  
**Follow up:** 12 weeks  
**Method of randomisation:** lottery method  
**Concealment of allocation:** unclear  
**Outcome assessor blinding:** unclear  
**Group comparability at entry:** no  
**Losses to follow up:** 75 complete data sets from 120 volunteers (63%) 37% drop out

### Participants

**Country:** Australia  
**Setting:** 6 aged-care facilities  
**Randomised:** 120  
**% Female:** 75  
**Age:** mean: 80.5 years, range: not reported  
**Consent:** assent accepted  
**Inclusion criteria:** mild to moderate dementia, assessments made by local Aged Care Assessment Team, level determined by MMSE < 23, resident in an aged care facility, legally and cognitively capable of providing informed consent to participate, able to respond appropriately to the majority of verbal requests, physically capable of undertaking some form of gentle but regular exercise, efforts to ensure participants were joining of their own free choice (frequent questioning where there were memory problems)  
**Exclusion criteria:** cognitive: severe dementia, MMSE of 0 to 9  
**% Eligible within home:** not reported  
**% Eligible that participate:** not reported  
**Group 1:** N = 30; female = 23; mean age = 81 years  
**Group 2:** N = 21; female = 10; mean age = 81.5 years  
**Group 3:** N = 24; female = 23; mean age = 79 years

### Interventions

**Study aim or objective:** to measure the effects of exercise on cognitive symptoms related to dementia and disability levels  
**Number of experimental groups:** 3  
**Group intervention delivery:**  
**Session duration:** 30 minutes  
**Number of sessions per week:** 3  
**Seated:** if necessary  
**Groups:**  
(1) Control group, no intervention  
(2) Control group, social visit from researcher, interactive group discussion on health related issues but no exercise, visits of equivalent duration to the exercise  
(3) 30-minute group exercise programme 3 x week for 12 weeks  
**Intervention:** based on joint and large muscle group movement with an intention to create gentle aerobic exertion, designed to include those in wheelchairs or with impaired movement, generation-appropriate music, data only analysed where participant attended = 75% of sessions

### Outcomes

**Measures:** demographic data, clock drawing test, revised elderly disability scale  
**Intention-to-treat analyses:** no  
**Attrition:**
Stevens 2006  (Continued)

Losses to follow up: N = 45 (38%)
75 complete data sets from 120 volunteers (63%)
Compliance:
Intervention: not reported
Control: n/a
Key findings:
(1) Exercise appeared to slow the rate of progression of cognitive symptoms related to dementia
(2) The revised elderly disability scale showed exercise slowed and reversed disability in some ADLs (self-helping skill and sociability)
Adverse events: none reported

Notes
Funding: not reported

Risk of bias

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</tbody>
</table>

Tappend 1994

Methods
Design: randomised controlled trial
Duration: 20 weeks
Follow up: none
Method of randomisation: not described
Concealment of allocation: unclear
Outcome assessor blinding: maintained
Group comparability at entry: yes
Losses to follow up: 9 (12.5%) (4 before pre-testing completed, 1 transfer, 3 hospitalised), no individual group data provided

Participants
Country: USA
Setting: Nursing home
Randomised = 72
% Female = 75
Age: mean: 84 years 8.5 years, range: 59 to 102 years
Consent: not specified
Inclusion criteria: diagnosis of dementia (on MMSE), 6 or more errors out of 10 on Short Portable Mental Status Questionnaire, ability to stand with assistance of 2 people
Exclusion criteria: medical: evidence of stroke, head injury, major psychiatric problem, mental retardation
% Eligible within home: 80
% Eligible that participate: 37.5
### Interventions

Study aim or objective: to compare the effects of skill training, a traditional stimulation approach and regular care on the ability to perform basic activities of daily living of nursing home residents with dementia.

- Number of experimental groups: 3
- Group intervention delivery:
  - Session duration: 2.5 hours a day
  - Number of sessions per week: 5
  - Seated: unclear
- Skill training group: focused on re-gaining function in basic ADL through repeated practice, with graded assistance
- Stimulation group: recreation-orientated activities, group discussion, music and relaxation
- Control group: usual care

The interventions were delivered in group format by a clinical specialist in gerontological nursing, assisted by a rehabilitation aide, for 2.5 hours per day, 5 days a week, for 20 weeks.

