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Case management for integrated care of older people with frailty in community settings (Review)

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TABLE OF CONTENTS

[Intervention Review]

Case management for integrated care of older people with frailty in community settings

Euan Sadler[1,2], Zarnie Khadjesari[3], Alexandra Ziemann[4], Katie J Sheehan[5], Julie Whitney[5,6], Dan Wilson[6], Ioannis Bakolis[7], Nick Sevdalis[8], Jane Sandall[9], Tayana Soukup[10], Teresa Corbett[11], Daniela C Gonçalves-Bradley[12], Dawn-Marie Walker[1]

[1]School of Health Sciences, University of Southampton, Southampton, UK. [2]Southern Health NHS Foundation Trust, Southampton, UK. [3]School of Health Sciences, University of East Anglia, Norwich, UK. [4]Department of Social & Policy Sciences, University of Bath, Bath, UK. [5]School of Life Course & Population Sciences, King's College London, London, UK. [6]Department of Clinical Gerontology, King's College Hospital NHS Foundation Trust, London, UK. [7]Health Service & Population Research Department, King's College London, London, UK. [8]Centre for Behavioural & Implementation Science Interventions (BISI), National University of Singapore, Singapore, Singapore. [9]Department of Women and Children's Health, King's College London, London, UK. [10]Department of Surgery and Cancer, Imperial College London, London, UK. [11]Faculty of Sport, Health and Social Sciences, Solent University, Southampton, UK. [12]CINTESIS – Center for Health Technology and Services Research, Porto, Portugal

Contact: Euan Sadler, E.A.Sadler@soton.ac.uk.

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ABSTRACT

Background

Ageing populations globally have contributed to increasing numbers of people living with frailty, which has significant implications for use of health and care services and costs. The British Geriatrics Society defines frailty as "a distinctive health state related to the ageing process in which multiple body systems gradually lose their inbuilt reserves". This leads to an increased susceptibility to adverse outcomes, such as reduced physical function, poorer quality of life, hospital admissions, and mortality. Case management interventions delivered in community settings are led by a health or social care professional, supported by a multidisciplinary team, and focus on the planning, provision, and co-ordination of care to meet the needs of the individual. Case management is one model of integrated care that has gained traction with policymakers to improve outcomes for populations at high risk of decline in health and well-being. These populations include older people living with frailty, who commonly have complex healthcare and social care needs but can experience poorly co-ordinated care due to fragmented care systems.

Objectives

To assess the effects of case management for integrated care of older people living with frailty compared with usual care.

Search methods

We searched CENTRAL, MEDLINE, Embase, CINAHL, Health Systems Evidence, and PDQ Evidence and databases from inception to 23 September 2022. We also searched clinical registries and relevant grey literature databases, checked references of included trials and relevant systematic reviews, conducted citation searching of included trials, and contacted topic experts.

Selection criteria

We included randomised controlled trials (RCTs) that compared case management with standard care in community-dwelling people aged 65 years and older living with frailty.

Data collection and analysis

We followed standard methodological procedures recommended by Cochrane and the Effective Practice and Organisation of Care Group. We used the GRADE approach to assess the certainty of the evidence.

Main results

We included 20 trials (11,860 participants), all of which took place in high-income countries. Case management interventions in the included trials varied in terms of organisation, delivery, setting, and care providers involved. Most trials included a variety of healthcare and social care professionals, including nurse practitioners, allied healthcare professionals, social workers, geriatricians, physicians, psychologists, and clinical pharmacists. In nine trials, the case management intervention was delivered by nurses only. Follow-up ranged from three to 36 months. We judged most trials at unclear risk of selection and performance bias; this consideration, together with indirectness, justified downgrading the certainty of the evidence to low or moderate.

Case management compared to standard care may result in little or no difference in the following outcomes.

- Mortality at 12 months' follow-up (7.0% in the intervention group versus 7.5% in the control group; risk ratio (RR) 0.98, 95% confidence interval (CI) 0.84 to 1.15; I^2 = 11%; 14 trials, 9924 participants; low-certainty evidence)
- Change in place of residence to a nursing home at 12 months' follow-up (9.9% in the intervention group versus 13.4**%** in the control group; RR 0.73, 95% CI 0.53 to 1.01; I^2 = 0%; 4 trials, 1108 participants; low-certainty evidence)
- Quality of life at three to 24 months' follow-up (results not pooled; mean differences (MDs) ranged from −6.32 points (95% CI −11.04 to −1.59) to 6.1 points (95% CI −3.92 to 16.12) when reported; 11 trials, 9284 participants; low-certainty evidence)
- Serious adverse effects at 12 to 24 months' follow-up (results not pooled; 2 trials, 592 participants; low-certainty evidence)
- Change in physical function at three to 24 months' follow-up (results not pooled; MDs ranged from −0.12 points (95% CI −0.93 to 0.68) to 3.4 points (95% CI −2.35 to 9.15) when reported; 16 trials, 10,652 participants; low-certainty evidence)

Case management compared to standard care probably results in little or no difference in the following outcomes.

- Healthcare utilisation in terms of hospital admission at 12 months' follow-up (32.7**%** in the intervention group versus 36.0% in the control group; RR 0.91, 95% CI 0.79 to 1.05; I^2 = 43%; 6 trials, 2424 participants; moderate-certainty evidence)
- Change in costs at six to 36 months' follow-up (results not pooled; 14 trials, 8486 participants; moderate-certainty evidence), which usually included healthcare service costs, intervention costs, and other costs such as informal care.

Authors' conclusions

We found uncertain evidence regarding whether case management for integrated care of older people with frailty in community settings, compared to standard care, improved patient and service outcomes or reduced costs. There is a need for further research to develop a clear taxonomy of intervention components, to determine the active ingredients that work in case management interventions, and identify how such interventions benefit some people and not others.

PLAIN LANGUAGE SUMMARY

Case management programmes for older people living with frailty in the community

Key messages

- Case management programmes for older people living with frailty in the community may make little or no difference to patient and service outcomes and care-related costs.
- There is insufficient evidence to warrant any current change in practice.
- Futures trials are needed to determine which elements of these programmes benefit different people.

Why is this review important?

The number of people living with frailty aged 65 years and older is increasing around the world. There is no standard definition of frailty, but broadly speaking, frailty is an age-related reduced ability to recover quickly following a health problem, which can then have a significant impact on the person's everyday activities. People living with frailty are at high risk of declines in health and well-being, and often experience poorly co-ordinated health and care services. Integrated care aims to improve co-ordination of services and patient outcomes and is being widely implemented in the UK and internationally. Case management is one type of community-based integrated care programme. These programmes are delivered by a health or social care professional, supported by a wider team, and include assessment, care planning, and co-ordination of care to meet the needs of the individual. No reviews have looked at whether case management

improves patient and service outcomes and reduces costs in people aged 65 years and older living with frailty, compared with standard care (usually involving management of care with a general practitioner). We conducted this review to address that gap.

What did we want to find out?

We wanted to find out if case management programmes are better than standard care for improving mortality, nursing home admission, quality of life, complications (medical event or injury that arose as a consequence of taking part in the trial), physical function, hospital admission, and costs.

What did we do?

We searched the scientific literature for randomised controlled trials, in which participants were randomly assigned to receive either the case management programme or standard care.

What did we find?

We found 20 relevant trials conducted in high-income countries in Europe, North America, Asia, and Oceania. This represented 11,860 people living with frailty.

Key results

• Mortality

The evidence is based on 14 trials with 9924 participants. Case management programmes compared to standard care may result in little or no difference in mortality after 12 months.

• Nursing home admission

The evidence is based on four trials with 1108 participants. Case management programmes compared to standard care may result in little or no difference in nursing home admission after 12 months.

• Quality of life

The evidence is based on 11 trials with 9284 participants. Case management programmes compared to standard care may result in little or no difference in quality of life after three to 24 months.

• Complications

The evidence is based on two trials with 592 participants. Case management programmes compared to standard care may result in little or no difference in complications after 12 to 24 months.

• Change in physical function

The evidence is based on 16 trials with 10,652 participants. Case management programmes compared to standard care may result in little or no difference in physical function after three to 24 months.

• Hospital admission

The evidence is based on five trials with 2424 participants. Case management programmes compared to standard care probably result in little or no difference in hospital admission after 12 months.

• Change in costs

The evidence is based on 14 trials with 8486 participants. Case management programmes compared to standard care probably result in little or no difference in change in costs (including healthcare service costs, intervention costs, and other costs such as informal care) after six to 36 months.

Main limitations of this review

We have little confidence in the evidence on mortality, nursing home admission, quality of life, complications, and change in physical function, and we are moderately confident in the evidence on change in healthcare utilisation and change in costs. Issues that reduced our confidence in the evidence included substantial variation between trials in the number of people enrolled, the definition of frailty, the setting of case management programmes, the care providers involved, and the time point of outcome measurement.

How up-to-date is this review?

The review authors searched for trials up to 23 September 2022.

SUMMARY OF FINDINGS

Summary of findings 1. Case management for integrated care compared to usual care of older people living with frailty in community settings

Case management for integrated care compared to usual care of older people living with frailty in community settings

Patient or population: people aged 65 years and older living with frailty
Setting: community (11 trials), primary care (4 trials), community and hospital (3 trials), community and primary care (2 trials); Europe (6 trials), North America (4 trials), Asia (4 trials); all trials conducted in high-income countries
Intervention: case management, defined as a community-based intervention that focuses on the planning, provision, and co-ordination of healthcare and social care to meet the needs of the individual
Comparison: standard care, defined as assessment, management, and care planning, usually by a GP, within a primary and community care setting

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (trials)	Certainty of the evidence (GRADE)	Comments
	Risk with usual care	Risk with case management for integrated care				
Mortality Follow-up: 12 months	**Study population**		**RR 0.98** (0.84 to 1.15)	9924 (14 RCTs)	⊕⊕⊖⊖ **Low**[a,b]	Case management may result in little or no difference in mortality at 12 months' follow-up (7.0% in intervention versus 7.5% in control group).
	75 per 1000	70 per 1000				
Change in place of residence to a nursing or residential home Follow-up: 12 months	**Study population**		**RR 0.73** (0.53 to 1.01)	1108 (4 RCTs)	⊕⊕⊖⊖ **Low**[a,c]	Case management may result in little or no difference in change in place of residence to a nursing home at 12 months' follow-up (9.9% in intervention group versus 13.4% in control group).
	134 per 1000	99 per 1000				
Quality of life Assessed with SF, EQ-5D, EQ-VAS, HRQOL, CL Follow-up: 3–24 months	Most trials reported little or no difference between groups for quality of life. Effects ranged from MD −6.32 points (95% CI −11.04 to −1.59) to MD 6.1 points (95% CI −3.92 to 16.12) when reported. We did not pool results owing to differences in outcomes reported and variation in the time points measured		—	9284 (11 RCTs)	⊕⊕⊖⊖ **Low**[a,d]	Case management may result in little or no difference in quality of life at 3 to 24 months' follow-up.
Serious adverse effects	Defined as number of individuals reporting a medical event or injury that arose as a consequence of participating in the trial.		—	592 (2 RCTs)	⊕⊕⊖⊖ **Low**[a,e]	Case management may result in little or no difference in serious adverse effects at 12 to 24 months' follow-up.

Follow-up: 12–24 months	The trials found little or no difference between groups for serious adverse effects. We did not pool results owing to variation in types of medical event or injury and in time points measured.				
Change in physical function Assessed with BI, GARS, KI, MKI, OARS, SSPB, TMIG-IC Follow-up: 3–24 months	Most trials reported little or no difference between groups for change in physical function. Effects ranged from MD −0.12 points (95% CI −0.93 to 0.68) to MD 3.4 points (95% CI −2.35, 9.15) when reported. We did not pool results owing to differences in outcomes reported, units of measurement, and time points of measurement.	—	10,652 (16 RCTs)	⊕⊕⊖⊖ **Low**[a,c]	Case management may result in little or no difference in change in physical function at 3 to 24 months' follow-up.
Change in healthcare utilisation (hospital admissions) Follow-up: 12 months	**Study population** 360 per 1000 327 per 1000	**RR 0.91** (0.79 to 1.05)	2424 (5 RCTs)	⊕⊕⊕⊖ **Moderate**[a]	In terms of change in healthcare utilisation, case management likely results in little or no difference in hospital admission at 12 months' follow-up (32.7% in the intervention group versus 36.0% in the control group).
Change in costs Follow-up: 6–36 months	Most trials reported little or no difference between groups for change in total costs, which usually included healthcare services, costs associated with the intervention, and other costs. We did not pool results owing to variation in units of measurements and time points of measurement.	—	8486 (14 RCTs)	⊕⊕⊕⊖ **Moderate**[a]	Case management likely results in little or no difference in change in costs at 6 to 36 months' follow-up.

*__The risk in the intervention group__ (and its 95% CI) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
BI: Barthel Index; **CI:** confidence interval;**CL:** Cantril's Ladder; **EQ-VAS:** EuroQol visual analogue scale; **GARS:** Groningen Activity Restriction Scale; **GP:** general practitioner; **HRQOL:** Health-Related Quality of Life Scale; **KI:** Katz Index of Independence in Activities of Daily Living; **MD**: mean difference; **MKI:** Modified Katz Index; **OARS:** Older American Resources and Services Multidimensional Functional Assessment Questionnaire; **RCT:** randomised controlled trial; **RR:** risk ratio; **SF:** Medical Outcomes Study Short-Form Health Survey; **SSPB:** Short Physical Performance Battery; **TMIG-IC:** Tokyo Metropolitan Institute of Gerontology Index of Competence.

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect.

[a] Downgraded one level for indirectness due to limitations associated with the definition of frailty in some trials.

[b] Downgraded one level for inconsistency, as the point estimate varied across trials. Although the formal test for statistical heterogeneity indicated that its value may not be important, methodological and clinical heterogeneity may reflect inconsistency between trials.
[c] Downgraded one level for inconsistency, as the results in general and point estimates in particular varied considerably between trials.
[d] Downgraded one level for risk of bias (unclear risk of performance bias).
[e] Downgraded one level for imprecision due to the small number of events and participants.

BACKGROUND

Demographic changes and advances in medical care and technology have led to an ageing global population. Although growing numbers of older people are living longer, many are doing so with one or more long-term conditions (Beard 2016). A key driving force for international policy agendas worldwide is to improve the quality, efficiency, and safety of health and care services through the delivery of effective integrated care (WHO 2016). Integrated care, broadly defined as "an organising principle for care delivery that aims to improve patient care and experience through improved coordination" (Shaw 2011), is widely recognised as a priority for care systems, policy-makers, and users globally (WHO 2016). In the UK, recent policy drives have led to the implementation of Integrated Care Systems (ICSs) across England. The aim of ICSs is to improve collaborative working between the UK National Health Service (NHS), other care providers, service users, carers, and local community organisations (NHS 2019). This review focuses on case management as one service model for delivering integrated care, among others. Case management has gained traction with policymakers and care providers as an approach to potentially improving patient and service outcomes, quality of care, and reducing costs for populations at high risk of decline in health and well-being, and emergency and hospital admissions (Hughes 2020; Ross 2011). The most vulnerable people in this group are classified as frail (Goodwin 2014; NHS 2019; Oliver 2014).

Description of the condition

This Cochrane Review focuses on community-dwelling people aged 65 years and older living with frailty. The British Geriatrics Society defines frailty as "a distinctive health state related to the ageing process in which multiple body systems gradually lose their inbuilt reserves" (British Geriatrics Society 2018). This leads to increased susceptibility to adverse outcomes, such as reduced physical function, poorer quality of life, hospital admissions, and mortality (Clegg 2013). Frailty is increasingly viewed as a long-term condition (Harrison 2015), and the prevalence of frailty increases with age. In the UK, the proportion of people living with frailty increases from 6.5% in those aged 60 years to 65% in those aged 90 years and older (Gale 2015). Frailty is also more prevalent among women (Gale 2015), minority ethnic groups (Majid 2020), lower socioeconomic groups (Gu 2016; Majid 2020), and people living in deprived neighbourhoods (Sinclair 2022). Individuals with frailty can have complex health and psychosocial needs (Manthorpe 2015), commonly experience multimorbidity (Hewitt 2016), and have higher care and support needs, resulting in higher levels of health and care service use and associated costs (Bock 2016; Han 2019). Owing to a general lack of care co-ordination and fragmented service provision, this population is at increased risk of poorer quality of care and health outcomes (Ament 2014; Andreasen 2015; Oliver 2014).

Description of the intervention

The intervention evaluated in this review is case management as a strategy for integrated care. Case management is a community-based intervention that focuses on the planning, provision, and co-ordination of healthcare and social care tailored to meet the needs of individuals with high support and care needs (Oeseburg 2009; Reilly 2015). Case management interventions are multifaceted and comprise multiple intervention components, including case finding, comprehensive assessment, care planning and provision, care co-ordination, monitoring, and evaluation (Ross 2011; Sandberg 2014). Such interventions are typically led by a nurse, social worker, or allied healthcare professional (e.g. physiotherapist), with the support of a multidisciplinary team. They are delivered in community care settings (i.e. the individual's home environment rather than an acute or residential care setting; Reilly 2015). Studies have identified case management as a common component of integrated care approaches for older people with complex care needs, including those living with frailty (Baxter 2018; Briggs 2018).

How the intervention might work

Given the reported benefits of delivering services closer to older people's home environment, and older people's preference for this approach (Oliver 2014; Shepperd 2021), it is important to understand how case management interventions for older people living with frailty might work. There is Cochrane Review evidence that case management for people living with dementia and their carers reduces rates of care home admission and healthcare costs in the medium term, and improves psychosocial outcomes for carers (Reilly 2015). The evidence for the benefits of case management for older people living with frailty are less clear, as not all people living with dementia have frailty.

There is some evidence from randomised controlled trials (RCTs) that case management interventions for older people living with frailty improve independence in activities of daily living (Eklund 2013), reduce mobility-related disability (Fairhall 2012), increase patient satisfaction (Gagnon 1999), delay admission to hospital or a nursing home (Bernabei 1998; Oeseburg 2009), reduce healthcare service use (Bernabei 1998; Oeseburg 2009; Sandberg 2015), and reduce healthcare costs (Bernabei 1998; Oeseburg 2009). One previous systematic review found that such interventions improve psychological health and well-being, and address unmet service needs (You 2012). However, other RCTs have found no effects of case management on improving levels of disability (Metzelthin 2013), improving quality of life and functional status, and reducing admission to hospital or length of hospital stay (Gagnon 1999). Another systematic review examining the effects of case management for 'at risk' groups in primary care settings, including older people living with frailty and complex needs, also reported insufficient evidence of effects on patient and service outcomes, including costs (Stokes 2015).

In view of this conflicting evidence, there is currently limited understanding of how case management approaches as a strategy for integrated care for older people living with frailty might work. Case management focuses largely on individual-level strategies to improve care co-ordination in populations most at risk of functional limitations, high use of healthcare and social care services, and hospital (re)admissions (Hughes 2020). Components and strategies of case management that may improve outcomes include: proactive care planning, provision, co-ordination, and monitoring; case manager relationship enhancing continuity of care; single point of access for holistic assessment and management; self-management support to improve health outcomes; and improved co-ordination of care and collaborative working between healthcare and social care professionals, multidisciplinary teams, and services across different care boundaries (Ross 2011; Hughes 2020).