### Outcomes

Measures:
- Function: Physical Self-Maintenance Scale, Performance Test of ADL, plus goal attainment
- Intention-to-treat analyses: no
- Attrition: N = 9 (12.5%)
  - 9 (4 before pre-testing completed, 1 transfer, 3 hospitalized), no individual group data provided
- Compliance: not reported

Key findings:
1. Greatest improvement in the skill training group
2. Moderate improvement in the stimulation group
3. Decline in the control group
4. Group differences were significant (P = 0.04) for the physical self maintenance scale but not for the performance test of activities of daily living (but results for this scale were in the same direction)

Adverse events: none reported

### Notes

- Funding: The Robert Wood Johnson Foundation grant

### Risk of bias

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors’ judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
</tr>
</tbody>
</table>
| Methods | Design: randomised controlled trial  
Duration: 16 weeks  
Follow up: none  
Method of randomisation: not described  
Concealment of allocation: unclear  
Outcome assessor blinding: yes - maintained  
Group comparability at entry: no  
Losses to follow up: N = 6 (8.5%): walking group N = 3, conversation group N = 2, walk and talk group N = 1, no causes specified. |
|---|---|
| Participants | Country: USA  
Setting: nursing home  
Randomised = 71  
% Female = 84  
Age: mean: 87 years, range: 70 to 105 years  
Consent: assent accepted  
Inclusion criteria: Alzheimer's disease, MMSE < 23, ability to stand, ability to mobilise with assistance +/- aid  
Exclusion criteria: medical: vascular dementia, stroke, Parkinson's disease, major depression, schizophrenia  
% Eligible within home: not reported  
% Eligible that participate: not reported  
Walking group: N = 26  
Mean age: 87.4 years (SD 5.87)  
Conversation group: N = 24  
Mean age: 89.6 years (SD 6.53)  
Walk and talk group: N = 21  
Mean age: 84.3 years (SD 7.53) |
| Interventions | Study aim or objective: to examine the effect of a combination of exercise and conversation with walking-only exercise and conversation-only treatments on the functional mobility of frail nursing home residents with Alzheimer's disease.  
Number of experimental groups: 3  
Individual intervention delivery  
Session duration: 30 minutes  
Number of sessions per week: 3  
Seated: no  
Walking group: self-paced with rests as required, and assistance of one/aid as required, no conversation initiated, but researcher responded to communication  
Conversation group: Holland's approach (aphasia) and facilitation for Alzheimer's patients, used in natural conversation  
Walk and talk group: both interventions simultaneously within a 30-minute session |
| Outcomes | Measures:  
Function: mobility (modified 6 min walk)  
Other: treatment fidelity (proportion of actual treatment to intended treatment)  
Intention-to-treat analyses: no |
Attrition: N = 6 (8.5%)
Walking group: N = 3
Conversation group: N = 2
Walk and talk group: N = 1
No causes specified
Compliance:
Walk and talk: 75%
Walk only: 57%
Talk only: 90%
Key findings:
(1) The lost participants were older and had more comorbidities
(2) Significant (P = 0.03) baseline difference between groups for age - the walk and talk group were younger
(3) Walk only group declined in functional mobility by 20.9%
(4) Talk only group declined in functional mobility by 18.8%
(5) Walk and talk group declined in functional mobility by only 2.5%
(6) Group difference significant at P < 0.01 (between groups comparison)
(7) Difference from baseline significant at P < 0.01 (between groups comparison)
(8) Treatment fidelity P < 0.05 (between groups comparison)
(9) Conclude that walking with conversation can contribute to the maintenance of functional mobility in institutionalised persons with Alzheimer's disease

Adverse events: none reported

Notes
Funding: National Institute for Nursing Research grant

Risk of bias

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors' judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
</tr>
</tbody>
</table>