Multiple contextual factors will also influence how complex interventions work to improve outcomes for older people living with frailty in community settings (Hawe 2009). These factors include individual (e.g. different levels of frailty), social (e.g. level and quality of informal support networks), organisational (e.g. how services are organised to enable integrated care), and system/structural contexts affecting access to healthcare and social care services.

Why it is important to do this review

With the growing implementation of integrated care as a key policy internationally, RCT-based evidence on the impact of case management interventions for older people living with frailty evaluated would be valuable for care providers and policymakers. Therefore, the aim of this Cochrane Review was to evaluate the effects of case management for integrated care of older people living with frailty, compared to usual care, on patient and service outcomes, including costs. We also wanted to determine whether it was possible to identify which elements of case management interventions might drive the desired effect, and which patient cohorts might benefit most from such interventions. A systematic evaluation of the effects of case management could be useful for a range of stakeholders, including integrated care system providers, service users and carers, policymakers, and researchers working in this field. A synthesis of the effective elements (if any) of case management for integrated care of older people living with frailty is essential to ensure that health and care providers deliver clinically improved interventions and achieve better value outcomes.

Furthermore, during the COVID-19 pandemic, older people living with frailty were a high-risk population for reduced health outcomes due to shielding policies (Ní Shé 2020). Studies examining the impact of COVID-19 protection measures on deconditioning in populations at high risk of frailty concluded that COVID-19 likely resulted in increased levels of frailty (Di Lorito 2021). The pandemic is likely to have had a significant impact on the delivery and implementation of integrated care systems, including case management interventions within such systems.

OBJECTIVES

To assess the effects of case management for integrated care of older people living with frailty compared with usual care.

METHODS

Criteria for considering studies for this review

Types of studies

We included RCTs, of both individual and cluster design, that evaluated case management for integrated care of older people with frailty versus usual care. An initial scoping of the literature indicated sufficient numbers of RCTs to include in a meta-analysis in this review. We included all trials, however old, conducted in high-, middle- and low-income countries.

We included full-text, peer-reviewed publications, conference abstracts (with a view to identifying full trials), and unpublished data. We included trials irrespective of their publication status and language of publication.

We excluded trials with non-randomised designs (e.g. interrupted time series) or that used observational methods only.

Types of participants

We included men and women aged 65 years and older who met the following criteria.

- Identified as frail using criteria defined by trial authors
- Living in a community setting (i.e. individuals living in their own home, retirement housing, or sheltered accommodation, but not those living in a nursing or residential home care setting)
- Not medically unwell (i.e. not receiving acute medical care)

Two dominant models of frailty are the phenotypical model and the cumulative deficit model. The phenotypical model categorises frailty as a clinical syndrome, specifically meeting three or more of the following five criteria: weight loss, exhaustion, weak grip strength, slow walking speed, and low physical activity (Fried 2001). The cumulative deficit model conceptualises frailty as a multidimensional state, including physical, psychological, and social domains of function, using a proportion of health deficits from the number of problems assessed (Searle 2008). Frailty criteria used by trial authors could include validated measures based on one of the models mentioned above.

We considered a population eligible with regard to frailty when the trial met one of the following criteria.

- The trial used a measure of frailty as an inclusion criterion (applicable to trials published since the early 2000s when frailty started to be defined and measured in research and practice)
- There was no definition of frailty but trial authors described their population as frail or described the intervention as intended for older people with frailty, and the frailty of the population was supported with a measure of function or dependency as an inclusion criterion, with specified cut-off points.
- The trial did not use a cut-off score, but the function or dependency baseline data suggested a frail cohort. We used published normative data to make these decisions and determine cut-off points in the measures presented. Where these measures could be found in validated frailty indices, we used the cut-off points established in those indices. Otherwise, we made decisions based on age-matched normative data.

Types of interventions

We included all trials that evaluated case management for integrated care of older people living with frailty versus usual care. Eligible interventions met the following criteria.

- Led by a single health or social care professional (e.g. a nurse, social worker, or allied healthcare professional) who had a role in care delivery for older people with frailty and complex needs, supported by a multidisciplinary team.
- Focused on the planning, provision, and co-ordination of healthcare and social care to meet the needs of the older person living with frailty.
- Delivered in community care settings (excluding care homes) and not acute care settings, with no minimum or maximum follow-up period to assess outcomes.
- May include comprehensive geriatric assessment (CGA), but only if a case management approach is applied to the CGA

process. We excluded CGA without any structured follow-up or a designated lead healthcare or social care professional. A case management approach to CGA would be indicated by:
  - planned and structured ongoing support after the initial assessment process;
  - a healthcare or social care professional leading the support; and
  - use of the support to plan, provide or co-ordinate care.

The comparison for this review was case management versus usual care (as described by trial authors, usually involving assessment, management, and care planning by a general practitioner (GP) in primary care) for older people with frailty delivered in community care settings.

We provided a description of care for the intervention and control groups in the Characteristics of included studies table, using the template for intervention description and replication (TIDieR) checklist (Hoffmann 2014).

Types of outcome measures

Primary outcomes

- Mortality. We justified including mortality as a primary outcome because frailty is the leading cause of death in older people (Clegg 2013).
- Change in place of residence to a nursing or residential home
- Quality of life
- Serious adverse effects (i.e. medical event or injury triggered by participating in the trial)

Secondary outcomes

- Change in physical function (i.e. level of independence in activities of daily living and instrumental activities of daily living), and change in cognitive, emotional, and social function
- Change in healthcare utilisation (i.e. hospital admissions, number of days spent in hospital) and social care utilisation (i.e. professional home care, informal care, and meals received)
- Change in costs (i.e. health service costs, intervention costs, and other costs)
- Patient satisfaction with care

Search methods for identification of studies

Electronic searches

We developed the search terms with the Cochrane Effective Practice and Organisation of Care (EPOC) Group's Information Specialist. We searched the Cochrane Database of Systematic Reviews (CDSR) and the Database of Abstracts of Reviews of Effects (DARE) for related systematic reviews.

We searched the following sources for primary trials.

- Cochrane Central Register of Controlled Trials (CENTRAL; 2018, Issue 10), in the Cochrane Library, which also included the Cochrane EPOC Group Register
- MEDLINE Ovid (1946 to 23 September 2022)
- Embase Ovid (1974 to 23 September 2022)
- CINAHL EBSCO (Cumulative Index to Nursing and Allied Health Literature; 1980 to 23 September 2022)
- Health Systems Evidence (www.healthsystemsevidence.org/; searched 23 September 2022)
- PDQ Evidence (www.pdq-evidence.org/; searched 23 September 2022)

Search terms comprised keywords and controlled vocabulary terms. We applied no language restrictions. See Appendix 1 for the search strategies.

Searching other resources

Trial registries

- World Health Organization (WHO) International Clinical Trials Registry Platform (ICTRP; trialsearch.who.int/; searched 23 September 2022)
- US National Institutes of Health Ongoing Trials Register ClinicalTrials.gov (www.clinicaltrials.gov; searched 23 September 2022)
- McMaster Aging Portal (www.mcmasteroptimalaging.org/; searched 23 September 2022)

Grey literature

We conducted a grey literature search of the following sources to identify trials not indexed in the databases listed above.

- King's Fund Library Database (koha.kingsfund.org.uk; searched 23 September 2022)
- British Geriatrics Society (www.bgs.org.uk; searched 23 September 2022)
- American Geriatrics Society (www.americangeriatrics.org; searched 23 September 2022)

We also reviewed the reference lists of all included trials and relevant systematic reviews for additional potentially eligible primary trials. We contacted researchers with expertise in the review topic to identify further unpublished literature. If we had included fewer than 10 trials, we would have conducted cited reference searches for all included trials in Web of Science. We provided appendices for all strategies used, including a list of sources screened and relevant primary trials reviewed.

Data collection and analysis

Selection of studies

We downloaded all titles and abstracts retrieved by electronic searching to a reference management database and removed duplicates. Ten review authors (ES, ZK, AZ, KS, JW, JS, TS, TC, DGB, DMW) screened titles and abstracts for inclusion. This involved one review author (ES) independently screening all titles and abstracts for inclusion, and nine review authors independently screening a proportion of titles and abstracts for inclusion, namely ZK (15%), AZ (15%), KS (20%), JW (15%), JS (5%), TS (10%), TC (10%), DGB (5%), and DMW (5%). We retrieved the full-text publications of potentially eligible trials, and seven review authors (ES, ZK, AZ, KS JW, TC, DMW) read through them to identify trials for inclusion, recording reasons for exclusion of the ineligible trials. This involved one review author (ES) independently screening all full-text publications, and six review authors independently screening a proportion of these, namely ZK (20%), AZ (20%), KS (20%), JW (20%), TC (10%), and DMW (10%). We resolved any disagreement through discussion or, when required, by involving

another review author (DW). We listed trials that initially appeared to meet the inclusion criteria, but which we later excluded, in the Characteristics of excluded studies table. We collated multiple reports of the same trial so that each trial, rather than each report, was the unit of interest in the review. We also provided any information we could obtain about ongoing trials. We recorded the selection process in sufficient detail to complete a PRISMA flow diagram (Page 2021).

Data extraction and management

We used the EPOC standard data collection form and adapted it for trial characteristics and outcome data (EPOC 2017a). We piloted the form on one trial in the review. Six review authors (ES, AZ, JW, TS, DGB, DMW) independently extracted the following study characteristics from the included trials and entered the data into Review Manager Web (RevMan Web 2020).

- Methods: trial design, number of trial centres, locations, trial settings, withdrawals, date of trial, follow-up
- Participants: number, mean age, age range, sex, socioeconomic status, severity of condition, diagnostic criteria, inclusion criteria, exclusion criteria, baseline mobility/function, presence of cognitive impairment, other relevant characteristics
- Interventions: intervention components, comparison
- Outcomes: main and other outcomes specified and collected, time points reported
- Notes: funding for trial, notable conflicts of interest of trial authors, ethical approval

Six review authors (ES, AZ, JW, TS, DGB, DMW) independently extracted outcome data in pairs (ES and TS independently extracted data from the same six trials, AZ and JW from another six trials; ES and DMW from four trials, and ES and DGB from another four trials). We noted in Characteristics of included studies if outcome data from any included trials were reported in an unusable way. We resolved disagreements by consensus or by involving another review author (DW).

Assessment of risk of bias in included studies

Three review authors (ES, ZK, DMW) independently assessed risk of bias for each included trial using the criteria recommended by the Cochrane EPOC group (EPOC 2017b). We resolved any disagreements by discussion or by involving a fourth review author (DGB). We assessed the risk of bias according to the following domains.

- Random sequence generation
- Allocation concealment
- Baseline outcome measurement
- Baseline characteristics
- Blinding of participants and personnel
- Blinding of outcome assessment
- Incomplete outcome data
- Selective outcome reporting
- Other bias, such as recruitment bias

We judged each potential source of bias as high, low, or unclear. We justified our judgement in risk of bias tables, providing a quotation from the trial report where possible. We summarised the risk of bias judgements across different trials for each of the domains listed. We assigned an overall risk of bias rating (high, unclear, or low) to each of the included trials using the approach suggested in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011). Specifically, we considered trials with low risk of bias for all key domains, or where it seemed unlikely that bias would have seriously altered the results, to have a low risk of bias. We considered trials to have an unclear overall risk of bias where risk of bias in at least one domain was unclear or where we considered that some bias could plausibly raise doubts about the conclusions. We considered trials with high risk of bias in at least one domain, or judged to have serious bias that decreased the certainty of the conclusions, to have a high overall risk of bias.

We considered blinding separately for different key outcomes where necessary. For example, in unblinded outcome assessment, risk of bias for all-cause mortality may be very different from risk of bias for participant-reported quality of life. Where information on risk of bias related to unpublished data or correspondence with a trial author, we noted this in the risk of bias tables. We did not exclude trials on the grounds of risk of bias, but reported the risk of bias when presenting the results of the trials.

When considering treatment effects, we took into account the risk of bias for the trials that contributed to that outcome (Higgins 2019).

We conducted the review according to a published protocol (Sadler 2018), and reported any deviations from it in the Differences between protocol and review section.

Measures of treatment effect

We planned to report dichotomous outcomes using risk ratios (RRs) and continuous outcomes with mean differences (MDs) or standardised mean differences (SMDs), each with their corresponding 95% confidence intervals (CIs). However, owing to considerable heterogeneity across trials, we had to describe the results of some outcomes narratively, expressing individual trial results as MDs where possible (Schünemann 2019).

For future updates of this review, if we identify sufficient data to pool continuous outcomes, we will use SMDs where trials have measured the same outcomes using different instruments, and then present the SMDs using generic effect size estimates as per guidance from the *Cochrane Handbook for Systematic Reviews of Interventions* (Schünemann 2019).

Unit of analysis issues

We included cluster-RCTs in this review. Whenever the trial authors accounted for cluster effects in their analysis, we obtained a direct estimate of the required effect measure (e.g. an odds ratio (OR) with its corresponding CI). For trials that did not properly account for the cluster design, we planned to conduct approximated corrected analyses using the formula $1 + (M - 1) \times ICC$, where M is the average cluster size and ICC is the intracluster correlation coefficient (Higgins 2019), which we set at 0.03 (Campbell 2005). This was not necessary, as all included cluster-RCTs took into account clustering and used mixed-effects regression models in their statistical analysis.

For cross-over trials, whenever participants were randomised at the start of the intervention using a within-group design, we handled pre- and post-data as we had data from parallel trials.

For trials with multiple treatment arms, we analysed data only from the intervention arm that contained all components of the intervention. Where populations were stratified into different groups, we only included arms with older people living with frailty.

Dealing with missing data

We contacted trial authors to obtain any missing data (e.g. when a trial was identified as abstract only) or verify key trial characteristics. When we were unable to obtain complete data, we reported these narratively in the non-pooled analyses. We assumed that all missing data were missing at random, in line with guidance provided in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011).

Assessment of heterogeneity

We used the I^2 statistic to measure heterogeneity among the trials in each analysis. We had planned to explore strong evidence for heterogeneity (I^2 values greater than 75%) by prespecified subgroup analysis (Higgins 2011). However, it was not possible to conduct subgroup analyses (see Subgroup analysis and investigation of heterogeneity).

Assessment of reporting biases

We attempted to contact trial authors to request missing outcome data. Where this was not possible, and the missing data were thought to introduce serious bias, we explored the impact of including such trials in the overall assessment of results. Where we pooled data from more than 10 trials, we created and examined a funnel plot to explore possible publication biases, and interpreted the results with caution (Sterne 2011).

Data synthesis

We conducted random-effects meta-analyses only where this was meaningful (i.e. when the treatments, participants, and the underlying clinical question were similar enough for pooling to make sense). When it was not possible to conduct a meta-analysis, we conducted a narrative synthesis to summarise the evidence and characteristics of included trials. Meta-analysis was considered for feasibility prior to undertaking the analysis.

A common way trial authors indicate that they have skewed data is by reporting medians and interquartile ranges (IQRs). In the protocol, we planned to note if data were skewed and consider the implications of this. However, since only one included trial reported medians/IQRs we did not investigate further the implications of skewed data.

Where multiple trial arms were reported in a single trial, we included only the relevant arms. We did not have to include more than two arms in the same analysis.

Subgroup analysis and investigation of heterogeneity

We planned to carry out the following subgroup analyses.

- Case management that includes care provision versus models that consist of care co-ordination only, as different levels and formulations of case management could have a dose response depending on level/combination of components of case management.
- Lower number of visits (i.e. initial assessment and follow-up) versus multiple visits (i.e. more than two) at different time points, as this could lead to a dose response, with multiple visits potentially likely to have better outcomes.
- Individuals with mild to moderate versus severe degrees of frailty. This was relevant to consider because case management approaches will likely have different objectives for people with mild to moderate degrees of frailty (e.g. healthy living, self-management of long-term conditions) compared to those with severe degrees of frailty (e.g. symptom control or palliation). In addition, we considered a subgroup analysis for different approaches to classification of frailty (i.e. phenotypical versus cumulative deficit models).
- Case management interventions to support older people with frailty conducted in high- to middle-income countries versus those conducted in low-income countries. This was relevant because the availability, nature, and scope of healthcare and social care services, support, and integration varies between countries.

We planned to use the following outcomes in subgroup analysis.

- Mortality
- Change in place of residence to a nursing or residential home
- Quality of life
- Serious adverse effects

Furthermore, we planned to analyse subgroups based on socioeconomic status, age, and sex as covariates, adjusting analyses accordingly and testing for subgroup interactions, providing that sufficient trials (i.e. five or more) were available.

Sensitivity analysis

We planned to perform the following sensitivity analyses, which we defined a priori to assess the robustness of our conclusions.

- Restricting the analysis to published trials
- Restricting the analysis to trials with a low risk of bias as specified in the *Cochrane Handbook for Systematic Reviews of interventions* (Higgins 2011)
- Imputing missing data
- Analysis by 10-year publication band to account for likely changes over time

Summary of findings and assessment of the certainty of the evidence

To draw conclusions about the certainty of the evidence within the text of the review, we created a summary of findings table for the following outcomes.

- Mortality
- Change in place of residence to a nursing or residential home
- Quality of life
- Serious adverse effects
- Change in physical function
- Change in healthcare utilisation (hospital admission)
- Change in costs

Three review authors (TC, DGB, DMW) assessed the certainty of the evidence (high, moderate, low, or very low) using

the five GRADE considerations (risk of bias, inconsistency, imprecision, indirectness, and publication bias; Guyatt 2008). They performed this grading independently in pairs (DGB and TC independently graded 12 trials, and DGB and DMW independently graded the remaining eight trials). We followed methods and recommendations described in the *Cochrane Handbook for Systematic Reviews of interventions* (Higgins 2011), and the EPOC worksheets (EPOC 2017c), using GRADEpro GDT software (GRADEpro GDT). We resolved disagreements on certainty ratings by discussion between these three review authors and provided justifications for decisions to downgrade or upgrade the ratings in footnotes to the table. We used plain language statements to report these findings in the review (EPOC 2017c).

We considered whether there was any additional outcome information that was not possible to incorporate into meta-analyses and noted this in the comments, stating if it supported or contradicted the information from the meta-analyses. If it was not possible to meta-analyse the data, we summarised the results narratively in the text.

RESULTS

Description of studies

Results of the search

The electronic searches retrieved 12,852 unique records for screening, with an additional 76 records identified from other sources. After removing duplicates, we screened the titles and abstracts of 12,679 records, of which we excluded 12,561. We retrieved and read 118 full-text reports, excluding 65. We included 20 trials (49 references) in this review (Characteristics of included studies). We also identified four ongoing trials (see Characteristics of ongoing studies). Figure 1 presents the flow of literature in a PRISMA diagram.

Figure 1. PRISMA flow diagram.

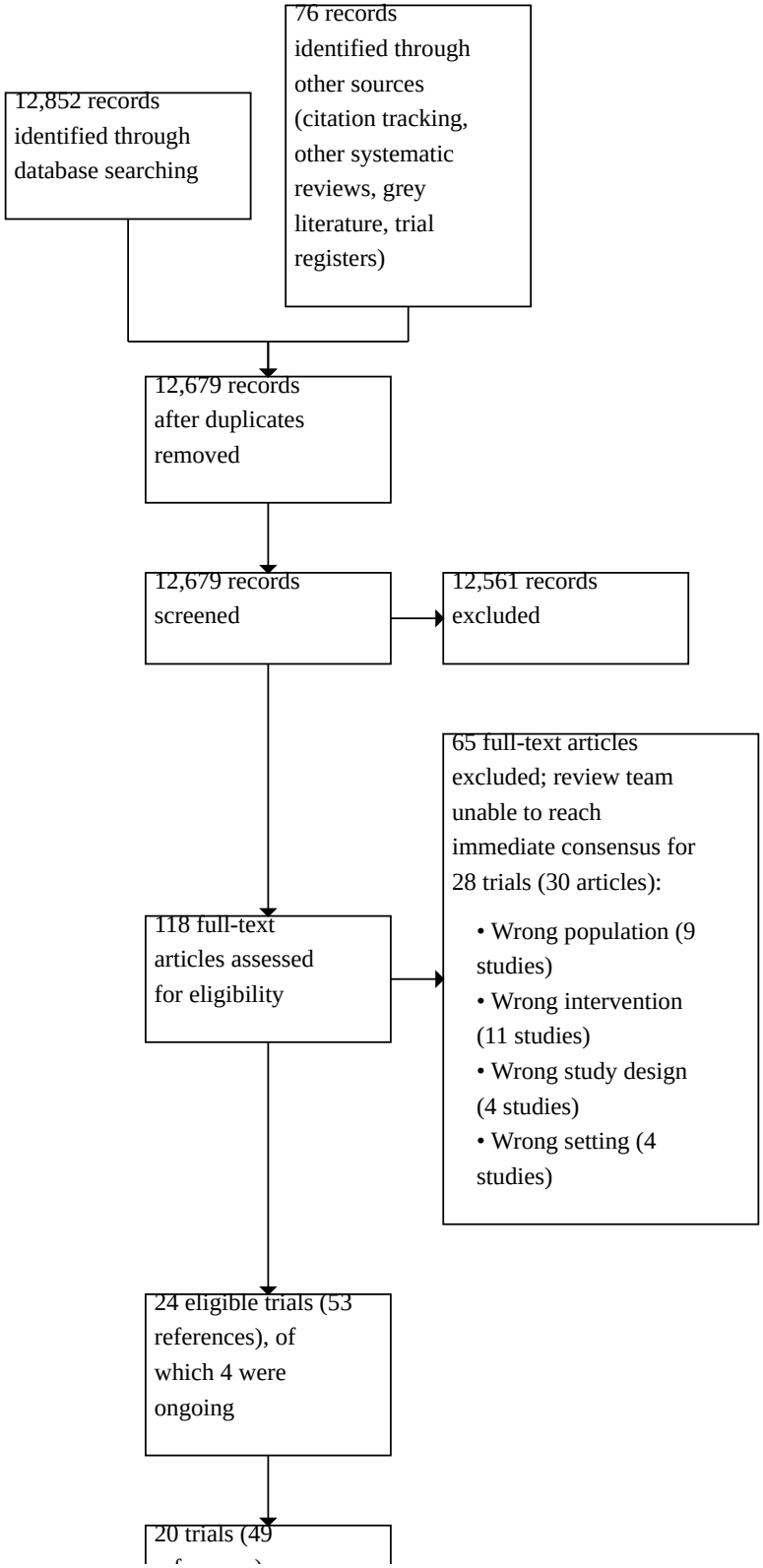
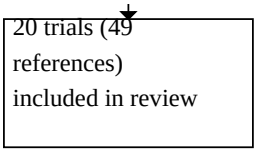


Figure 1. (Continued)



Included studies

Trial designs

Four trials used a cluster-randomised design (Bleijenberg 2016; Hoogendijk 2016; Metzelthin 2013; Suijker 2016); Hoogendijk 2016 adopted a stepped-wedge cluster-randomised design (a modified cross-over design). One other trial had a pseudo-cluster-randomised design (Melis 2008). These trials took clustering into account and used mixed-effect regression models in their statistical analyses, so no further adjusting was necessary. The remaining trials had a parallel individual allocation, with the participant as the unit of allocation.

There was one cross-over trial, which randomised participants at the start of intervention using a within-group design (Hoogendijk 2016). We handled pre- and post-data as we did the data from parallel-group trials, either pooled or narratively. One cluster-randomised trial had two treatment arms (Bleijenberg 2016). We analysed data only from the intervention arm that contained all components of the intervention.

Trial populations

Twenty trials randomised 11,860 participants. The number of participants at baseline ranged from 47 (Gagnon 1999) to 2283 (Suijker 2016). All trials recruited both men and women. Of trials reporting the proportion of men and women in each group, seven reported that over 70% of participants in both groups were women (Applebaum 2002; Bernabei 1998; Kono 2012; Kono 2016; Melis 2008; Markle-Reid 2006; van Hout 2010).

Most trials used age as an inclusion criterion, though Metzelthin 2013 did not define a specific age for "older people". Seven trials included adults over 65 years (Bernabei 1998; Hoogendijk 2016; Kono 2012; Kono 2016; Leung 2004; Parsons 2012; Sandberg 2015), five included adults over 70 years (Cameron 2013; Dalby 2000; Gagnon 1999; Melis 2008; Suijker 2016), and three included adults over 75 years (Markle-Reid 2006; Spoorenberg 2018; van Hout 2010). The average age of included participants ranged from 75.5 years (Leung 2004) to 84 years (Markle-Reid 2006).

The definition of frailty varied considerably between trials. Cameron 2013 assessed participants using the Cardiovascular Health Study criteria (Fried 2001), Hoogendijk 2016 used a cut-off of three or more points on the PRISMA-7 questionnaire (Hébert 2010), and Metzelthin 2013 and Spoorenberg 2018 used the Groningen Frailty Indicator (Steverink 2001). Bleijenberg 2016 developed an in-house frailty index based on previous theoretical models of deficit. van Hout 2010 used a self-report measure to ascertain frailty. Thirteen trials did not report using a frailty assessment, but we included them nonetheless as they described the participating cohort as frail or disabled (Applebaum 2002; Béland 2006; Bernabei 1998; Dalby 2000; Eklund 2013; Gagnon 1999; Kono 2012; Kono 2016; Leung 2004; Markle-Reid 2006; Melis 2008; Parsons 2012; Sandberg 2015).

At baseline, the trial populations had the following health conditions, as defined by the WHO International Classification of Diseases, Version 11 (ICD-11; WHO 2018): cardiovascular disease (Dalby 2000; Gagnon 1999; Hoogendijk 2016; Leung 2004; van Hout 2010), metabolic disease (Gagnon 1999; Hoogendijk 2016; Leung 2004; van Hout 2010), respiratory disease (Hoogendijk 2016; Leung 2004; Sandberg 2015; van Hout 2010), diseases of the musculoskeletal system (Dalby 2000; Hoogendijk 2016; Sandberg 2015; van Hout 2010), neurology disorders (Applebaum 2002; Bernabei 1998; Hoogendijk 2016; Leung 2004), cognitive deficits (Eklund 2013; Markle-Reid 2006; Melis 2008; Parsons 2012; Sandberg 2015), urinary incontinence (Béland 2006; Bernabei 1998), neoplasms (Hoogendijk 2016; van Hout 2010), mental and behavioural disorders (Béland 2006; Kono 2012; Markle-Reid 2006; Melis 2008; Metzelthin 2013; Parsons 2012), abnormalities of gait and mobility (Bernabei 1998; Cameron 2013; Eklund 2013; Kono 2016; Melis 2008; Parsons 2012; Sandberg 2015; Suijker 2016; van Hout 2010), visual disturbances and blindness (Eklund 2013; Parsons 2012; van Hout 2010), and hearing loss (Parsons 2012; van Hout 2010). Eleven trials described their populations as multimorbid (Béland 2006; Bernabei 1998; Cameron 2013; Hoogendijk 2016; Leung 2004; Markle-Reid 2006; Melis 2008; Sandberg 2015, Spoorenberg 2018; Suijker 2016; van Hout 2010). Fifteen trials reported that participants had home care needs, support, or services (Applebaum 2002; Béland 2006; Gagnon 1999; Hoogendijk 2016; Kono 2012; Kono 2016; Leung 2004; Markle-Reid 2006; Melis 2008; Metzelthin 2013; Parsons 2012; Sandberg 2015; Spoorenberg 2018; Suijker 2016; van Hout 2010).

Sixteen trials provided no information on ethnicity. Four trials reported ethnicity at baseline (Applebaum 2002; Bleijenberg 2016; Markle-Reid 2006; Suijker 2016). Markle-Reid 2006 compared participants who dropped out of the trial to those who completed the trial at six months' follow-up in terms of different characteristics, including ethnicity, and found no differences between the intervention and control groups.

Living at home in the community rather than in a nursing home or long-term care facility was an inclusion criterion in most trials, although three trials did not explicitly state this (Bernabei 1998; Markle-Reid 2006; Metzelthin 2013). Melis 2008 included people living independently or in a retirement home.

Settings

All trials were conducted in high-income countries. Ten trials took place in Europe (Italy (Bernabei 1998), the Netherlands (Bleijenberg 2016; Hoogendijk 2016; Melis 2008; Metzelthin 2013; Spoorenberg 2018; Suijker 2016; van Hout 2010), and Sweden (Eklund 2013; Sandberg 2015)), five in North America (Canada (Béland 2006; Dalby

2000; Gagnon 1999; Markle-Reid 2006) and the USA (Applebaum 2002)), three in Asia (Hong Kong (Leung 2004) and Japan (Kono 2012; Kono 2016)), and two in Oceania (Australia (Cameron 2013) and New Zealand (Parsons 2012)).

Interventions

Interventions varied in setting and care providers. Most interventions involved a variety of healthcare and social care professionals, including nurse practitioners, allied healthcare professionals, social workers, geriatricians, physicians, psychologists, and clinical pharmacists. In nine trials, the case management intervention was delivered by nurses only (Bleijenberg 2016; Dalby 2000; Gagnon 1999; Hoogendijk 2016; Markle-Reid 2006; Melis 2008; Parsons 2012; Suijker 2016; van Hout 2010).

Eleven trials delivered interventions in participants' homes (Applebaum 2002; Béland 2006; Bernabei 1998; Dalby 2000; Eklund 2013; Kono 2012; Kono 2016; Markle-Reid 2006; Spoorenberg 2018; Suijker 2016; van Hout 2010), and four trials co-ordinated care in GP practices (Bleijenberg 2016; Melis 2008; Metzelthin 2013; Sandberg 2015). Three trials began assessments in a hospital setting then delivered care in community settings (Cameron 2013; Gagnon 1999; Leung 2004), and two trials implemented interventions across primary and community care settings (Hoogendijk 2016; Parsons 2012).

Trial duration varied significantly, when reported. Seven interventions took place over 12 months (Bernabei 1998; Eklund 2013; Leung 2004; Sandberg 2015; Spoorenberg 2018; Suijker 2016; van Hout 2010), with varying frequency and duration of contacts between the healthcare providers and participants. For example, Sandberg 2015 reported one home visit per month over 12 months, whilst Bernabei 1998 described two-monthly reviews of the care plan by a case manager with ad-hoc/emergency support. Four trials lasted 24 months (Hoogendijk 2016; Kono 2012; Kono 2016; Metzelthin 2013); in Kono 2016, there was contact every three months, versus every six months in Kono 2012. Two interventions ran over a six-month period (Bleijenberg 2016; Markle-Reid 2006). Gagnon 1999 implemented the intervention for 10 months, Dalby 2000 for 14 months, and Cameron 2013 reported a median of 10 face-to-face sessions with a physiotherapist.

Outcome measures

Trials reported a range of outcome measures at follow-up durations ranging from three to 36 months. The following trials reported primary outcomes of this review.

- Mortality (Applebaum 2002; Béland 2006; Bernabei 1998; Bleijenberg 2016; Cameron 2013; Eklund 2013; Gagnon 1999; Hoogendijk 2016; Kono 2012; Kono 2016; Metzelthin 2013; Parsons 2012; Sandberg 2015; Spoorenberg 2018; Suijker 2016; van Hout 2010)
- Change in place of residence to a nursing or residential home (Applebaum 2002; Bernabei 1998; Cameron 2013; Dalby 2000; Kono 2012; Kono 2016; Leung 2004; van Hout 2010)
- Quality of life (Bleijenberg 2016; Cameron 2013; Gagnon 1999; Hoogendijk 2016; Markle-Reid 2006; Melis 2008; Parsons 2012; Sandberg 2015; Spoorenberg 2018; Suijker 2016; van Hout 2010)
- Serious adverse effects (Cameron 2013; Parsons 2012)

The following trials reported secondary outcomes of this review.

- Change in function, including physical function (Applebaum 2002; Bernabei 1998; Bleijenberg 2016; Cameron 2013; Eklund 2013; Gagnon 1999; Hoogendijk 2016; Kono 2012; Kono 2016; Leung 2004; Melis 2008; Metzelthin 2013; Parsons 2012; Spoorenberg 2018; Suijker 2016; van Hout 2010), cognitive function (Bernabei 1998; Kono 2016; Leung 2004; Melis 2008), emotional function (Applebaum 2002; Bernabei 1998; Cameron 2013; Kono 2012; Kono 2016; Leung 2004; Markle-Reid 2006; Metzelthin 2013; Suijker 2016), and social function (Cameron 2013; Hoogendijk 2016; Kono 2012; Kono 2016; Markle-Reid 2006; Metzelthin 2013; Sandberg 2015). Only Sandberg 2015 reported medians/IQRs for the number of social participation activities and total important leisure activities (indicators of social function).
- Hospitalisation (Applebaum 2002; Bernabei 1998; Bleijenberg 2016; Cameron 2013; Dalby 2000; Eklund 2013; Kono 2012; Kono 2016; Suijker 2016), change in other types of healthcare utilisation (Applebaum 2002; Bernabei 1998; Bleijenberg 2016; Dalby 2000; Eklund 2013; Gagnon 1999; Kono 2016; Leung 2004; Melis 2008; Metzelthin 2013; Sandberg 2015; Suijker 2016; van Hout 2010), and change in social care utilisation (Bernabei 1998; Melis 2008; Metzelthin 2013; Sandberg 2015)
- Change in costs (Applebaum 2002; Béland 2006; Bernabei 1998; Cameron 2013; Hoogendijk 2016; Kono 2012; Kono 2016; Markle-Reid 2006; Melis 2008; Metzelthin 2013; Sandberg 2015; Spoorenberg 2018; Suijker 2016)
- Patient satisfaction with care (Applebaum 2002; Bleijenberg 2016; Gagnon 1999)

Funding, ethical approval, and conflict of interest

Eighteen trials reported funding sources, which were provided by medical research institutes or university funding bodies. Most trials reported ethical or institutional review board approval (Leung 2004). Only one trial reported a potential conflict of interest, stating that one author was a board member of the Dutch Association of users of interRAI tools (Hoogendijk 2016). Five trials did not report conflicts of interest (Applebaum 2002; Gagnon 1999; Leung 2004; Markle-Reid 2006; Melis 2008), and in the remaining trials, the authors had no known conflict of interest.

Excluded studies

In the Characteristics of excluded studies table we presented 28 trials for which we could not reach an immediate consensus on eligibility. Reasons for exclusion at this stage included the following.

- Wrong intervention: CGA with no case management (Bandinelli 2006; Ekdahl 2016; Li 2010; Montserin 2010; Rockwood 2000); geriatric assessment and multidisciplinary team involvement with no case management (Di Polina 2017; Stuck 2000; Zimmer 1985); multidisciplinary team health promotion intervention (Hall 1992); and nurse-led comprehensive assessment, collaborative care planning, and health promotion, but without case management (Ploeg 2010)
- Wrong population: older people with one or more long-term conditions (Blom 2016; Newcomer 2004; Reuben 1999; Sommers 2000), older people seen by a primary care clinician on at least one occasion within the last 12 months (Counsell 2007; Daniels 2011), frequent attenders of an outpatient clinic (also the wrong

setting for this review; Engelhardt 1996), people aged 80 years and older not defined specifically as frail but who "expressed an interest in the study" (Imhof 2012), and older people recently discharged from hospital with good social support (Montgomery 2003)

- Wrong setting: intervention delivered in a hospital (Bandinelli 2006), in an outpatient setting (Boult 2001; Burns 1995), or in residential care or the older person's own home but without separate data for participants receiving care at home (Parsons 2017; Schapira 2022)
- Non-randomised design (de Stampa 2014; June 2009; Noel 2004; Ruikes 2016)

Risk of bias in included studies

See Figure 2 and Figure 3 for a graphical and summary depiction of the risk of bias assessment results.

Figure 2. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.