Notes

- Design: randomised controlled trial
- Duration: 8 weeks (see notes)
- Follow up: 1 year
- Method of randomisation: not described
- Concealment of allocation: unclear
- Outcome assessor blinding: yes - maintained
- Group comparability at entry: no
- Losses to follow up: none
**Participants**

<table>
<thead>
<tr>
<th>Country</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting</td>
<td>long-term care facility</td>
</tr>
<tr>
<td>Randomised</td>
<td>13</td>
</tr>
<tr>
<td>% Female</td>
<td>92</td>
</tr>
<tr>
<td>Age: mean</td>
<td>approximately 86 years</td>
</tr>
<tr>
<td>Consent</td>
<td>fully informed consent</td>
</tr>
<tr>
<td>Inclusion criteria</td>
<td>able to walk approximately 250 feet indepenently with or without aid, Tinetti score 14 to 24</td>
</tr>
<tr>
<td>Exclusion criteria</td>
<td>cognitive: dementia; medical: serious illness requiring medical intervention in previous 6 months</td>
</tr>
<tr>
<td>% Eligible within home</td>
<td>not reported</td>
</tr>
<tr>
<td>% Eligible that participate</td>
<td>not reported</td>
</tr>
<tr>
<td>Intervention group</td>
<td>N = 6</td>
</tr>
<tr>
<td>Control group</td>
<td>N = 7</td>
</tr>
</tbody>
</table>

**Interventions**

<table>
<thead>
<tr>
<th>Study aim or objective</th>
<th>to determine the effects of two exercise programmes on balance in elderly, ambulatory people</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of experimental groups</td>
<td>2</td>
</tr>
<tr>
<td>Group intervention delivery</td>
<td>not reported</td>
</tr>
<tr>
<td>Session duration</td>
<td>not reported</td>
</tr>
<tr>
<td>Number of sessions per week</td>
<td>2</td>
</tr>
<tr>
<td>Seated</td>
<td>no</td>
</tr>
<tr>
<td>Exercise group 1 (Control group)</td>
<td>traditional exercise incorporating balance and strengthening exercises, no specific equipment used, included weight transference, walking and lower limb strengthening</td>
</tr>
<tr>
<td>Exercise group 2 (Intervention group)</td>
<td>traditional exercise as above, plus Swiss ball exercises to improve dynamic balance and strengthening component</td>
</tr>
<tr>
<td>Both interventions delivered in group format by a physiotherapy student</td>
<td></td>
</tr>
</tbody>
</table>

**Outcomes**

<table>
<thead>
<tr>
<th>Measures</th>
<th>Balance: Tinetti score.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention-to-treat analyses</td>
<td>no</td>
</tr>
<tr>
<td>Attrition</td>
<td>N = 0</td>
</tr>
<tr>
<td>Compliance</td>
<td>not reported</td>
</tr>
<tr>
<td>Key findings:</td>
<td></td>
</tr>
<tr>
<td>(1) Control group was significantly younger (P &lt; 0.03) than intervention group</td>
<td></td>
</tr>
<tr>
<td>(2) Neither exercise programme made a significant difference in mean Tinetti balance score</td>
<td></td>
</tr>
<tr>
<td>(3) Possibly due to the exercises, or their frequency and duration not being sufficient to produce any measurable change</td>
<td></td>
</tr>
<tr>
<td>Adverse events</td>
<td>none reported</td>
</tr>
</tbody>
</table>
Urbscheit 2001  (Continued)

Notes

Funding: Grants from Kentucky Physical Therapy Association and the University of Louisville Graduate Research fund
Tinetti scores were assessed pre and post-test (8 weeks) for all 13 participants, 8 of the total 13 participants were able to be followed for 1 year post study, although were assessed only in terms of mobility and assistive devices used

Risk of bias

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors’ judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
</tr>
</tbody>
</table>

Yoder 1989

Methods

Design: randomised controlled trial
Duration: n/a (one-off intervention)
Follow up: n/a
Method of randomisation: not described
Concealment of allocation: unclear
Outcome assessor blinding: No
Group comparability at entry: n/a
Losses to Follow up: none