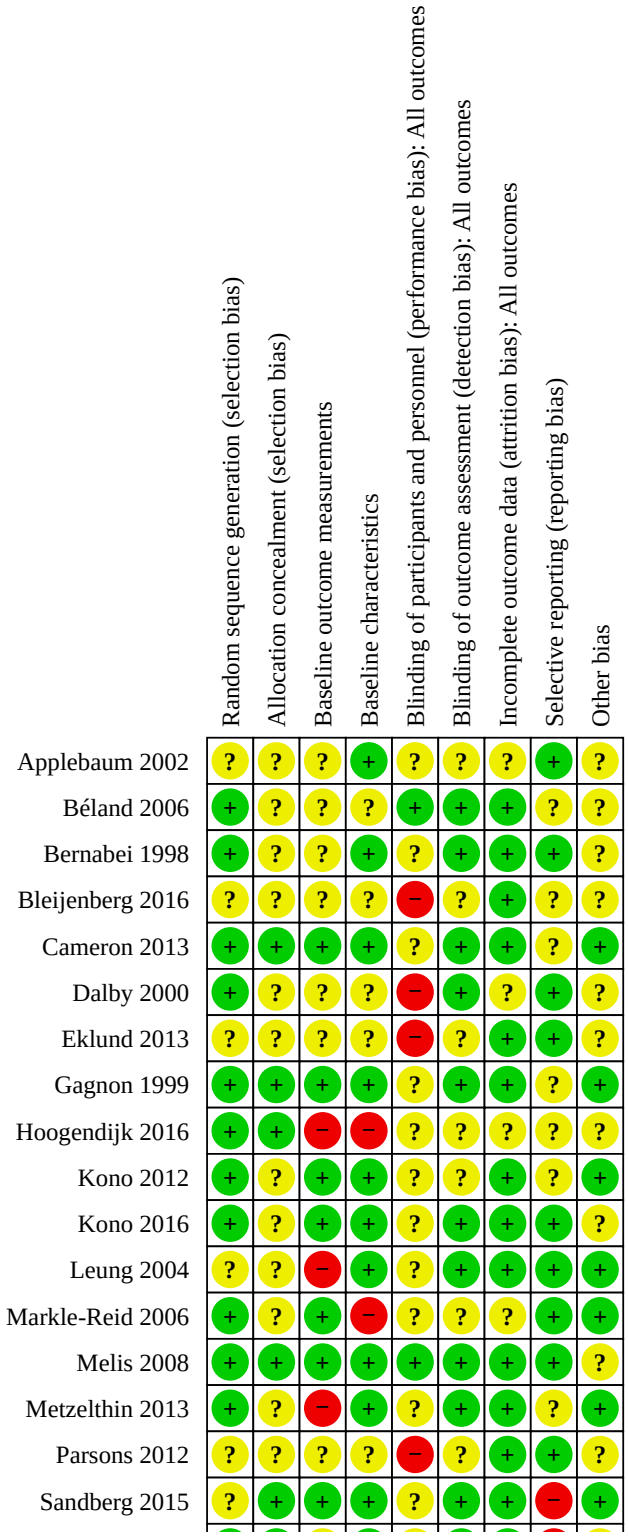


Figure 2. (Continued)

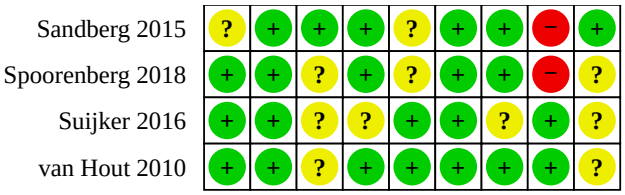
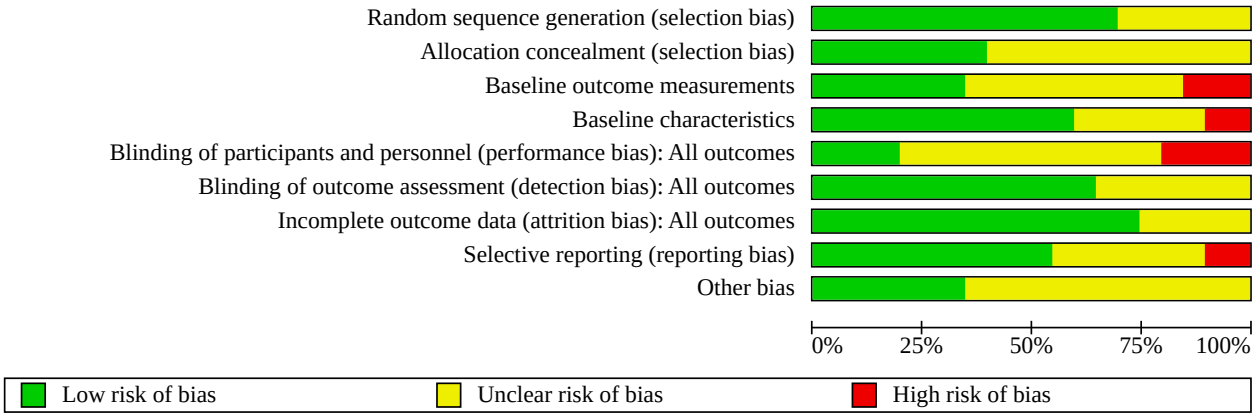


Figure 3.



Allocation

Fourteen trials reported an adequate random sequence generation, and we rated them at low risk of bias for this domain, whereas the remaining six trials had an unclear risk of bias (Applebaum 2002; Bleijenberg 2016; Eklund 2013; Leung 2004; Parsons 2012; Sandberg 2015). We judged eight trials at low risk of bias for allocation concealment as they described strict implementation of an allocation sequence (Cameron 2013; Gagnon 1999; Hoogendijk 2016; Melis 2008; Sandberg 2015; Spoorenberg 2018; Suijker 2016; van Hout 2010). The remaining twelve trials had an unclear risk of bias, as they provided insufficient information to make a judgement.

Baseline outcome measurement

Seven trials reported baseline outcome measurements that were similar between groups, and we assessed them at low risk of bias (Cameron 2013; Gagnon 1999; Kono 2012; Kono 2016; Markle-Reid 2006; Melis 2008; Sandberg 2015), whereas three trials were at high risk of bias for this domain, as they reported baseline differences between groups for functional abilities (Hoogendijk 2016; Metzelthin 2013) or use of hospital services (Leung 2004). We assessed the remaining 10 trials at unclear risk of bias, as they provided insufficient information to make a decision.

Baseline characteristics

Most trials reported similar baseline characteristics, and we assessed them at low risk of bias; however, we were unable to reach a judgement for six trials (Béland 2006; Bleijenberg 2016; Dalby 2000; Eklund 2013; Parsons 2012; Suijker 2016). We rated two trials at high risk of bias, because participants allocated to the comparison group were more likely to report mental health problems (Markle-Reid 2006), or because groups differed regarding educational level, frailty score, and number of chronic conditions (Hoogendijk 2016).

Blinding

We judged most trials at unclear risk of performance bias: although they blinded participants and personnel, it was unclear whether blinding was properly maintained. We considered four trials at low risk of performance bias (Béland 2006; Melis 2008; Suijker 2016; van Hout 2010) and four trials at high risk of performance bias, as no specific steps were taken to blind participants or personnel to the allocated intervention (Bleijenberg 2016; Dalby 2000; Eklund 2013; Parsons 2012).

Thirteen trials were at low risk of detection bias, and the remaining seven trials provided insufficient information to make a judgement (Applebaum 2002; Bleijenberg 2016; Eklund 2013; Hoogendijk 2016; Kono 2012; Markle-Reid 2006; Parsons 2012).

Incomplete outcome data

Most trials were at low risk of attrition as they had very little missing outcome data, or the missing outcome data were similar between groups and trial authors provided reasons for missing data. There was insufficient information to make a judgement for five trials, which we rated at unclear risk of attrition bias (Applebaum 2002; Dalby 2000; Hoogendijk 2016; Markle-Reid 2006; Suijker 2016).

Selective reporting

We judged two trials at high risk of reporting bias, as the main outcomes differed between the protocol and the published results

(Sandberg 2015; Spoorenberg 2018). Eleven trials were at low risk of reporting bias (Applebaum 2002; Bernabei 1998; Dalby 2000; Eklund 2013; Kono 2016; Leung 2004; Markle-Reid 2006; Melis 2008; Parsons 2012; Suijker 2016; van Hout 2010), and there was insufficient information to make a judgement for the remaining trials.

Other potential sources of bias

There was an unclear risk for other potential sources of bias in 13 trials. Bernabei 1998 did not report how the sample was recruited; Hoogendijk 2016, Kono 2016, Melis 2008, and Spoorenberg 2018 reported aspects of their recruitment procedures and methodology that might have constrained the generalisability of the results. There was insufficient information reported by the investigators to make a judgement for the remaining trials (Applebaum 2002; Béland 2006; Bleijenberg 2016; Dalby 2000; Eklund 2013; Parsons 2012; Suijker 2016; van Hout 2010).

We judged seven trials at low risk of other bias (Cameron 2013; Gagnon 1999; Kono 2012; Leung 2004; Markle-Reid 2006; Metzelthin 2013; Sandberg 2015). We sent emails to three corresponding authors requesting available statistical data for particular follow-up outcomes (Cameron 2013; Melis 2008; Spoorenberg 2018). One author replied, explaining that they had measured cognitive function using the Mini Mental State Examination (MMSE) at baseline but had not used this variable as a primary or secondary outcome and so had not included it in the analysis (Cameron 2013).

Effects of interventions

See: **Summary of findings 1** Case management for integrated care compared to usual care of older people living with frailty in community settings

Primary outcomes

Mortality

Sixteen trials reported mortality at follow-up durations ranging from six to 36 months (Applebaum 2002; Béland 2006; Bernabei 1998; Bleijenberg 2016; Cameron 2013; Eklund 2013; Gagnon 1999; Hoogendijk 2016; Kono 2012; Kono 2016; Metzelthin 2013; Parsons 2012; Sandberg 2015; Spoorenberg 2018; Suijker 2016; van Hout 2010). We pooled data from the 14 trials that measured the number of participants who had died at 12 months' follow-up (Applebaum 2002; Béland 2006; Bernabei 1998; Bleijenberg 2016; Cameron 2013; Eklund 2013; Gagnon 1999; Hoogendijk 2016; Kono 2016; Metzelthin 2013; Parsons 2012; Sandberg 2015; Spoorenberg 2018; Suijker 2016). Case management may result in little or no difference in mortality at 12 months' follow-up (7.0% in the intervention group versus 7.5% in the control group; RR 0.98, 95% CI 0.84 to 1.15; I^2 = 11%; 14 trials, 9924 participants; low-certainty evidence; Analysis 1.1). We downgraded the certainty of the evidence by one level for indirectness due to limitations associated with the definition of frailty in some trials, and by one point for inconsistency, as the point estimate varied across trials (Summary of findings 1).

We did not pool other reported mortality data owing to variation in the time points of measurement; overall these trials reported little or no difference between groups (Analysis 1.2; Applebaum 2002; Kono 2012; Kono 2016; Metzelthin 2013; Parsons 2012; Suijker 2016; van Hout 2010).

Change in place of residence to a nursing or residential home

Eight trials reported change in place of residence to a nursing or residential home at follow-up durations ranging from six to 24 months (Applebaum 2002; Bernabei 1998; Cameron 2013; Dalby 2000; Kono 2012; Kono 2016; Leung 2004; van Hout 2010). We pooled data for the four trials that measured the number of participants admitted to a nursing home at 12 months' follow-up (Applebaum 2002; Bernabei 1998; Cameron 2013; Kono 2016). We found that case management for this population may result in little or no difference in change in place of residence to a nursing home at 12 months (9.91% in the intervention group versus 13.4% in the control group; RR 0.73, 95% CI 0.53 to 1.01; I^2 = 0%; 4 trials, 1108 participants; low-certainty evidence; Analysis 2.1). We downgraded the certainty of the evidence by one level for indirectness due to limitations associated with the definition of frailty in some trials, and by one level for inconsistency, as the results varied considerably across trials (Summary of findings 1).

We did not pool other data on change in place of residence to a nursing home owing to variation in the time points of measurement; these trials found little or no difference between the groups (Analysis 2.2; Applebaum 2002; Dalby 2000; Kono 2012; Kono 2016). Leung 2004 assessed change in place of residence to *"residential facilities for long-term placement"* at 12 months' follow-up and found little or no difference between groups (RR 0.52, 95% CI 0.05 to 5.56; 92 participants; Analysis 2.2). Melis 2008 also found little or no difference between groups for days spent in a home for the aged (MD −8.0 days, 95% CI −13.46 to 29.46) and days spent in a nursing home (MD −1.0 days, 95% CI −5.74 to 7.74) at six months' follow-up. van Hout 2010 reported little or no difference between groups in the time to institutionalisation (nursing homes or homes for disabled older persons) at 18 months (hazard ratio (HR) 1.04, 95% CI 0.07 to 16.6; Analysis 2.2).

Quality of life

Eleven trials reported quality of life, at follow-up durations ranging from three to 24 months (Bleijenberg 2016; Cameron 2013; Gagnon 1999; Hoogendijk 2016; Markle-Reid 2006; Melis 2008; Parsons 2012; Sandberg 2015; Spoorenberg 2018; Suijker 2016; van Hout 2010). Most trials measured this outcome using the Medical Outcomes Study 36-item Short Form Health Survey (SF-36) or 12-item Short Form Health Survey (SF-12; Jenkinson 1997), or the EuroQol five-dimension questionnaire (EQ-5D; EuroQol 1990). We did not pool results owing to variations in outcomes reported and time points of measurement across trials. Most trials reported little or no difference between groups for quality of life. Effects ranged from MD −6.32 points (95% CI −11.04 to −1.59) to MD 6.1 points (95% CI −3.92 to 16.12) when reported (Analysis 3.1). We rated the certainty of the evidence as low, downgrading by one level for indirectness due to limitations associated with the definition of frailty in some trials, and by one level due to unclear risk of performance bias (Summary of findings 1). We concluded that case management may result in little or no difference in quality of life at three to 24 months' follow-up (results not pooled; 11 trials, 9284 participants; low-certainty evidence; Summary of findings 1).

Serious adverse effects

Only two trials measured and reported serious adverse effects at follow-up durations ranging from 12 to 24 months (Cameron 2013; Parsons 2012). Cameron 2013 recorded the number of individuals reporting a medical event or injury that arose as a consequence of

participating in the trial, and Parsons 2012 recorded the number of individuals with falls or hospitalisations. The outcomes were monitored and recorded by clinicians. Both trials reported little or no difference between groups for serious adverse effects. We did not pool the results owing to variation in types of medical event or injury and in the time points of measurement. There were no major medical events attributable to the intervention (Analysis 4.1). In Cameron 2013, two participants allocated to the intervention reported back pain that required modification of their intervention package. We rated the evidence as low-certainty, downgrading by one level for indirectness due to limitations associated with the definition of frailty in some trials, and by one level for imprecision due to the small number of events and participants. The evidence suggests that case management may result in little or no difference in serious adverse effects at 12 and 24 months' follow-up (results not pooled; 2 trials, 592 participants; low-certainty evidence; Summary of findings 1).

Secondary outcomes

Change in function

Physical function

Sixteen trials reported physical function (Applebaum 2002; Bernabei 1998; Bleijenberg 2016; Cameron 2013; Eklund 2013; Gagnon 1999; Hoogendijk 2016; Kono 2012; Kono 2016; Leung 2004; Melis 2008; Metzelthin 2013; Parsons 2012; Spoorenberg 2018; Suijker 2016; van Hout 2010), mainly in relation to independence in activities of daily living and instrumental activities of daily living, measured with indices such as Katz 1963 and Mahoney 1965, at follow-up durations ranging from three to 24 months. We did not pool results owing to variations in outcomes reported and in units and time points of measurement across trials. Most trials found little or no difference between groups in change in physical function. Effects ranged from MD −0.12 points (95% CI −0.93 to 0.68) to MD 3.4 points (95% CI −2.35 to 9.15) when reported (Analysis 5.1). We rated the certainty of the evidence as low, downgrading by one level for indirectness due to limitations associated with the definition of frailty in some trials, and by one level for inconsistency, as the results varied considerably between trials. We concluded that case management may result in little or no difference in change in physical function at three to 24 months' follow-up (results not pooled; 16 trials, 10,652 participants; low-certainty evidence; Summary of findings 1).

Cognitive, emotional, and social function

Four trials reported cognitive function at follow-up durations ranging from six to 24 months (Bernabei 1998; Kono 2016; Leung 2004; Melis 2008). The trials measured mental status (e.g. with the MMSE; Folstein 1975) or cognitive capacity. We did not pool results owing to variations in outcomes reported and in time points of measurement across trials. Most trials found little or no difference between groups for cognitive function. Effects ranged from MD 0.1 points (95% CI −0.37 to 0.57) to MD 0.6 points (95% CI 0.04 to 1.16) when reported (Analysis 5.2). We downgraded the certainty of the evidence to very low for risk of bias, inconsistency, and indirectness. Therefore, the evidence is very uncertain about the effect of case management on change in cognitive function at six to 24 months' follow-up in older people living with frailty (results not pooled; 4 trials, 806 participants; very low-certainty evidence).

Ten trials reported emotional function at follow-up durations ranging from three to 24 months (Applebaum 2002; Bernabei 1998; Cameron 2013; Kono 2012; Kono 2016; Leung 2004; Markle-Reid 2006; Melis 2008; Metzelthin 2013; Suijker 2016). Most trials measured symptoms of depression using either the Center for Epidemiologic Studies Depression Scale (Radloff 1977) or the Geriatric Depression Scale (Yesavage 1982). We did not pool results owing to variations in outcomes reported and time points of measurement across trials. Most trials reported little or no difference between groups for emotional function. Effects ranged from MD −0.11 points (95% CI −0.80 to 0.58) to MD 2.72 points (95% CI 0.39 to 5.07) when reported (Analysis 5.2). We rated the certainty of the evidence as low, downgrading for risk of bias and indirectness. Therefore, case management may result in little or no difference in change in emotional function (depression) at three to 24 months' follow-up (results not pooled; 9 trials; 4595 participants; low-certainty evidence).

Seven trials reported social function at follow-up durations ranging from three to 24 months (Cameron 2013; Hoogendijk 2016; Kono 2012; Kono 2016; Markle-Reid 2006; Metzelthin 2013; Sandberg 2015). The trials measured varied concepts, such as social space (Cameron 2013) and satisfaction with social activity (Kono 2016). We did not pool the results owing to variations in outcomes reported and time points of measurement across trials. Most trials found little or no difference between groups for social function. Effects ranged from MD −5.26 points (95% CI −9.18 to −1.34) to MD 5.2 points (95% CI 1.28 to 9.12) when reported (Analysis 5.2). We rated the certainty of the evidence as very low, downgrading for risk of bias, inconsistency, and indirectness. Therefore, we are unsure about the effect of case management on change in social function at three to 24 months' follow-up in older people living with frailty (results not pooled, 2688 participants; 7 trials; very low-certainty evidence).

Change in healthcare and social care utilisation

Healthcare utilisation

Fourteen trials reported change in healthcare utilisation (Applebaum 2002; Bernabei 1998; Bleijenberg 2016; Dalby 2000; Eklund 2013; Gagnon 1999; Kono 2012; Kono 2016; Leung 2004; Melis 2008; Metzelthin 2013; Sandberg 2015; Suijker 2016; van Hout 2010). We pooled data for the five trials that reported the number of participants admitted to hospital after 12 months' follow-up (Applebaum 2002; Bernabei 1998; Bleijenberg 2016; Cameron 2013; Kono 2016). Case management likely results in little or no difference in hospital admission at 12 months' follow-up (32.7% in the intervention group versus 36.0% in the control group; RR 0.91, 95% CI 0.79 to 1.05; I^2 = 43%; 5 trials, 2424 participants; moderate-certainty evidence; Analysis 6.1). We downgraded the certainty of the evidence by one level for indirectness due to limitations associated with the definition of frailty in some trials (Summary of findings 1).

Six trials reported number of participants hospitalised after follow-up durations other than 12 months (Applebaum 2002; Dalby 2000; Eklund 2013; Kono 2012; Kono 2016; Suijker 2016). The trials found little or no difference between groups (3274 participants). We did not pool the results owing to variation in units and time points of measurement across trials (Analysis 6.2). Two trials reported total number of days spent in hospital at 12 months' follow-up (Leung 2004; Sandberg 2015). Leung 2004 found little or no

difference between groups for total number of hospital bed days (MD 11.1 days, 95% CI −7.84 to 30.01; 92 participants), and Sandberg 2015 found little or no difference between groups for total length of stay (MD 0.50 days, 95% CI −3.90 to 4.90; 153 participants). Gagnon 1999 also found little or no difference between groups for mean hospital length of stay in days at 10 months' follow-up (MD 1.1 days, 95% CI −4.70 to 6.90; 427 participants). We could not pool these results owing to variation in units and time point of measurement across trials (Analysis 6.2).