Participants

Country: USA
Setting: 2 nursing homes
Randomised = 30
% Female = 100
Age: mean: 81.5 years 7.2 years, range: 70 to 92 years
Consent: not specified
Inclusion criteria: used the first 30 participants scoring > 25 on Parachek Geriatric Rating Scale, residential status
Exclusion criteria: see inclusion criteria
% Eligible within home: not reported
% Eligible that participate: not reported
Intervention:
Group A: N = 15
Group B: N = 15

Interventions

Study aim or objective: hypothesised that participants engaged in the added-purpose, occupationally embedded exercise would engage in more repetitions, and exercise for a longer duration and with fewer stops than the participants engaged in rote exercise.
Number of experimental groups: 2
Individual session delivery
Session duration: 30 minutes
Number of sessions per week: 2 to 3
Seated: unclear
Added-purpose, occupationally embedded exercise condition designed, through materials and instructions, to elicit a rotary arm exercise with the added purpose of stirring cookie dough. Compared with an occupational form designed to elicit the rotary arm exercise with no added purpose.

### Outcomes

<table>
<thead>
<tr>
<th>Measures:</th>
<th>Intention-to-treat analyses: no</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise tolerance: number of rotations, duration of exercise, frequency of discontinuities</td>
<td></td>
</tr>
<tr>
<td>Attrition: N = 0</td>
<td></td>
</tr>
<tr>
<td>Compliance: Intention: n/a Control: n/a</td>
<td></td>
</tr>
<tr>
<td>Key findings: (1) Added purpose exercise elicited significantly more exercise repetitions than did the rote exercise condition (one-tailed P = 0.012). Adverse events: none reported</td>
<td></td>
</tr>
</tbody>
</table>

### Notes

Funding: not reported

### Risk of bias

<table>
<thead>
<tr>
<th>Item</th>
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<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
</tr>
</tbody>
</table>

### Characteristics of excluded studies  [ordered by study ID]

<table>
<thead>
<tr>
<th>Study</th>
<th>Reason for exclusion</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alessi 1995b</td>
<td>Not primarily physical outcomes of interest (sleep-orientated)</td>
<td></td>
</tr>
<tr>
<td>Alexander 2001</td>
<td>Review group consensus agreed that the study accommodation (congregate housing) was not synonymous with a long term care environment</td>
<td></td>
</tr>
<tr>
<td>Backman 1986</td>
<td>Participants were self-caring within a long-term care environment; interventions were of a psychological, rather than physical, nature</td>
<td></td>
</tr>
<tr>
<td>Becker 2003</td>
<td>Multifaceted intervention included staff and resident education, advice on environmental adaptations and hip protectors</td>
<td></td>
</tr>
<tr>
<td>Binder 1995</td>
<td>Comparison of the same exercise intervention, one group was provided with vitamin supplement</td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Blair 1996</td>
<td>Focus was behavioural management rather than physical activity</td>
<td></td>
</tr>
<tr>
<td>Brill 1999b</td>
<td>Aims to prevent admission to long-term care</td>
<td></td>
</tr>
<tr>
<td>Carmeli 2000</td>
<td>Participants were not randomly allocated to study conditions</td>
<td></td>
</tr>
<tr>
<td>de Carvalho Bastone 2004</td>
<td>Participants were assigned to exercise group or comparative group by personal choice (those who did, or did not want to attend exercise sessions)</td>
<td></td>
</tr>
<tr>
<td>Dyer 2004</td>
<td>Multifactorial falls prevention programme including medication review, podiatry and optometry</td>
<td></td>
</tr>
<tr>
<td>Evans 1995</td>
<td>A review paper which describes an apparently relevant study although insufficient information was provided, and no reference cited. The author was contacted for further information, however no reply was received</td>
<td></td>
</tr>
<tr>
<td>Fisher 1991</td>
<td>Not a RCT</td>
<td></td>
</tr>
<tr>
<td>Fitzimmons 2001</td>
<td>Evaluated the effect of exercise on depression, rather than physical outcomes</td>
<td></td>
</tr>
<tr>
<td>Fox 2000</td>
<td>Review group consensus deemed passive interventions to reduce contractures to be beyond the scope of this review</td>
<td></td>
</tr>
<tr>
<td>Friedman 1991</td>
<td>Aimed to improve communication rather than physical performance measures</td>
<td></td>
</tr>
<tr>
<td>Goldberg 1980</td>
<td>No physical outcomes evaluated</td>
<td></td>
</tr>
<tr>
<td>Hagen 2003</td>
<td>Participants not randomised</td>
<td></td>
</tr>
<tr>
<td>Hopman-Rock 1999</td>
<td>Interventions targeted cognitive, rather than physical, functioning</td>
<td></td>
</tr>
<tr>
<td>Ikezoe 2005</td>
<td>Non-random allocation of participants</td>
<td></td>
</tr>
<tr>
<td>Jensen 2002</td>
<td>Multifaceted intervention to address falls prevention</td>
<td></td>
</tr>
<tr>
<td>Jensen 2004</td>
<td>Multifaceted intervention to address falls prevention</td>
<td></td>
</tr>
<tr>
<td>Judge 1993</td>
<td>Communication with the authors identified very few long-term care patients for whom no separate data were available</td>
<td></td>
</tr>
<tr>
<td>Kelly 1983</td>
<td>Interventions were not aimed primarily at improving physical condition</td>
<td></td>
</tr>
<tr>
<td>Kerse 2004</td>
<td>Falls risk management programme</td>
<td></td>
</tr>
<tr>
<td>Reference</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Light 1984</td>
<td>Review group consensus deemed passive interventions to reduce contractures to be beyond the scope of this review</td>
<td></td>
</tr>
<tr>
<td>MacRae 1996</td>
<td>Non-random allocation to the study conditions</td>
<td></td>
</tr>
<tr>
<td>McMurdo 2000</td>
<td>Multifaceted intervention to address falls risk</td>
<td></td>
</tr>
<tr>
<td>Moyer 1996</td>
<td>Review group consensus excluded this paper on the basis that no objective physical outcomes measures were used</td>
<td></td>
</tr>
<tr>
<td>Nowalk 2001</td>
<td>Primary focus on reduction of falls</td>
<td></td>
</tr>
<tr>
<td>O’Hagan 1994</td>
<td>Non-random allocation to the study conditions</td>
<td></td>
</tr>
<tr>
<td>Ray 1997</td>
<td>Multifaceted falls prevention programme</td>
<td></td>
</tr>
<tr>
<td>Remsburg 1999</td>
<td>Non-random allocation to the study conditions</td>
<td></td>
</tr>
<tr>
<td>Rydwick 2004</td>
<td>Non-random allocation of participants</td>
<td></td>
</tr>
<tr>
<td>Sherrington 1997</td>
<td>Only a small proportion of participants were residing in institutional care, the majority were independently living in the community. The authors were contacted for separate data, but none were available</td>
<td></td>
</tr>
<tr>
<td>Shimada 2003</td>
<td>Participants were from out-patient facilities and nursing homes</td>
<td></td>
</tr>
<tr>
<td>Shumway-Cook 1997</td>
<td>Participants were community-dwelling</td>
<td></td>
</tr>
<tr>
<td>Stasi 2004</td>
<td>Not a physical rehabilitation intervention</td>
<td></td>
</tr>
<tr>
<td>Steffen 1995</td>
<td>Not a RCT</td>
<td></td>
</tr>
<tr>
<td>Stones 1993</td>
<td>Focused on memory rather than physical outcomes of interest</td>
<td></td>
</tr>
<tr>
<td>Tan 2004</td>
<td>Non-random allocation of participants</td>
<td></td>
</tr>
<tr>
<td>Van Heugten 2000</td>
<td>Participants recruited from a variety of settings, no separate data available for long-term care residents</td>
<td></td>
</tr>
<tr>
<td>Wolf 2001</td>
<td>Included independent living and residential care participants</td>
<td></td>
</tr>
<tr>
<td>Yip 2004</td>
<td>Non-random allocation of participants</td>
<td></td>
</tr>
</tbody>
</table>
### Characteristics of studies awaiting assessment  
**[ordered by study ID]**