Thirteen trials reported a wide range of other healthcare utilisation data, at follow-up durations ranging from six to 24 months (Applebaum 2002; Bernabei 1998; Bleijenberg 2016; Dalby 2000; Eklund 2013; Gagnon 1999; Kono 2016; Leung 2004; Melis 2008; Metzelthin 2013; Sandberg 2015; Suijker 2016; van Hout 2010). They found little or no difference between groups (6931 participants). We did not pool the results owing to variation in outcomes reported and in units and time points of measurement (Analysis 6.2)

Social care utilisation

Four trials reported change in social care utilisation (Bernabei 1998; Melis 2008; Metzelthin 2013; Sandberg 2015), which included professional home care, informal care, and meals received (Analysis 6.3), at follow-up durations ranging from six to 12 months. we did not pool the results owing to variation in outcomes reported and in units and time points of measurements across trials. Most trials reported little or no difference between groups for change in social care utilisation. Effects ranged from MD 0.3 hours (95% CI −0.37 to 0.97) to MD 133.0 hours (95% CI 9.41 to 256.59) when reported. We downgraded the certainty of the evidence by one level for indirectness and by one level for inconsistency, concluding that case management may result in little or no difference in change in social care utilisation at six to 12 months' follow-up (results not pooled, 4 trials, 853 participants; low-certainty evidence).

Change in costs

Fourteen trials reported costs, at follow-up durations ranging from six to 36 months (Applebaum 2002; Béland 2006; Bernabei 1998; Cameron 2013; Hoogendijk 2016; Kono 2012; Kono 2016; Leung 2004; Markle-Reid 2006; Melis 2008; Metzelthin 2013; Sandberg 2015; Spoorenberg 2018; Suijker 2016). Most trials provided total costs, which usually included healthcare service costs, intervention costs, and other costs such as informal care. We did not pool the results owing to variation in outcomes reported and in units and time points of measurement across trials. Most trials reported little or no difference between groups for change in total costs (Analysis 7.1). We graded the certainty of the evidence as moderate, downgrading one level for indirectness due to limitations associated with the definition of frailty in some trials. We concluded that case management likely results in little or no difference in change in costs at six to 36 months' follow-up (results not pooled; 14 trials, 8486 participants; moderate-certainty evidence; Summary of findings 1).

Patient satisfaction with care

Three trials reported patient satisfaction with care, at follow-up durations ranging from six to 12 months (Applebaum 2002; Bleijenberg 2016; Gagnon 1999). Most trials reported little or no difference between groups. Gagnon 1999 used the Client Satisfaction Questionnaire (Attkisson 1982), with follow-up at 10 months, and found that older adults who received the intervention were slightly more satisfied than those who received usual care (MD 1.10 points, 95% CI −0.10 to 2.30; 427 participants). We did not pool the results owing to variations in outcomes reported and in units and time points of measurement across trials. We downgraded the certainty of the evidence to low for risk of bias and indirectness, concluding that overall case management may result in little or no difference in patient satisfaction with care at six to 12 months' follow-up (results not pooled; 3 trials, 3037 participants; low-certainty evidence; Analysis 8.1).

Subgroup and sensitivity analyses

We had planned to carry out subgroup analyses to examine whether different likely dose responses might vary with different combinations of components, formulations, or levels of case management, or according to number or type of follow-up visits. However, due to limitations associated with reporting of trial design characteristics, it was not possible to conduct these subgroup analyses. We had also planned to conduct a subgroup analysis to examine whether the likely effects of case management interventions varied for older people with different levels of frailty (i.e. mild, moderate, or severe levels) or according to classification of frailty. However, this was not possible, as trials varied considerably in their definitions of frailty. Additionally, as included trials were conducted in high-income countries only, we were unable to compare the effects of case management in high-income versus low-and middle-income countries.

We had planned to perform sensitivity analyses to assess the robustness of our conclusions and explore their impact on effect sizes. However, due to limitations associated with reporting of trial design characteristics, it was not possible to conduct these.

DISCUSSION

Summary of main results

We included 20 RCTs (11,860 participants) that evaluated the effects of case management for integrated care versus standard care without case management for older people living with frailty in community settings. All trials were conducted in high-income countries. Case management interventions varied in their organisation, delivery, community setting and health/social care providers involved. Most trials included a variety of healthcare and social care professionals, including nurse practitioners, allied healthcare professionals, social workers, geriatricians, physicians, psychologists, and clinical pharmacists. In nine trials, the case management intervention was delivered by nurses only. Follow-up ranged from three to 36 months. We judged most trials at unclear risk of selection and performance bias; this consideration, together with indirectness, justified downgrading the certainty of the evidence to low or moderate.

Case management compared to standard care for older people living with frailty may result in little or no difference in the following outcomes.

- Mortality at 12 months' follow-up (7.0% in the intervention group versus 7.5% in the control group; RR 0.98, 95% CI 0.84 to 1.15; I^2 = 11%; 14 trials, 9924 participants; low-certainty evidence)
- Change in place of residence to a nursing home at 12 months' follow-up (9.9% in the intervention group versus 13.4**%** in the

control group; RR 0.73, 95% CI 0.53 to 1.01; I^2 = 0%; 4 trials, 1108 participants; low-certainty evidence)

- Quality of life at 3 to 24 months' follow-up (results not pooled; MDs ranged from −6.32 points (95% CI −11.04 to −1.59) to 6.1 points (95% CI −3.92 to 16.12) when reported; 11 trials, 9284 participants; low-certainty evidence)
- Serious adverse effects at 12 to 24 months' follow-up (results not pooled; 2 trials, 592 participants; low-certainty evidence)
- Change in physical function at three to 24 months' follow-up (results not pooled; MDs ranged from −0.12 points (95% CI −0.93 to 0.68) to 3.4 points (95% CI −2.35 to 9.15) when reported; 16 trials, 10,652 participants; low-certainty evidence)

Case management compared to standard care for older people living with frailty probably results in little or no difference in the following outcomes.

- Healthcare utilisation in terms of hospital admission at 12 months' follow-up, (32.7**%** in the intervention group versus 36.0% in the control group; RR 0.91, 95% CI 0.79 to 1.05; I^2 = 43%; 6 trials, 2424 participants; moderate-certainty evidence)
- Change in costs at six to 36 months' follow-up (results not pooled; 14 trials, 8486 participants; moderate-certainty evidence), which usually included healthcare service costs, intervention costs, and other costs such as informal care.

Overall completeness and applicability of evidence

For the primary outcomes, most trials reported data on mortality, around half reported data on admission to a nursing home and quality of life, whereas only two trials measured and reported serious adverse effects, which limited our understanding of serious adverse effects in this population (Cameron 2013; Parsons 2012). Evidence for the interventions came from RCTs, five of which were cluster-randomised or pseudo-cluster-randomised trials conducted in the Netherlands (Bleijenberg 2016; Hoogendijk 2016; Melis 2008; Metzelthin 2013; Suijker 2016). All trials were set in high-income countries, so we cannot generalise the findings to low- and middle-income countries. Case management interventions in the included trials varied in terms of setting, healthcare and social care providers involved, and length of follow-up; these factors may affect the applicability of evidence in terms of how such interventions should be best organised and delivered for older people with frailty in different community settings. We only pooled trials with complete datasets, when appropriate. Where papers had incomplete datasets, we reported their results narratively. We contacted three trials authors for additional data but received only one reply, confirming that a variable was assessed at baseline and not as an outcome measure.

Factors affecting the applicability of the evidence in this review include the different settings in which case management was conducted in the included trials. Case management interventions will work differently depending on the healthcare and social care system in which they operate. This makes it difficult to compare case management approaches in different countries with different healthcare and social care systems. There was insufficient information about the wider systems surrounding the interventions to be able to examine this meaningfully. Populations in the included trials were limited to a few high-income countries (particularly the Netherlands and Canada). Age was generally representative of older people living with frailty (i.e. mean age around 80 years in most trials), and there was no evidence of exclusion based on upper age limit. Data on sex for most of the trials suggested this was representative of the population of older people living with frailty (i.e. that frailty is more prevalent in women). The very limited reporting of data on ethnicity in the included trials meant that we were unable to comment on the impact of this aspect. Other potential limitations in the included trials were the variation in reporting of important outcomes, and lack of longer-term follow-up in most trials.

We had planned to carry out several subgroup analyses to examine the potential influence of several factors on the effects of case management. However, due to limitations associated with the reporting of trial design characteristics, it was not possible to conduct subgroup analyses. Therefore, we were unable to examine whether likely dose responses might vary according to different combinations of components, formulations, or levels of case management, or by number or type of follow-up visits. We attempted to collect information on dose using the TIDieR approach to describe characteristics of the complex interventions in the included trials, but in most cases trial authors had not provided the necessary information (Hoffmann 2014). There were insufficient data on dose to be able to perform subgroup analysis based on this factor. Therefore, we could not conclude whether dose or quality of management approach influenced effectiveness.

Similarly, it was not possible to examine whether the likely effects of case management interventions might vary for older people with different levels of frailty (i.e. mild, moderate, or severe levels) or according to different classifications of frailty, to ascertain which cohorts might experience most benefit from such interventions. One limitation was that the trials varied considerably in how they defined frailty, indicating the lack of consensus on use of a standardised measure (Kjelsnes 2022). Only one-third of trials (N = 7) reported using a frailty assessment; we included the remaining 13 trials because they described participating cohorts as frail or disabled, which could have affected the completeness and applicability of evidence. Frailty assessments were more common in the Dutch trials and less common in earlier trials, as researchers began to define and measure the concept of frailty after 2000 (e.g. Fried 2001). In the absence of a frailty measure, we considered a population eligible when the study supported their frailty status through a measure of function or dependency, or where the function or dependency baseline data suggested the population was frail. We made such decisions in close consultation with the two clinical specialist review authors (DW, JW) within our team to improve the validity and reliability of the screening process. Although there were clear parameters for classification of trial cohorts without specific frailty assessments, this approach has its limitations, because functional impairment/disability and frailty do not fully overlap as clinical syndromes (Yoshimura 2019). The trial populations also had other co-existing long-term conditions and multimorbidity. This was to be expected and so does not constitute a limitation (Hestmann Vinjerui 2020), although the reporting of co-existent and multimorbid conditions was poorly documented in the included trials.

Furthermore, as included trials were conducted in high-income countries only, it was not possible to compare the likely effects of case management interventions in high-income countries versus low-and middle-income countries. This is important because the

availability, nature, and scope of healthcare and social care services, support, and integration will vary between countries.

Quality of the evidence

All included trials were RCTs. We judged most at unclear risk of bias in different domains (selective reporting, attrition, blinding of participants and personnel, and other biases) owing to lack of detailed information. The evidence for the primary outcomes (mortality, change in place of residence/admission to a nursing home, quality of life, serious adverse events) was of low certainty, and the evidence for the secondary outcomes (change in function, healthcare and social care use/ hospital admissions, costs, and participant or carer satisfaction) was of low or moderate certainty. Reasons for downgrading the certainty of the evidence included risk of bias concerns, indirectness (related to the definition of frailty in some trials), inconsistency (because point estimates varied considerably across trials), and imprecision (due to small sample sizes).

Potential biases in the review process

To limit publication bias, we conducted a systematic and comprehensive search of published articles using a range of databases, and searched grey literature sources for unpublished articles. Two review authors independently screened trials from the search results. Two review authors also conducted full-text screening of potentially eligible trials and reached a consensus through discussion, to reduce the risk of missing a potential eligible trial for inclusion. Finally, two reviewers independently conducted data extraction, risk of bias assessments, and grading of the evidence, with subsequent discussions to reach consensus.

Agreements and disagreements with other studies or reviews

In line with our results, one systematic review published in 2015 found insufficient evidence of effects of case management interventions on a range of patient and service outcomes, including costs, for 'at risk' patient groups in primary care, including older people living with frailty and complex needs (Stokes 2015); and an earlier systematic review found that case management did not increase service use or costs (Oeseburg 2009). On the other hand, You 2012 found evidence that case management improves patient and service outcomes, although evidence of benefits were in different outcomes, namely participants' psychological health and well-being, and unmet service needs. You 2012 also had less specific participant eligibility criteria and included observational studies as well as randomised trials. Beswick 2008 was a seminal systematic review and meta-analysis that reported a reduced risk of nursing home admissions, as well as reduced hospital admissions, and improved physical function, though not mortality. However, evidence was drawn more broadly from pooling the results of a range of complex interventions for older populations in community settings, including, but not limited to, case management interventions.

Interestingly, evidence from one Cochrane Review indicated that case management may be more effective in people with dementia, reducing rates of care home admission and healthcare costs in the medium term, and improving psychosocial outcomes for carers (Reilly 2015). This is likely related to differences in the target population, as not all people with dementia experience frailty, and differences in the role of carers, who support and advocate for people with cognitive impairment. Another Cochrane Review, which examined the effectiveness of CGA in hospital settings, found no change in mortality and function (Ellis 2011; Ellis 2017). Likewise, a recent Cochrane Review of CGA in community settings for this population found no impact on mortality or nursing home admissions, but did find a reduced risk of unplanned hospital admissions (Briggs 2022). Although case management, like CGA, includes comprehensive assessment and initial care planning and is tailored to the needs of older people living with frailty, the two are distinct interventions, since case management focuses on the planning, provision, co-ordination, and monitoring of healthcare and social care.

The findings of this review largely concur with those of several previous systematic reviews, which found a lack of sufficient evidence for the effectiveness or cost-effectiveness of complex interventions (Van der Elst 2018), and integrated care models (Looman 2019; Marino 2018), for older people living with frailty. Some interventions included in these systematic reviews were case management interventions. Other reviews included case management delivered alongside other components, such as comprehensive assessment and multidisciplinary team involvement, which are common combined components of integrated care approaches for older people living with frailty (Hoogendijk 2016), and among older populations more widely (Briggs 2018). Another systematic review of the international evidence on the effects of integrated care interventions, including populations with complex needs, identified case management as a common shared component, and reported some evidence of improved participant satisfaction, quality of care, and access to services (Baxter 2018). Similarly to our review, Baxter 2018 found unclear effects on other patient and service outcomes, including service costs. Overall, these reviews highlight the challenges of evaluating the effects of case management when combined with other components within broader integrated care models for older people living with frailty, those with complex needs, or older populations more widely.

Process evaluation and qualitative studies of three included trials in this review reported positive patient and provider benefits of these case management interventions (Eklund 2013; Metzelthin 2013; Spoorenberg 2018). Implementation mechanisms in which case management supported integration of care included improved experience of continuity of care, building trusting patient-provider relationships, addressing different organisational cultures, developing bottom-up and top-down approaches, and a shift towards a more person-centred care approach tailored to meet the individual needs of this population (Dunér 2011; Metzelthin 2013; Spoorenberg 2015; Uittenbroek 2018). These studies suggest that such case management interventions may have affected processes of care and organisation of systems to support integration of care, but without necessarily improving patient and service outcomes.

AUTHORS' CONCLUSIONS

Implications for practice

We found uncertain evidence on the effects of case management for integrated care of older people with frailty in community settings, compared to usual care. Applying evidence from the included trials to different settings becomes more challenging when interventions are complex, as they cross many organisational, social, and

cultural boundaries. The impact of case management on acute outcomes may vary depending on the options available to the case manager. Responsive integrated care systems that have rapid access to intermediate care, same-day emergency care, and other community services such as hospital at home, have more potential to improve acute outcomes such as hospital admission. Essentially, if these services are inexistent or unwieldy, case management is unlikely to have a significant impact. For example, there is evidence that providing hospital at home for older people could be as effective as hospital admission (Shepperd 2021).

Implications for research

Future research should focus on better designed trials with consensus on definitions and measures of frailty. Complex interventions need measures of dose and intensity to evaluate whether those factors influence the effectiveness of the intervention. Trials should use a standardised definition of frailty (ideally with measurable indication of severity), and agreed outcome measures for quality of life, function, well-being, and participant experience measures. One option is using the COMET principles (COMET 2010). This would facilitate a greater number of small-scale trials (arguably better for supporting research in middle- and lower-income countries) while enabling more effective meta-analysis and meta-regression analysis.

There is also a need for more trials evaluating the effects of case management in combination with other commonly identified components of integrated care for older people living with frailty, as the evidence for the benefits of integrated care approaches for this population remains equivocal. Future research should develop a clear taxonomy for intervention components, to determine the active ingredients that work in case management interventions and identify how such interventions benefit some people and not others. For example, such a taxonomy has been developed for falls prevention interventions for older populations (Lamb 2011).

We do not know to what extent the trials in this review achieved the intended purpose of case management, which is helping older people to navigate a complex fragmented healthcare system. Further high-quality research is needed to better understand how these complex interventions work in practice. As it is unclear whether case management was actually supporting integration of care (assessed by only a few process evaluation studies and qualitative studies of trials in this review), we cannot determine why exactly the interventions did not improve the reported outcomes. Future research is needed to evaluate whether case management interventions implemented in practice to help people navigate complex systems actually achieve this aim, and if so, whether there is a dose effect, and whether case management works better in certain areas (e.g. where the various providers are not well integrated).

Finally, our searches did not yield any trials published after 2018, which could suggest a notable drop in RCTs in older people as a result of the COVID-19 pandemic. It would be useful to investigate whether case management interventions stopped or radically changed because of shielding policies, and if so, to what extent withdrawal of case management accelerated poorer health outcomes in people living with frailty.

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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Applebaum 2002

Study characteristics	
Methods	Year: not described Location: not described Trial method: RCT (individually randomised)

Participants	Total number randomised: 308
	Mean age: intervention group 78.2 years, control group 79.5 years
	Sex: intervention group 72% women; control group 71.1% women
	Frailty status: no frailty assessment used
	Inclusion criteria
	• Chronically disabled older people receiving in-home services, financed through a local tax levy, at risk of high use of acute services. High risk individuals:
	  ◦ hospitalised in past year;
	  ◦ used emergency room in past 6 months;
	  ◦ functional limitations in certain instrumental or activities of daily living; or
	  ◦ with 1 of several defined medical conditions.
	Exclusion criteria
	• None described

Interventions	Name of intervention: model of integrated care and case management for older people living in the community

Applebaum 2002 *(Continued)*

	Why (aim): integrate acute and long-term care services What (materials): preventive activities (improved assessment and training), intervention activities (communication with physicians, interaction with acute care system) What (procedures): targeted staff resources, improved communication (e.g. periodic team meetings) Who: clinical nurse care managers supervised by a geriatrician How: not specified Where: community-based long-term care case management agency in conjunction with an academic geriatrics centre When and how much: not specified Tailoring: not specified Modifications: not specified How well (planned): not specified How well (actual): not specified Comparison group: not described
Outcomes	Mortality: proportion died and mean number of survived days post enrolment Change in place of residence to a nursing or residential home: NH admissions (% with one admission) QOL: not reported Serious adverse effects: not reported Function-physical: ADLs, IADLs, overall health status, health status in last month Function-cognitive: not reported Function-emotional: overall mood (range 0–20) Function-social: not reported Healthcare use: hospital admissions (% with ≥ 1 admission), nursing home admissions Social care use: not reported Healthcare costs: Medicare costs and beneficiary payments (average monthly expenditure) Social care costs: not reported Patient satisfaction with care: satisfaction with Medicare care, satisfaction with "ESP" (definition of 'ESP' not given by study investigators)
Notes	Time points measured: 6, 12, 18 months depending on participant's date of entry Time points reported: 6, 12, 18 months Funding: "funded in part through a community property tax levy that generates over $13 million annually to finance care management and home care services, with support from the Robert Wood Johnson Foundation's Building Health Systems Initiative" Ethical approval: not reported Conflicts of interest: none declared

Applebaum 2002 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "individuals were randomly assigned." Comment: no further details.
Allocation concealment (selection bias)	Unclear risk	No information reported.
Baseline outcome measurements	Unclear risk	Unclear: the study reports most measures but does not report Medicare data.
Baseline characteristics	Low risk	Quote: "A comparison of treatment and control group differences on social and physical functioning items, health use, and demographic characteristics indicates no significant differences between the two groups. Although small variation exists on select variables, none of the comparisons were statistically significant and we conclude that the two groups were equivalent at baseline."
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Quote: "Medicare claims data documenting health care utilization and expenditures, mortality information from state health records, and demographic characteristics, and in home services data from agency files."; "Additionally a sub-sample of 150 clients participated in face-to-face interviews at baseline, 6, and 12 months to assess service quality, health care utilization and health satisfaction, and physical functioning." Comment: no mention of blinding.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No information reported.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	11 people withdrew and asked for their data not to be included, but no further detail given and no analyses conducted on dropouts.
Selective reporting (reporting bias)	Low risk	All results of outcome measures reported.
Other bias	Unclear risk	No information reported.

Bernabei 1998

Study characteristics

Methods	Year: 1995 Location: Rovereto, Northern Italy Trial method: RCT (individually randomised)
Participants	Total number randomised: 199 Mean age: intervention group 80.7years; control group 83.1 years Sex: intervention group 70% women; control group 71% women

Bernabei 1998 *(Continued)*

	Frailty status: no frailty assessment used Inclusion criteria • living in the town in question • Age > 65 years • In receipt of health/social care from municipal services Exclusion criteria • Unwilling to provide consent
Interventions	Name of intervention: case management and care planning by community geriatric evaluation unit and GPs Why (aim): to provide an integrated care plan What (materials): intervention involved assessment using modified British Colombia long-term care programme application and assessment form, assessing dependence in ADLs, cognition, and depression as well as health conditions and medication use What (procedures): case management and care planning delivered by community geriatric evaluation unit and GPs Who: nurses, social worker, and geriatrician (GPs involved in meetings and emergency situations only) How: case managers performed an initial assessment and review every 2 months, including dealing with problems and emergencies and providing help; the assessment outcome was reported back to the team at the geriatric evaluation unit and the team determined which services the person would be eligible for, and formulated an individualised care plan in agreement with GPs. Where: community setting When and how much: 2-monthly review of care plan by case manager with ad-hoc/emergency support, for 1 year. Tailoring: not specified Modifications: not specified How well (planned): not specified How well (actual): not specified Comparison: "primary and community care with the conventional and fragmented organisation of services—that is, general practitioner's regular ambulatory and home visits, nursing and social services, home aids, and meals on wheels."
Outcomes	Mortality: mortality rate using National Death Registry Change in place of residence to a nursing or residential home: number admitted to NH QOL: not reported Serious adverse effects: not measured Function-physical: ADLs, IADLS, British Columbia long term care (BC LTC) programme application and assessment form Function-cognitive: mental status, Short Portable Mental Status Questionnaire (SPMSQ) Function-emotional: depression symptoms, Geriatric Depression Scale (GDS) Function-social: not reported

Bernabei 1998 *(Continued)*

	Healthcare use: hospital and NH admissions, total number of days in hospital or NH, number with an ED attendance, number of home visits by GPs, number of nursing care hours, home support hours and meals on wheels Social care use: number of meals received Healthcare costs: cost of health services used, including hospital and NH admissions, total number of days in hospital or NH, and cost of case management intervention Social care costs: not reported Patient satisfaction with care: not reported
Notes	Time points measured: baseline and 12 months Time points reported: baseline and 12 months Funding: Progetto Finalizzato Invecchiamento (Italy), National Research Council (USA) Ethical approval: Steering committee of the National Research Council's aging project and local state authority Conflicts of interest: none declared

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer generated list.
Allocation concealment (selection bias)	Unclear risk	Insufficient information provided to make a judgement.
Baseline outcome measurements	Unclear risk	Insufficient information provided to make a judgement.
Baseline characteristics	Low risk	Quote: "There were no significant differences at baseline in the intervention and control groups across several functional and clinical variables."
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information provided to make a judgement.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "Case managers, however, performed the assessment simply as a part of their routine activities; both patients and professionals remained blind about the outcomes under study and the length of follow up. This greatly limited the risk of introducing a bias."
Incomplete outcome data (attrition bias) All outcomes	Low risk	No losses to follow-up.
Selective reporting (reporting bias)	Low risk	Reported results for measures listed in methods section.
Other bias	Unclear risk	No information reported on recruitment procedures.

Bleijenberg 2016

Study characteristics	
Methods	Year: October 2010–Mar 2011 recruitment, 12 months from recruitment Location: Utrecht, the Netherlands Trial method: single-blind, 3-arm, cluster-RCT with 1-year follow-up
Participants	Total number randomised: 3092 (2302 eligible for this review) Mean age: 74.2 years Sex: 55.2% women Frailty status: a frailty index (FI) was constructed based the cumulative deficit model Inclusion criteria • Age ≥ 60 years (due to "large numbers of older adults of non-Dutch origin reporting early onset frailty in GP practices") • Potential frailty Exclusion criteria • Terminal illness (estimated life expectancy ≤ 3 months or less) • Residence in assisted-living facilities or NHs
Interventions	Name of intervention: intervention 1: frailty screening (not included in this review); intervention 2: frailty screening followed by personalised nurse-led care (personalised care programme) Why (aim): intervention 1: to identify older adults at risk of adverse events through electronic medical record data; intervention 2: not specified What (materials): intervention 1: EMR data screening: individuals aged ≥ 60 years considered at risk if they were at risk for frailty, were exposed to polypharmacy, or had not had a visit with their GP for ≥ 3 years (consultation gap); intervention 2: frailty assessment using Groningen Frailty Indicator questionnaire and Intermed Self-Assessment, development of evidence-based care plans for common geriatric conditions, training for nurses What (procedures): intervention 1: quarterly reports including older adults at risk were generated for each of the participating practices but were sent only to the practices in the intervention groups. The GPs in intervention group 1 were advised to act upon these reports according to the current standards and guidelines; intervention 2: personalised nurse-led care programme followed application of screening instrument (intervention 1) Who: intervention 1: not described who did screening, GP to act on screening results; intervention 2: registered practice nurses How: intervention 1: not described; intervention 2: 6 frailty assessments using Groningen Frailty Indicator questionnaire and Intermed Self-Assessment, CGA at home, follow-up visits, care co-ordination based on needs Where: GP practices When and how much: 6 months (Oct 2010–March 2011; intervention 2) Tailoring: not specified Modifications: not specified How well (planned): not specified How well (actual): not specified

Bleijenberg 2016 *(Continued)*

	Comparison: usual care, *"defined as the continuation of daily care practice without the implementation of either intervention."*
Outcomes	Mortality: number died collected from the EMRs of participating GP practices Change in place of residence to a nursing or residential home: admission to NH or assisted-living facility QOL: self-reported HRQOL (RAND-36, EuroQol, perceived QOL score) Serious adverse effects: not specified Function-physical: ADL (modified Katz-15), IADL (range 0–15) Function-cognitive: not reported Function-social: not reported Healthcare use: number of hospital admissions, GP out -of -hours (OOH) consultations during follow-up, number of ED visits, number of GP consultations (phone, office, home) Social care use: not reported Healthcare costs: not reported Social care costs: not reported Patient satisfaction with care: satisfaction with care (range 0–10)
Notes	Time points measured: baseline, 6 months, 12 months Time points reported: baseline, 6 months, 12 months Funding: "grant from The Netherlands Organization for Health Research and Development (311040201) as part of the National Care for the Elderly Program" Ethical approval: "The institutional review board of the University Medical Center Utrecht approved the U-PROFIT trial (protocol ID 10–149/O), which is registered as NTR2288". Conflicts of interest: none declared

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "All participating general practices were identified before randomization. The general practices were stratified according to practice size (small, <1,000; average, 1,000–3,000; large, >3,000 patients). Within each stratum, practices were randomized using a computer-generated random allocation sequence with the aim of an allocation ratio at the individual level."
Allocation concealment (selection bias)	Unclear risk	Quote: "A modified informed consent procedure was used (individuals were not aware of the intervention arm that they were allocated to but were fully informed at the end of the study)."
Baseline outcome measurements	Unclear risk	Information not given.
Baseline characteristics	Unclear risk	Quote: "Approximately 60% of the participants had a baseline Katz-15 score of 0 or 1, indicating that the majority were (almost) fully independent. Consequently, these individuals had little room for improvement. Although broad selection criteria were chosen to ensure that no older people were missed, GPs indicated that older people with poor cognitive function were less likely to be included."

Bleijenberg 2016 *(Continued)*

		Comment: no other information reported.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Investigators (GPs) not blinded.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Trial authors do not state whether the nurses or research assistants were blinded.
Incomplete outcome data (attrition bias) All outcomes	Low risk	ITT principles were followed.
Selective reporting (reporting bias)	Unclear risk	Quote: "Although responders did not differ from nonresponders in most aspects, selective inclusion cannot be excluded. To reduce selective inclusion, maximal efforts were made to include frail people (i.e. the nurses and research assistants offered assistance when needed)."
Other bias	Unclear risk	Information not given.

Béland 2006

Study characteristics	
Methods	Year: June 1999–March 2001 Location: Montreal, Canada Trial method: RCT (individually randomised)
Participants	Total number randomised: 1309 Mean age: intervention group 82 years; control group 82 years Sex: intervention group 71% women; control group 72% women Frailty status: no frailty assessment used. Background describes the cohort as frail, title refers to disability, Functional Autonomy Measurement System (SMAF) scale use to assess disability Inclusion criteria • Age > 64 years • Community-dwelling, residing within territory of local community service centre • Competence in French or English (either the participant or caregiver) • Participating caregiver (if a caregiver existed) • At least moderate disability (SMAF score ≤ 10) Exclusion criteria • Pending nursing home admission • Pending move out of territory of local community service centre
Interventions	Name of intervention: System of Integrated Care for Older Persons (SIPA) Why (aim): integrating care, rapidly meeting needs, and avoiding inappropriate hospital and NH utilisation

Béland 2006 *(Continued)*

	What (materials): CGA on admission to SIPA, interdisciplinary protocols (nutrition, falls, congestive heart failure, dementia, depression, medication, vaccination), mobilisation of resources, including intensive home care, group homes, 24-hour on-call service What (procedures): "community-based multidisciplinary teams with full clinical responsibility for delivering integrated care through the provision of community health and social services and the coordination of hospital and NH care." Who: multidisciplinary team with different compositions in 2 sites: case managers (nurse or social worker), and other healthcare and social care professions, including community nurses, social workers, occupational therapists, physiotherapists, homemakers, staff family physicians, consultant pharmacists (1 site), and community organisers (1 site) How: assessing needs, organising and delivering most community services, CGA on admission to SIPA, protocols applied in collaboration with participant's family physician, rapid mobilisation of resources (intensive home care, group homes, and a 24-hour on-call service); case managers intervened on medical and social issues with patients and caregivers, liaised with family physicians, and actively followed patients throughout the care trajectory, assuring continuity and easing transitions between hospital and community. Where: public community organisations responsible for home care When and how much: not specified Tailoring: not specified Modifications: not specified How well (planned): not specified How well (actual): not specified Comparison: usual care (not specified)
Outcomes	Mortality: number of individuals who died Change in place of residence to a nursing or residential home: not reported QOL: not reported Serious adverse effects: not reported Function-physical: self-declared chronic diseases: Established Populations Epidemiologic Study of the Elderly scale (EPESE), functional limitations (Nagi scale), IADL (OARS), ADL (Barthel scale) Function-cognitive: not reported Function-emotional: not reported Function-social: not reported Healthcare use: home health care, inpatient care, ED visits, alternate level of care, skills nursing homes Social care use: home social care Healthcare costs: home health care, inpatient care, ED visits, alternate level of care, skills nursing homes Social care costs: home social care Patient satisfaction with care: not reported
Notes	Time points measured: baseline, 12 months Time points reported: baseline, 12 months

Béland 2006 *(Continued)*

	Funding: "Health Transition Fund (Health Canada); Canadian Institutes of Health Research; Canadian Health Services Research Foundation; Fonds de la recherche en santé du Québec (FRSQ); Quebec Ministry of Health and Social Services." Ethical approval: research ethics committees of the Jewish General Hospital and the 2 local community service centres Conflicts of interest: none declared

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomly allocated to either SIPA or control according to the allocation sequence (block size of 6–8) generated by the SAS Plan procedure.
Allocation concealment (selection bias)	Unclear risk	No information reported.
Baseline outcome measurements	Unclear risk	No information reported.
Baseline characteristics	Unclear risk	No information reported.
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Data were manually entered by trained assistants blinded to the participants' trial status.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Interviewers were blinded to the experimental status of the interviewees.
Incomplete outcome data (attrition bias) All outcomes	Low risk	ITT principle applied.
Selective reporting (reporting bias)	Unclear risk	All results of outcomes reported; reported % increase in care accessed, care accessed and costs of care at follow-up rather than differences in outcomes between groups.
Other bias	Unclear risk	No information reported.

Cameron 2013

Study characteristics

Methods	Year: January 2008–June 2011 Location: Sydney, Australia Trial method: RCT (individually randomised)
Participants	Total number randomised: 241 Mean age: intervention group 83.4 years; control group 83.2 years Sex: intervention group 67% women; control group 68% women

Cameron 2013 *(Continued)*

	Frailty status: assessed by CHS criteria Inclusion criteria • Age ≥ 70 years • ≥ 3 CHS frailty criteria • Residence in Hornsby or Ku-ring-gai local government areas, not in a residential aged care facility Exclusion criteria • Living in a residential aged care facility • Moderate or severe cognitive impairment (defined as MMSE score ≤ 18) • Ongoing client of Division of Rehabilitation and Aged Care Services (DRACS) • Illness likely to be associated with life expectancy < 12 months, estimated by a score of ≤ 3 on a modified version of the Implicit Illness Severity Scale • Participation in another physical intervention research project. Comparison: not specified
Interventions	Name of intervention: multifactorial, interdisciplinary treatment programme Why (aim): "to compare the effects of a multifactorial, interdisciplinary intervention specifically targeting frailty with usual care" and "to establish the effects of the intervention on both frailty and impaired mobility" What (materials): in-person meetings and telephone consultations What (procedures): "Case management by the physiotherapist, and regular case conferences involving the physiotherapist, geriatrician, rehabilitation physician, nurse and dietician, facilitated coordination of the delivery of the intervention. Reassessment was ongoing throughout the intervention phase. The physiotherapist was the co-ordinator of the intervention. Home visits usually involved several intervention components and included not only the WEBB exercise program, but other identified interventions that were relevant to the frail person at that particular time." Who: physiotherapist, geriatrician, rehabilitation physician, nurse, and dietician How: face-to-face, telephone Where: community and hospital settings When and how much: median of 10 face-to-face sessions with physiotherapist Tailoring: not specified Modifications: not specified How well (planned): delivered as planned How well (actual): not specified Comparison: not specified
Outcomes	Mortality: mortality rate (hospital records) Change in place of residence to a nursing or residential home: admissions to nursing care facilities QOL: EQ5D VAS Serious adverse effects: adverse events (monitored during study) Function-physical: level of frailty according to CHS criteria (primary outcome); mobility, Short Physical Performance Battery (SPPB primary outcome); disability, Barthel Index; satisfaction with level of community access; mobility in last month, scale; Reintegration to Normal Living Index, scale; Walking speed, 4-minute walking test; Activity Measure for Post Acute Care (AMPAC), scale.

Cameron 2013 *(Continued)*

	Function-cognitive: MMSE (baseline only) Function- emotional: depression symptoms, GDS (short) Function-social: 'Social Space', University of Alabama at Birmingham Life Space Assessment (range 0-120) Healthcare use: number of hospital admissions, number of admissions to nursing care facility Social care use: not reported Healthcare costs: total cost per person Social care costs: not reported Patient satisfaction with care: not reported
Notes	Time points measured: 3 and 12 months Time points reported: 3 and 12 months Funding: Australian National Health and Medical Research Council Health Services Research Grant Ethical approval: Northern Sydney & Central Coast Health Human Research Ethics Committee (ACTRN12608000250336) Conflicts of interest: none declared

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "A permuted block randomisation approach was used to achieve balanced treatment allocation. There were two strata (frail with three CHS frailty criteria and very frail with four or five CHS frailty criteria). A random number sequence was generated for the order of treatment allocation within the blocks using SPSS v15 RV. UNIFORM function (SPSS, Inc., Chicago, IL, USA). Block sizes of four and six were used and these blocks were randomly arranged within blocks of ten."
Allocation concealment (selection bias)	Low risk	Quote: "Project personnel not involved in assessing participants or in providing the intervention managed the randomised group allocation. The treatment allocation tables for both strata were stored centrally off site."
Baseline outcome measurements	Low risk	Baseline outcome measurements were conducted and similar between groups.
Baseline characteristics	Low risk	The groups were well-matched at baseline, except that the control group had a slightly better functioning mean score.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information provided to make a judgement.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Staff members performing the outcome assessment and data analysis were masked to group allocation.
Incomplete outcome data (attrition bias)	Low risk	Quote: "The primary analyses were undertaken in accordance with the intention-to-treat principle."

Cameron 2013 *(Continued)*
All outcomes

Selective reporting (reporting bias)	Unclear risk	Not all protocol outcomes are reported.
Other bias	Low risk	No other apparent sources of bias.