#### Chin A Paw 2006

<table>
<thead>
<tr>
<th>Methods</th>
<th>RCT, twice weekly intervention delivered for 24 weeks, 3 experimental groups, one control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>N = 224 from 6 long-term care facilities in the Netherlands aged ≥ 65 years, able to walk 6 metres, able to understand instructions and with no medical contraindications to exercise</td>
</tr>
<tr>
<td></td>
<td>Mean age 81.7 years</td>
</tr>
<tr>
<td>Interventions</td>
<td>6 months of bi-weekly strength training, or functional skills training, or both strength and functional skills training</td>
</tr>
<tr>
<td></td>
<td>Social interaction control</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Functional skills training alone or combined with strength training led to improvements in fitness and performance measures</td>
</tr>
<tr>
<td>Notes</td>
<td></td>
</tr>
</tbody>
</table>

#### de Greef 2006

<table>
<thead>
<tr>
<th>Methods</th>
<th>RCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>N = 36, frail, older nursing home residents</td>
</tr>
<tr>
<td>Interventions</td>
<td>Low-intensity exercise programme</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Disability, strength, functional capacity, balance, agility and walking speed</td>
</tr>
<tr>
<td></td>
<td>Performance in ADLs significantly improved</td>
</tr>
<tr>
<td>Notes</td>
<td></td>
</tr>
</tbody>
</table>

#### Donat 2007

<table>
<thead>
<tr>
<th>Methods</th>
<th>Prospective, single blind, RCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>N = 42, aged over 65 years, with risk of falling</td>
</tr>
<tr>
<td>Interventions</td>
<td>Unsupervised home exercise versus supervised exercise group</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Fear of falling, strength, flexibility, balance and functional mobility</td>
</tr>
<tr>
<td></td>
<td>Significant improvement in balance, functional mobility, strength and proprioception</td>
</tr>
<tr>
<td>Notes</td>
<td></td>
</tr>
</tbody>
</table>
**Federici 2005**

<table>
<thead>
<tr>
<th>Methods</th>
<th>RCT, 3-month exercise programme compared to control which did not engage in physical activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>N = 40, aged 58 years</td>
</tr>
<tr>
<td>Interventions</td>
<td>Dance-based exercise programme, 3 months, twice a week for from 30 to a maximum of 60 minutes General conditioning, later static and dynamic balance and co-ordination</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Balance significantly improved in the intervention group</td>
</tr>
<tr>
<td>Notes</td>
<td></td>
</tr>
</tbody>
</table>

**Makita 2006**

<table>
<thead>
<tr>
<th>Methods</th>
<th>RCT of exercise therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>N = 145 female nursing home residents, with stable health in Tokyo, Japan</td>
</tr>
<tr>
<td>Interventions</td>
<td>Exercise therapy 3 times a week for 3 months focusing on ROM and balance</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Flexibility and ROM improved</td>
</tr>
<tr>
<td>Notes</td>
<td></td>
</tr>
</tbody>
</table>

**Mozley 2007**

<table>
<thead>
<tr>
<th>Methods</th>
<th>Cluster RCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>143 care home residents</td>
</tr>
<tr>
<td>Interventions</td>
<td>Individualised therapy programme delivered by a full-time occupational therapist</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Geriatric Mental State -Depression Scale, Barthel Index, Manchester Quality of Life Profile-Residential</td>
</tr>
<tr>
<td>Notes</td>
<td></td>
</tr>
</tbody>
</table>

**Rolland 2007**

<table>
<thead>
<tr>
<th>Methods</th>
<th>RCT, 1 hour bi-weekly intervention versus routine care control for 12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>Nursing home residents with mild Alzheimer's disease from 5 homes in Toulouse, France N = 134, mean age 83 years Able to transfer from chair and walk 6 metres without human assistance</td>
</tr>
<tr>
<td>Interventions</td>
<td>Individualised aerobic, strength, flexibility and balance training, 1 hour, twice a week, separated by at least one day</td>
</tr>
</tbody>
</table>
Rolland 2007  (Continued)

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Slower decline in functional ADL measures than those receiving routine medical care Faster walking in intervention group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notes</td>
<td></td>
</tr>
</tbody>
</table>

Sato 2007

<table>
<thead>
<tr>
<th>Methods</th>
<th>RCT, once-a-week intervention versus twice-a-week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>N = 21</td>
</tr>
<tr>
<td>Interventions</td>
<td>Once versus twice-a-week water exercise including functional mobility in water for 6 months</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Significant improvements in functional mobility in both groups compared to baseline, no change after 3 months</td>
</tr>
<tr>
<td>Notes</td>
<td></td>
</tr>
</tbody>
</table>

Tseng 2006

<table>
<thead>
<tr>
<th>Methods</th>
<th>RCT, usual care versus 2 intervention groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>N = 59 bed-ridden stroke survivors 4 week, twice per day, 6 days per week</td>
</tr>
<tr>
<td>Interventions</td>
<td>2 range of motion protocols, exercising upper and lower extremities, with versus without nurse assistance</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Simple nurse-led ROM enhanced physical and psychological function of bed-ridden older people with stroke</td>
</tr>
<tr>
<td>Notes</td>
<td></td>
</tr>
</tbody>
</table>

Characteristics of ongoing studies  [ordered by study ID]

Frandin 2007

<table>
<thead>
<tr>
<th>Trial name or title</th>
<th>The effect on function of increasing activity for nursing home residents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methods</td>
<td></td>
</tr>
<tr>
<td>Participants</td>
<td>Residents expected to stay in nursing homes &gt; 3 months</td>
</tr>
<tr>
<td>Interventions</td>
<td>Individually tailored enhanced activities of daily living training</td>
</tr>
</tbody>
</table>
### Frandin 2007

| Outcomes | Physical function, well being, amount of activity, falls |
| Starting date | August 2005 |
| Contact information | Kerstin Frandin, kerstin.frandin@neurotec.ki.se |
| Notes | |

### Grant 2007

| Trial name or title | The effect of exercise on muscle, function and cost in VA nursing home residents |
| Methods | |
| Participants | Residents in VA nursing home, 65 years or older, able to follow one step commands |
| Interventions | Low intensity exercise |
| Outcomes | Muscle mass, physical function, cost |
| Starting date | 2002 |
| Notes | HSRP20071249 |

### Underwood 2007

| Trial name or title | Older people's exercise intervention in residential and nursing accommodation |
| Methods | |
| Participants | Residents in nursing home, over 65 years, able to participate in baseline assessment, able to transfer |
| Interventions | Physical activation and group based exercise programme |
| Outcomes | Impact on depression, EQ5D, Mobility, falls, cognitive function, pain, medication use, hospital admissions |
| Starting date | 1/01/08 |
| Notes | Martin Underwood, m.underwood@qmul.ac.uk |
DATA AND ANALYSES

This review has no analyses.