Dalby 2000

Study characteristics	
Methods	Year: not specified Location: Stoney Creek, Ontario, Canada Trial method: RCT (individually randomised)
Participants	Total number randomised: 142 Mean age: intervention group 79.1 years; control group 78.1 years Sex: intervention group 52% women; control group 43% women Frailty status: no frailty assessment used Inclusion criteria • Functional impairment, admission to hospital, or bereavement in previous 6 months Exclusion criteria • Living in NH • Participation in another research study • Previous visit by nurse to home or participation in pretest of the survey
Interventions	Name of intervention: preventive home visits by a nurse Why (aim): to favourably affect the combined rate of deaths and admissions to an institutions What (materials): medical records, care plans What (procedures): nurse served as case manager by integrating community services and agencies into participants' care plans Who: nurse How: review of medical records and comprehensive assessment addressing physical, cognitive, emotional, and social function, medication use, and safety and suitability of home environment; care plan development with primary care physician, the patient, the family, caregivers, and other healthcare professionals. Follow-up visits and phone calls were conducted as needed over the course of the 14-month trial to provide vaccinations, monitor, promote health and provide psychosocial support. Where: community, participant's home When and how much: 14 months, as needed Tailoring: not specified Modifications: not specified How well (planned): not specified

Dalby 2000 *(Continued)*

	How well (actual): not specified
Outcomes	Mortality: measured as a combined rate of deaths and admissions to an institution Change in place of residence to a nursing or residential home: not reported QOL: not reported Serious adverse effects: not reported Function-physical: not reported Function-cognitive: not reported Function-social: not reported Healthcare use: rate of health services utilisation measured as visits to family physician and specialists, visits to ED, hospital admissions (overnight), length of stay in hospital, outpatient procedures Social care use: not reported Healthcare costs: not reported Social care costs: not reported Patient satisfaction with care: not reported
Notes	Time points measured: 14 months Time points reported: 14 months Funding: Ontario Ministry of Health, Community Health Branch Ethical approval: Research Committee of St. Joseph's Hospital, Hamilton, Ontario Conflicts of interest: none declared

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Eligible participants were randomly assigned either to the visiting nurse (VN) group or the usual care (UC) group by a research assistant not affiliated with the HSO using a random numbers table. The randomization schedule was developed by another research assistant, who was not involved in the randomization process."
Allocation concealment (selection bias)	Unclear risk	Quote: "The randomization schedule was kept within the Health Services Delivery Research Unit of St. Joseph's Community Health Centre throughout the trial." Comment: no information on how allocation was concealed.
Baseline outcome measurements	Unclear risk	No detail of how these data were collected.
Baseline characteristics	Unclear risk	Unclear: 1 significant difference but no detail of any adjustments in the analyses.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "The 2 family physicians and the office nurse were aware of which patients were in the VN group. They were blinded as to the UC group members and the results of their screening questionnaire until after the trial was completed."

Dalby 2000 *(Continued)*

		Comment: participants not blinded.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "The research nurse involved in reviewing the medical records was blinded to group allocation."
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	No information, no mention of ITT.
Selective reporting (reporting bias)	Low risk	Data on all outcome measures reported.
Other bias	Unclear risk	No information given.

Eklund 2013

Study characteristics	
Methods	Year: October 2008–November 2011 Location: Mölndal, Sweden Trial method: RCT (individually randomised)
Participants	Total number randomised: 181 Mean age: not specified Sex: intervention group 55% women; control group 55% women Frailty status: no frailty assessment used Inclusion criteria • Age ≥ 80 or 65–79 • ≥ 1 chronic disease • Dependence in ≥ 1 ADL • Seeking care in ED of Sahlgrenska University Hospital/Mölndal and discharge home in the municipality of Mölndal, Sweden. Exclusion criteria • Acute severe illness with immediate need of assessment and treatment by a physician (within 10 minutes) • Dementia (or severe cognitive impairment, clinically assessed by the nurse with geriatric competence at ED) • Palliative care
Interventions	Name of intervention: Continuum of Care for Frail Older People Why (aim): maintaining functional ability What (materials): frailty screening and geriatric assessment, case management, information transfer in case of hospital care, care planning at home, close follow-up, person-centred approach with shared decision-making

Eklund 2013 *(Continued)*

	What (procedures): creation of continuum of care by collaboration between nurse with geriatric competence at ED, hospital wards, and multiprofessional team for care and rehabilitation in the municipality with a case manager Who: multiprofessional team included professionals in nursing (the case manager), occupational therapy, physiotherapy, and social work How: frailty screening and geriatric assessment in ED by nurse with geriatric competence, case management in municipality with multiprofessional team for care and rehabilitation, information transfer in case of hospital care to ward and case manager (case manager responsible for contacting ward and patient to prepare discharge), care planning at home by case manager based on ED frailty screening and geriatric assessment, rehabilitation in municipality if needed, regular follow-up by case manager Where: community, participant's home When and how much: ≥ 1 year, contact ≥ once a month Tailoring: not specified Modifications: not specified How well (planned): not specified How well (actual): not specified Comparison: "ordinary care"
Outcomes	Mortality: number of individuals who died Change in place of residence to a nursing or residential home: not reported QOL: not reported Serious adverse effects: not reported Function-physical: frailty (sum of 8 core frailty indicators: weakness, fatigue, weight loss, low physical activity, poor balance, low gait speed, visual impairment, and cognitive impairment. Level of frailty was operationalised as non-frail (0 frailty indicators), pre-frail (1–2 indicators), frail (> 2 indicators)); ADL (ADL staircase), self-rated health derived from one statement on the SF-36 Function-cognitive: not reported Function-social: not reported Healthcare use: number of participants with ≥ 1 hospital admission, home visit (physician, nurse), visit to an outpatient clinic (nurse) Social care use: not reported Healthcare costs: not reported Social care costs: not reported Patient satisfaction with care: not reported
Notes	Time points measured: 3, 6, and 12 months Time points reported: 3, 6, and 12 months Funding: the Vårdal Institute, the Swedish Institute for Health Sciences and Vinnvård Ethical approval: Regional Ethical Review Board in Gothenburg, reference number: 413–08 Conflicts of interest: none declared

Eklund 2013 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Using sealed opaque envelopes.
Allocation concealment (selection bias)	Unclear risk	Envelopes were obtained by the nurse.
Baseline outcome measurements	Unclear risk	No information given.
Baseline characteristics	Unclear risk	No information given.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants not blinded.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	The trial authors do not state whether the Research Assistants were blinded.
Incomplete outcome data (attrition bias) All outcomes	Low risk	ITT principles followed.
Selective reporting (reporting bias)	Low risk	Reported pre-specified outcomes in several publications.
Other bias	Unclear risk	No information reported.

Gagnon 1999

Study characteristics

Methods	Year: June 1996–August 1996 Location: Montreal, Canada Trial method: RCT (individually randomised)
Participants	Total number randomised: 427 Mean age: intervention group 81.4 years; control group 81.8 years Sex: intervention group 57.1% women; control group 59.1% women Frailty status: no frailty assessment used Inclusion criteria • Age ≥ 70 years • discharged from ED within previous 12 months • Living in catchment area • English or French speaking

Gagnon 1999 *(Continued)*

- "Passing" the MMHE
- Requiring assistance with ≥ 1 ADL or 2 IADLs
- ≥ 40% probability of admission to hospital "as defined by the Boult assessment tool"

Exclusion criteria

- Admission to ED from NH or long-term care facility
- Participation in other research studies
- Currently being seen by geriatric team in hospital
- Not available for ≥ 2 months during the study
- Partner already participating in the study
- "period of hospitalisation at the time of contact"

Interventions	Name of intervention: nurse case management Why (aim): "to create and implement a responsive plan of care" What (materials): co-ordinating care planning and providing care What (procedures): nurse case manager's role was twofold: (1) "supporting the older people and their caregivers during times of transition related to health status, environmental changes, and changes in resource needs", and (2) co-ordinating "the work of all healthcare providers involved in the care of the older persons." Who: nurses How: by co-ordinating care planning and delivering care Where: hospital to older person's home When and how much: for 10 months, 8 am to 8 pm Monday to Friday Tailoring: not specified Modifications: not specified How well (planned): not specified How well (actual): not specified Comparison: usual care: hospital and community services provided separately
Outcomes	Mortality: record review, mortality rate Change in place of residence to a nursing or residential home: not measured QOL: SF-36 (primary outcome) Serious adverse effects: not reported Function-physical: self-reported ADLs and IADLs, OARS Function-cognitive: not reported Function-social: not reported Healthcare use: number of hospital admissions and ED admissions, length of hospital stay Social care use: not reported Healthcare costs: not reported Social care costs: not reported

Gagnon 1999 *(Continued)*

	Patient satisfaction with care: satisfaction with care/services, Client Satisfaction Scale (CSQ-8)
Notes	Time points measured: baseline and 10 months Time points reported: baseline and 10 months Funding: Ministry of Health and Social Services of Quebec (Canada) Ethical approval: Sir Mortimer B. Davis, Jewish General Hospital Ethics Committee Conflicts of interest: none declared

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Subjects were stratified by community health center catchment area and randomized in blocks of eight using a computer-generated table of random numbers."
Allocation concealment (selection bias)	Low risk	Quote: "Group assignment was placed in sealed opaque envelopes. Envelopes were opened sequentially as older people consented to join."
Baseline outcome measurements	Low risk	Relevant characteristics associated with the outcomes reported and similar between groups.
Baseline characteristics	Low risk	Baseline characteristics reported and similar between groups.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information provided to make a judgement.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "In order to prevent research assistants collecting outcome data from having knowledge of the patients' group assignment before outcome assessment: (1) the research assistants responsible for notifying subjects and clinicians of group assignment differed from the research assistants collecting outcome data, (2) outcome assessors were not given information as to group assignment of patients, and (3) during any contact with patients, outcome assessors were instructed to request that they not divulge to which arm of the study they were assigned."
Incomplete outcome data (attrition bias) All outcomes	Low risk	Quote: "Assessment of effectiveness was made by performing intention-to-treat analyses, i.e., subjects were compared by their assigned group. Active treatment comparisons, excluding those who, postrandomization, refused the experimental intervention, were subsequently made."
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a judgement.
Other bias	Low risk	No other apparent source of bias.

Hoogendijk 2016

Study characteristics

Methods	Year: May 2010–March 2013

Hoogendijk 2016 *(Continued)*

	Location: Amsterdam and West-Friesland, Netherlands Trial method: RCT (stepped-wedge cluster-randomised design)
Participants	Total number randomised: 1147 Mean age: 80.5 years Sex: 65.5% women Frailty status: PRISMA-7 score > 3 Inclusion criteria • Community-dwelling, "in two regions in the Netherlands: Amsterdam (18 practices, urban area) and West-Friesland (17 practices, urbanized rural area)" • Age ≥ 65 years • PRISMA-7 score ≥ 3 Exclusion criteria • Not stated explicitly
Interventions	Name of intervention: Intervention-Geriatric Care Model (GCM)-group Why (aim): "to evaluate the impact of the GCM on quality of life and several other patient outcomes" What (materials): in-person visits What (procedures): "The intervention consisted of a geriatric in-home assessment by a practice nurse, followed by a tailored care plan. Reassessment occurred every six months. Nurses worked together with primary care physicians and were supervised and trained by geriatric expert teams. Complex patients were reviewed in multidisciplinary consultations." Who: nurses How: "Trained practice nurses (n = 21), who were based at the primary care practices, worked together with PCPs and carried out the intervention at the patient level in four steps. Every six months, a practice nurse visited the frail older adult at home. During the first home visit, a multidimensional geriatric assessment was conducted (Step 1) using the inter RAI Community Health Assessment (CHA) version 9.1. After each assessment, practice nurses wrote a tailored care plan in consultation with the PCP of the patient (Step 2). During a second home visit, the practice nurse and the older adult formulated care goals and actions for the final care plan (Step 3). During and after the intervention period, the older adult and the practice nurse evaluated the outcomes of the actions listed in the care plan. There was regular contact by telephone, and if necessary, an additional home visit was scheduled after 3months (Step 4). The GCM was managed by two geriatric expert teams (one in each region) consisting of an experienced geriatric nurse and a geriatrician. Geriatric expert teams had the following tasks: (1) (quality) management and training, (2) multidisciplinary consultations for complex patients, and (3) building and maintaining local care networks." Where: primary and community care settings When and how much: 24 months Tailoring: not specified Modifications: not specified How well (planned): not specified How well (actual): not specified Comparison: usual care

Hoogendijk 2016 *(Continued)*

Outcomes	Mortality: mortality rate Change in place of residence to a nursing or residential home: not reported QOL: SF-12 (primary outcome); EQ-5D Serious adverse effects: not measured Function-physical: functional limitations in ADLs and IADLs (KATZ scale); self-rated health, single questions derived from RAND-36, % good-excellent Function-psychological/cognitive: psychological well-being, RAND-36 mental health subscale Function-social: social functioning, single questions derived from RAND-36, % poor Healthcare use: total and acute hospital admissions from hospital medical records Social care use: not reported Healthcare costs: difference in costs Social care costs: not reported Patient satisfaction with care: not reported
Notes	Time points measured: baseline, 6,12, 18, and 24 months Time points reported: baseline, 6,12, 18, and 24 months Funding: Netherlands Organization for Health Research and Development (ZonMw) Ethical approval: VU University Medical Center medical ethics committee (NL2043) Conflicts of interest: 1 trial author is a board member of the Dutch Association of users of interRAI tools (unpaid). No other conflicts of interest reported.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-based randomisation.
Allocation concealment (selection bias)	Low risk	Unit of allocation by institution.
Baseline outcome measurements	High risk	There were baseline differences between groups for functional limitations.
Baseline characteristics	High risk	There were baseline differences between groups for educational level, region, frailty index score, and number of chronic diseases.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information provided to make a judgement.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Blinded for baseline. Unclear who made follow-up assessments.

Hoogendijk 2016 *(Continued)*

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Quote: "Intervention effect analyses were based on the intention-to-treat principle using mixed model analysis (i.e. multilevel modeling)."
Selective reporting (reporting bias)	Unclear risk	Not all secondary outcomes are reported (quality of care, process outcomes, carer outcomes or costs).
Other bias	Unclear risk	Quote: "generalizability of our findings is limited by the geographic location (two regions in the Netherlands) and potential selection bias. It is possible that PCPs did not pre-select all potentially frail patients. We have no data to compare approached and included patients with all older patients in the primary care practices."

Kono 2012

Study characteristics	
Methods	Year: December 2007–March 2010 Location: Osaka, Japan Trial method: RCT (individually randomised)
Participants	Total number randomised: 323 Mean age: intervention group 80.3 years; control group 79.6 years Sex: intervention group 73.9% women, control group 74.1% women Frailty status: no frailty assessment used Inclusion criteria • Age ≥ 65 years • Support Level 1 or 2 in the Long-Term Care Insurance (LTCI) system • Living at home at baseline • No use of formal long-term care services reimbursed by the LTCI in previous 3 months Exclusion criteria • Refusal to provide consent (not explicitly mentioned)
Interventions	Name of intervention: case management through preventative home visits Why (aim): "to examine effects on functional and psychosocial parameters and public long-term care service utilization of a preventive home visit program for ambulatory frail elders over 2 years in three Japanese communities." What (materials): not specified What (procedures): "Routine preventive home visits were conducted for elders in the intervention group every 6 months for 2 years [...] by community health nurses, care managers, or social workers according to the structured multidimensional interview-based assessments of five key elements: locomotion, daily activities, social contacts or relationships with other people, health conditions, and signs of abuse." Who: community health nurses, care managers, or social workers How: home visits

Kono 2012 *(Continued)*

	Where: community When and how much: every 6 months for 2 years Tailoring: not specified Modifications: not specified How well (planned): not specified How well (actual): not specified
Outcomes	Mortality: mortality rate (number of reported deaths) Change in place of residence to a nursing or residential home: number of individuals living at home QOL: not reported Serious adverse effects: not reported Function-physical: ADLs, Barthel Index; IADLs, Index of Competence developed by the Tokyo Metropolitan Institute of Gerontology (primary outcomes) Function-cognitive: not reported Function-emotional: depression symptoms, GDS (primary outcome) Function-social: level of social support, Social Support Scale (range 0–4) Healthcare use: hospital admissions Social care use: not reported Healthcare costs: total healthcare costs (total per person per month), including costs related to hospital care, oupatient clinic utilisation, long-term care, home care services, home aid, visiting nursing care, day care services, institutionalised care Social care costs: public long-term care costs, including home care services, home aid, visiting nursing care, day care services, institutionalised care Patient satisfaction with care: not reported
Notes	Time points measured: baseline, 12, and 24 months Time points reported: baseline, 12, and 24 months Funding: Japan Society for the Promotion of Science Ethical approval: Nursing Research Ethical Committee of Osaka City University, Japan (UMIN000001113) Conflicts of interest: none declared

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "participants were randomized to either the intervention group (n = 161) or usual care group (n = 162) by researchers using computer-generated random numbers stratified on the basis of gender, age group, and district within each community."
Allocation concealment (selection bias)	Unclear risk	Insufficient information provided to make a judgement.

Kono 2012 *(Continued)*

Baseline outcome measurements	Low risk	Baseline outcomes measurements provided and similar between groups.
Baseline characteristics	Low risk	Baseline characteristics are provided and similar between groups.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information provided to make a judgement.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided to make a judgement.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Quote: "All analyses were conducted by intention to treat (including participants who refused the intervention."
Selective reporting (reporting bias)	Unclear risk	Insufficient information provided to make a judgement.
Other bias	Low risk	No other apparent source of bias.

Kono 2016

Study characteristics	
Methods	Year: October 2011–September 2013 Location: Osaka, Japan Trial method: RCT (individually randomised)
Participants	Total number randomised: 360 Mean age: 79.2 years Sex: 75% women Frailty status: no frailty assessment used Inclusion criteria • Age ≥ 65 years • Support Level 1 (less frail) or 2 (more frail) Exclusion criteria • Refusal to provide consent (not explicitly mentioned)
Interventions	Name of intervention: Visit group/PHV programme Why (aim): "to determine the effects on functional parameters of the updated PHV [Preventive Home Visit] program over 24 months in ambulatory frail older adults certified at the two lowest care-need levels in the Japanese LTCI system." What (materials): in-person visits

Kono 2016 *(Continued)*

	What (procedures): "Routine PHVs were provided every 3 months for 24 months by community care nurses, social workers, or care managers who worked at all six community-based integrated centres in the three municipalities. PHVs were conducted with rigorous recommendations, based on a systematic structured assessment sheet of care needs, including four domains: health, mental health, activities, and participation (17). After assessing care needs and client and/or family care preference, comprehensive recommendations were made, which included "sustain self-care," "need observation or supervision from visitors," and "need continuous or long-term health care"." Who: community care nurses, social workers, or care managers How: facility-based and home-based care Where: community care When and how much: every 3 months for 2 years Tailoring: not specified Modifications: not specified How well (planned): not specified How well (actual): not specified Comparison: "usual care in the Japanese LTCI system, which includes unstructured visits from community based integrated centers, every 3 months to individuals utilizing home-based LTC services."
Outcomes	Mortality: number of individuals who died monitored by trial authors Change in place of residence to a nursing or residential home: number and % participants living alone QOL: not reported Serious adverse effects: not reported Function-physical: IADLs, Barthel Index and Index of Competence developed by the Tokyo Metropolitan Institute of Gerontology (primary outcomes) Function-cognitive: cognitive capacity subscale short Japanese version Metamemory in Adulthood Questionnaire (MAQ) Function-emotional: depression symptoms, GDS short version Function-social: daily life satisfaction related to social activities, Social Activities-Related Life Satisfaction Scale Healthcare use: number of individuals institutionalised Social care use: not reported Healthcare costs: total healthcare costs Social care costs: not reported Patient satisfaction with care: not reported
Notes	Time points measured: 12, 24, and 36 months Time points reported: 12, 24, and 36 months Funding: Japan Society for the Promotion of Science Ethical approval: Nursing Research Ethical Committee of Osaka City University, Japan (UMIN000006463)

Kono 2016 *(Continued)*

Conflicts of interest: none declared

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Using computer-generated random numbers, stratified on the basis of gender, age group, and community, these 360 participants were randomized to either the visit group (VG) allocated to the updated PHV program (n = 179) or the control group (CG; n = 181)."
Allocation concealment (selection bias)	Unclear risk	Insufficient information provided to make a judgement.
Baseline outcome measurements	Low risk	Baseline outcomes measurements provided and similar between groups.
Baseline characteristics	Low risk	Baseline characteristics provided and similar between groups.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information provided to make a judgement.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "Investigators related to certification of care need levels were blinded."
Incomplete outcome data (attrition bias) All outcomes	Low risk	Quote: "All analyses were conducted by intention to treat (including participants who declined PHVs), using SAS version 9.4, with a two-tailed probability level less than.05 indicating statistical significance."
Selective reporting (reporting bias)	Low risk	There is no evidence that outcomes were selectively reported.
Other bias	Unclear risk	Quote: "The present study has several limitations. First, because the surveys were conducted via mail and self-reported, participants having problems (ie, cognitive impairment) might not complete the survey or provide inaccurate information related to cognitive function, medical condition, or hospitalizations. Second, home visitors could provide a similar type of [Preventive Home visit] assessment to participants in [Control Group] even though they did not use structured sheet."