APPENDICES

Appendix 1. MEDLINE search strategy

We used the following search strategy for MEDLINE (Ovid) and adapted it for the other databases
1. homes for the aged/
2. exp nursing homes/
3. group homes/
4. housing for the elderly/
5. residential facilities/
6. long-term care/
7. halfway houses/
8. hospitals, veterans/
9. geriatric nursing/
10. or/1-9
11. aged/ or “aged, 80 and over”/ or frail elderly/
12. (elderly or geriatr$ or old age or late life).tw.
13. 11 or 12
14. Nursing Care/
15. Rehabilitation Nursing/
16. community health nursing/
17. hospitals, convalescent/
18. rehabilitation centers/
19. institutionalization/
20. or/14-19
21. 13 and 20
22. ((nursing or group) adj home$).tw.
23. ((home$ or hous$ or residen$ or institution$ or facilit$) adj5 (aged or elderly or old age or geriatric)).tw.
24. (residential or long-term) adj5 (care or facilit$)).tw.
25. ((sheltered or retirement or residential) adj5 (house$ or home$ or accommodation)).tw.
26. (life care cent$ or continuing care cent$ or extended care facilit$).tw.
27. ((care or convalescent) adj (home$ or cent$ or facilit$)).tw. and 13
28. or/22-27
29. 10 or 21 or 28
30. rehabilitation/
31. occupational therapy/
32. physical therapy techniques/
33. "physical therapy (specialty)"/
34. exercise therapy/or hydrotherapy/
35. exercise movement techniques/
36. exercise/
37. dance therapy/
38. early ambulation/
39. tai ji/or bicycling
40. walking/ or yoga/
41. "physical education and training"/
42. physical fitness/
43. recovery of function/
44. rehabilitation nursing/
45. residential treatment/
46. physical stimulation/
47. health promotion/
48. leisure activities/ or recreation/ or dancing/
49. health facility environment/
50. (rehabilitat$ or exercise$ or physiotherap$ or keep fit$).tw.
51. (Physical adj3 (therap$ or education or train$ or stimulat$ or fitness or activit$ or function$)).tw.
52. ((exercise or movement or occupational or residential) adj5 (therap$ or train$ or treatment or program$)).tw.
53. (strength$ or aerobic or resistance) adj3 activit$.tw.
54. (improve$ adj3 (function or mobil$ or recover$)).tw.
55. ((fitness or health) adj3 promotion).tw.
56. (dance$ or walk$ or yoga or tai chi or leisure activit$ or bicycl$ or cycl$ or aquatic).tw.
57. ((endurance or balance or strength or flexibility) adj3 training).tw.
58. or/30-57
59. randomized controlled trial.pt.
60. randomized controlled trials/
61. controlled clinical trial.pt.
62. controlled clinical trials/
63. random allocation/
64. clinical trial.pt.
65. exp clinical trials/
67. random$.tw.
68. research design/
69. multicenter study.pt.
70. intervention studies/
71. cross-over studies/
72. control$.tw.
73. alternate treatment.tw.
74. latin square.tw.
75. "comparative study"/
76. exp evaluation studies/
77. Follow-up studies/
78. Prospective studies/
79. prospective.tw.
80. counterbalance$.tw.
81. quasi-random$.tw.
82. ((experiment$ or treatment) adj3 (design$ or condition or group$)).tw.
83. or/59-82
84. 29 and 58 and 83
WHAT'S NEW

Last assessed as up-to-date: 29 July 2008.

17 March 2008  Amended  Converted to new review format.

HISTORY

Review first published: Issue 1, 2009

CONTRIBUTIONS OF AUTHORS

Anne Forster conceived and designed the review and wrote the funding application with the assistance of John Young, Jane Smith and John Green. Jo Hardy and Anne Forster took a lead role in writing the protocol with advice from John Young, Jane Smith and John Green. Anne Forster co-ordinated the review with assistance from Jo Hardy and Ruth Lambley. Jo Hardy and Anne Forster developed the search strategy, and organised the retrieval of papers. Anne Forster, Jo Hardy and Ruth Lambley screened search results. Jo Hardy wrote to authors of papers for additional information. All co-authors assisted in identification of papers for inclusion into the review, appraised quality of papers, assisted in the design of the data extraction protocol and extracted data from papers. Ruth Lambley undertook data management, assimilation of information from all included papers and led the writing of the review.

DECLARATIONS OF INTEREST

John Young is a co-applicant for a research grant from BUPA to investigate delirium prevention in care homes. Anne Forster, John Young and Ruth Lambley are developing a research project to investigate exercise programmes in care homes. This work started after the results of the Cochrane review had been submitted.

SOURCES OF SUPPORT

Internal sources

- NHS R&D Levy Funding, UK.

External sources

- Physiotherapy Research Foundation, UK.