Leung 2004

Study characteristics

Methods	Year: baseline April 2001 Location: Hong Kong Trial method: RCT (individually randomised)
Participants	Total number randomised: 92 Mean age: 75.5 years

Leung 2004 *(Continued)*

	Sex: intervention group 44.4% women; control group 57.4% women Frailty status: no frailty assessment used Inclusion criteria • Age ≥ 65 years • ≥ 2 hospitalisations in past 6 months • ≥ 2 chronic health conditions including hypertension, diabetes, chronic obstructive airway disease, stroke/cardiovascular accident, heart failure, Parkinson's disease • Home-dwelling • Agreement to take part for the duration of the study Exclusion criteria • Refusal to provide consent (not explicitly mentioned)
Interventions	Name of intervention: case management/care planning by case managers (intervention group) Why (aim): to reduce the utilisation of hospital services (provided through the public hospital system of Hong Kong) What (materials): telephone, in-person visits What (procedures): frail older people were assigned case managers who were nurses and who were paired up with the case geriatricians for medical support; the care provided included regular monitoring of health status for preventive interventions, phone assistance between 8 am and 9 pm, home visits where needed, prescribing of community-based supportive services, and access to the case geriatrician for medical support through telephone consultation, outpatient department, and admission to the hospital for further investigation and treatment Who: case managers who were nurses trained in nursing elderly people in the community, and geriatricians How: delivered through telephone consultations, home visits, outpatient department visits Where: community and hospital When and how much: 12 months (not explicitly reported) Tailoring: not specified Modifications: not specified How well (planned): not specified How well (actual): not specified
Outcomes	Mortality: reported by trial authors, unclear how it was measured Change in place of residence to a nursing or residential home: number of individuals admitted to "residential facilities for long-term placement" QOL: not reported Serious adverse effects: not reported Function-physical: functional performance ADLs, level of transfers, level of continence, measured by Minimal Data Set-Home Care (MDS-HC) Function-cognitive: mental status, MDS-HC mental status subscale Function-emotional: mood symptoms, MDS-HC mood symptoms subscale Function-social: not reported

Leung 2004 *(Continued)*

	Healthcare use: total number of acute hospital bed-days, hospital bed-days, rehabilitation hospital bed-days; total episodes of hospital and unplanned hospital admission; total number of attendances at outpatient department and geriatric day hospital; total number of home visits by community nurse Social care use: not reported Healthcare costs: not reported Social care costs: informal care costs Patient satisfaction with care: not reported
Notes	Time points measured**:** 12 months Time points reported: 12 months Funding: not reported Ethical approval: not reported Conflicts of interest: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Insufficient information provided to make a judgement.
Allocation concealment (selection bias)	Unclear risk	Insufficient information provided to make a judgement.
Baseline outcome measurements	High risk	Quote: "Significant differences were observed between the two groups on most of the parameters for hospital services at baseline (Box 2). The intervention group's utilisation of hospital services was significantly higher than the control group at baseline, except for attendance at the outpatient department, geriatric day hospital, and the emergency room, where the differences, though higher, were not significant."
Baseline characteristics	Low risk	Baseline characteristics provided and similar between groups.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information provided to make a judgement.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "Data related to utilisation of hospital services were captured by a computerised network of databases of public hospitals."
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rate was approximately 10%, with reasons provided.
Selective reporting (reporting bias)	Low risk	No evidence that outcomes were selectively reported.
Other bias	Low risk	No other apparent source of bias.

Markle-Reid 2006

Study characteristics	
Methods	Year: February 2001–June 2002 Location: Ontario, Canada Trial method: RCT (individually randomised)
Participants	Total number randomised: 288 Mean age: intervention group 83.37 years; control group 84.25 years Sex: intervention group 77.50% women, control group 76.20% women Frailty status: no frailty assessment used Inclusion criteria • Age ≥ 75 years • Newly referred to and eligible for personal support services through the Community Care Access Centre (CCAC) in Ontario, Canada Exclusion criteria • Refusal of informed consent • Inability to understand English • Eligibility for nursing services
Interventions	Name of intervention: proactive case management nursing health promotion intervention (nursing group) Why (aim): "to evaluate the comparative effects and costs of a proactive nursing health promotion intervention in addition to usual home care for older people compared with usual home care services alone." What (materials): telephone, in-person visits What (procedures): registered nurses conducted an initial and ongoing health assessments, identified and managed risk factors for functional decline, and provided education on healthy lifestyles and management of chronic illnesses Who: registered nurses from a community-nursing agency How: home visits and phone consultations by the registered nurses Where: community based When and how much: over a 6-month period Tailoring: not specified Modifications: not specified How well (planned): not specified How well (actual): not specified Comparison: "care as usual"
Outcomes	Mortality: not reported Change in place of residence to a nursing or residential home: not reported

Markle-Reid 2006 *(Continued)*

	QOL: SF-36 Serious adverse effects: not reported Function-physical: not reported Function-cognitive: not reported Function-emotional: depression symptoms, Center for Epidemiologic Studies Depression Scale (CES-D) Function-social: perceived social support, Personal Resource Questionnaire (PRQ-85) Healthcare use: not reported Social care use: not reported Healthcare costs: total costs of all types of health and social care services Social care costs: not reported Patient satisfaction with care: not reported
Notes	Time points measured: 6 months Time points reported: 6 months Funding: "Canadian Health Services Research Foundation, Ontario Ministry of Health and Long-Term Care, The Community Care Access Centre of Halton, McMaster University, System-Linked Research Unit on Health and Social Services Utilization." Ethical approval: McMaster University Research and Ethics Board (Canada) Conflicts of interest: none declared

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Eligible and consenting participants were randomized to one of two treatment strategies, using a computerized randomization schedule, which randomly assigns subjects to two groups to ensure equal numbers at baseline in both groups."
Allocation concealment (selection bias)	Unclear risk	Insufficient information provided to make a judgement.
Baseline outcome measurements	Low risk	Baseline outcome measurements provided and similar between groups.
Baseline characteristics	High risk	Quote: "Participants in the nursing group, compared with the usual care group, reported, at baseline, lower scores in role functioning related to emotional health (mean difference -10.08; 95% CI 2.53, 17.61; Table 2), and lower scores in mental health functioning (mean difference -10.6; 95% CI 5.13, 16.07)."
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information provided to make a judgement.

Markle-Reid 2006 *(Continued)*

Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Quote: "Trained interviewers, blinded to the purpose of the study and the treatment assignment, obtained baseline (prerandomization) and follow-up outcome assessments at 6 months from the participants."
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Quote: "The hypothesis of effectiveness and efficiency was tested in a two-group comparison of all participants who completed the 6-month follow-up using intention-to-treat analysis."
Selective reporting (reporting bias)	Low risk	No evidence that outcomes were selectively reported.
Other bias	Low risk	No other apparent source of bias.

Melis 2008

Study characteristics	
Methods	Year: April 2003–December 2004 Location: the Netherlands Trial method: RCT (individually randomised)
Participants	Total number randomised: 155 Mean age: 82.2 years Sex: intervention group 75.3% women; control group 74.2% women Frailty status: no frailty assessment used Inclusion criteria • Age ≥ 70 years • Living independently or in a retirement home • Health problem, request for help related to cognitive disorders, behavioural and psychological symptoms of dementia, mood disorders, mobility disorders and falling, or malnutrition • Established goal of achieving ≥ 1 of the following criteria: MMSE < 26, GARS-3 > 25, or SF-20 (mental health subscale) < 75 Exclusion criteria • Urgent medical (or otherwise) problem within < 1 week • MMSE < 20 or proven moderate to severe dementia (Clinical Dementia Rating scale > 1) and no informal caregiver • Other forms of intermediate care or healthcare from a social worker or community-based geriatrician • On waiting list for a NH • Life expectancy ≤ 6 months
Interventions	Name of intervention: Dutch Geriatric Intervention Program (DGIP) Why (aim): to test "the effects of the DGIP compared to usual care in improving health-related quality of life and promoting successful aging in independently living frail older patients." What (materials): not specified What (procedures): not specified

Melis 2008 *(Continued)*

	Who: geriatric specialist nurse How: home visit by a geriatric specialist nurse 2 weeks post-referral, within the next 3 months up to 6 visits for additional geriatric evaluation and management; individualised treatment plans formulated and delivered predominantly by the nurse, although "the primary care physicians continued their usual medical care" which included "referrals, medication changes, and other interventions as agreed upon during interdisciplinary consultations with the nurse and geriatrician on individual cases" Where: primary care setting When and how much: home visits Tailoring: guidelines for delivering the intervention were developed as part of the study to "structure activities without losing the flexibility of tailoring the individual interventions." Modifications: not specified How well (planned): not specified How well (actual): not specified Comparison: usual care
Outcomes	Mortality: mortality/survival Change in place of residence to a nursing or residential home: days spent in home for the aged and in a NH QOL: Cantril's Self-Anchoring Ladder, Dementia Quality of Life, and SF-20 subscales Serious adverse effects: not reported Function-physical: ADLs and IADLs using GARS-3 (primary outcome), mobility using Timed Up and Go test (TUAG) Function-cognitive: mental status, MMSE Function-emotional: perceived loneliness, the de Jong-Gierveld & Kamphuis Loneliness Scale (range 0–11) Function-social: not reported Healthcare use: total number of hospital stays, number of healthcare units used per patient (physician care) Social care use: hours of home care, days spent at day centre, number of days when participant received a meal Healthcare costs: total care costs (includes healthcare services, intervention, and other costs) Social care costs: not reported Patient satisfaction with care: not reported
Notes	Time points measured: 3 and 6 months Time points reported: 3 and 6 months Funding: ZonMw (The Netherlands Organization for Health Research and Development) and the Radboud University Nijmegen Medical Centre Ethical approval: Local ethics committee, the Netherlands (NCT00105378) Conflicts of interest: none declared

Melis 2008 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "We used a two step pseudocluster randomization procedure".
Allocation concealment (selection bias)	Low risk	Quote: "A person not related to the study conduct performed the randomisation."
Baseline outcome measurements	Low risk	Baseline outcome measurements provided and similar between groups.
Baseline characteristics	Low risk	Quote: "Patients were comparable at baseline as well, giving no indication of selection bias."
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Quote: "The physicians were not informed as to which group they were in."
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "This study was observer blind. Despite several precautionary measures taken, disclosure of treatment assignment occurred frequently. However, our primary outcomes were collected using a written questionnaire that the patient (if necessary with help from a relative) completed before each study visit. The researcher could not influence this."
Incomplete outcome data (attrition bias) All outcomes	Low risk	Quote: "The primary analysis was a modified intention-to-treat analysis on differences (Intervention – Control) in changes from baseline in the GARS-3 and MOS-20 MH at 3-month of follow-up (T1T0). A random effects model was used to account for clustering at the level of the physician (19)."
Selective reporting (reporting bias)	Low risk	No evidence that outcomes were selectively reported.
Other bias	Unclear risk	Quote: "Primary care physicians appeared to be very selective. Approximately 3% of all older patients cared for by one primary care physician were included in this study. However, we have to keep in mind that only a minority of older patients can be characterized as vulnerable, depending on the definition (35). This means that only a minority actually is eligible for this intervention, which explicitly focused on frail persons who also needed to have an incident geriatric problem. Unfortunately, we were unable to collect further details on the patients who were not included, so generalization of these results to the general population of community-dwelling older persons deserves further evaluation."

Metzelthin 2013

Study characteristics

Methods	Year: November 2009–June 2012 Location: Sittard, the Netherlands Trial method: cluster-RCT (randomised at the level of general practices)
Participants	Total number randomised: 346 (12 GP practices)

Metzelthin 2013 *(Continued)*

	Mean age: intervention group 77.49 years; control group 76.80 years Sex: intervention group 55% women; control group 61% women Frailty status: Groningen Frailty Indicator used Inclusion criteria • Older person • Groningen Frailty Indicator score ≥ 5 • Signed informed consent form Exclusion criteria • Terminal illness • Confined to bed • Severe cognitive or psychological impairments • Inability to communicate in Dutch
Interventions	Name of intervention: prevention of care (PoC) Why (aim): "to investigate the effectiveness of the PoC approach on various patient level outcomes compared with usual care" What (materials): in-person visits, treatment plan What (procedures): using a 6-step PoC approach to reduce disability and prevent (further) functional decline: (step 1) determine frailty using Groningen Frailty indicator; (step 2) home visit for multidimensional assessment focused on daily activities and risk factors performed by practice nurse; (step 3) formulation of preliminary treatment plan; (step 4) second home visit by the practice nurse aimed at formulating final treatment plan; (step 5) treatment plan starts; (step 6) regular evaluation of treatment plans and the need for support by the practice nurse who is also case manager and keeps the extended care team informed on the progress Who: GP and practice nurse How: 6-step PoC approach Where: 6 general practices When and how much: for 24 months Tailoring: not specified Modifications: not specified How well (planned): not specified How well (actual): not specified Comparison: care as usual
Outcomes	Mortality: number of individuals who died (monitored) Change in place of residence to a nursing or residential home: not reported QOL: not reported Serious adverse effects: not reported Function-physical: disability, GARS, GARS ADL, GARS IADL (all 3 measured as primary outcomes) Function-cognitive: not reported

Metzelthin 2013 *(Continued)*

	Function-emotional: depression symptoms, Hospital Anxiety and Depression Scale Depression subscale (HADS-D) Function-social: social support, Social Support list (SSL); social participation, Maastricht Social Participation-Consumptive Participation-Frequency (MSPP-CP-F) subscale (range 0–3) Healthcare use: number receiving outpatient medical services and primary care (including practice nurse, occupational therapist, physiotherapist) Social care use: number receiving professional home care, informal care, and in-home modifications Healthcare costs: total costs including primary care, hospital care, long-term care costs, and intervention costs Social care costs: total costs including informal care costs, home modifications costs Patient satisfaction of care: not reported
Notes	Time points measured: 6, 12, and 24 months Time points reported: 6, 12, and 24 months Funding: Dutch National Care for the Elderly Programme by The Netherlands Organisation for Health Research and Development Ethical approval: Medical Ethical Committee of the Maastricht University/Academic Hospital Maastricht in the Netherlands (ISRCTN31954692) Conflicts of interest: none declared

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "We stratified the practices in pairs and used a computer generated randomisation list to randomise them into either the intervention or control group."
Allocation concealment (selection bias)	Unclear risk	Unit of allocation by institution.
Baseline outcome measurements	High risk	Groups were different at baseline regarding frailty and disability.
Baseline characteristics	Low risk	Baseline characteristics were measured and were similar between groups.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information provided to make a judgement.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "outcome assessors were kept blinded to the allocation."
Incomplete outcome data (attrition bias) All outcomes	Low risk	Quote: "We analysed the primary and secondary outcomes, measured at the level of the patient, according to the intention to treat principle. We imputed missing values at the level of the scale by means of multiple imputations. We based the maximum number of missing values within a scale on the guidelines given by the developers."

Metzelthin 2013 *(Continued)*

Selective reporting (reporting bias)	Unclear risk	Not all protocol outcomes are reported, although main outcome and some secondary outcomes are.
Other bias	Low risk	No other apparent source of bias.

Parsons 2012

Study characteristics	
Methods	Year: 2003–2006 (duration of participation 3 years, not explicitly stated) Location: Christchurch, New Zealand Trial method: RCT
Participants	Total number randomised: 351 Mean age: intervention group 80.8 years; control group 81.0 years Sex: intervention group 51% women; control group 41% women Frailty status: no frailty assessment used; high risk of permanent residential care placement using a standardised needs assessment tool Inclusion criteria • Age ≥ 65 years (≥ 55 years for Maori, the indigenous people of New Zealand) • High risk of permanent residential care according to standardised needs assessment by regional geriatric assessment service or hospital clinical team • Being a patient of the participating general practices Exclusion criteria • Need for immediate residential care placement • Inability to communicate in English or provide a family member as interpreter
Interventions	Name of intervention: Coordinator of Services for Elderly (COSE) Why (aim): to facilitate older adults remaining at home What (materials): standardised comprehensive assessment, package of required support services (including access to medical records and knowledge regarding range of available services and funding streams), specialist health services, regular meetings What (procedures): standardised comprehensive assessment, package of required support services Who: care managers (nurse working at advanced level) How: "after standardised comprehensive assessment, a package of required support services is contracted and COSE worker maintained continuation of care from referral until discharge until no longer needed; COSE nurses used all information from assessment, medical records and coordinated medical and social services." COSE worker had knowledge regarding range of available (local) service options and funding streams; developed and maintained communication with important agencies, service providers, and patient groups, participated with primary care and reassessed older persons if needs changed, regular scheduled meetings with primary care physician and COSE worker. Where: family physician clinics, community When and how much: not specified

Parsons 2012 *(Continued)*

	Tailoring: not specified Modifications: not specified How well (planned): not specified How well (actual): not specified Comparison: usual care
Outcomes	Mortality: mortality data from the regional health office and confirmed using national mortality statistics from The New Zealand Health Information Services Change in place of residence to a nursing or residential home: permanent residential care placement QOL: EuroQol Serious adverse effects: adverse events (monitored during study) Function-physical: ADL (including short-form, self-performance, long-form), IADL (including difficulty, involvement, summary) Function-cognitive: not reported Function-emotional: not reported Function-social: not reported Healthcare use: not reported Social care use: not reported Healthcare costs: not reported Social care costs: not reported Patient satisfaction with care: not reported
Notes	Time points measured: 3, 6, 12, 18, and 24 months Time points reported: unclear Funding: New Zealand Ministry of Health Ethical approval: "The Ministry of Health Ethics Committee approved the study in 2003, which was registered on the Australian Clinical Trials Registry (ACTR) No. 12605000140651." Conflicts of interest: none declared

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "The quality of the trial met all criteria outlined for randomized controlled trials." Comment: cluster randomisation by GP practices. No further details.
Allocation concealment (selection bias)	Unclear risk	No information reported.
Baseline outcome measurements	Unclear risk	Only endpoints and trajectory reported.

Parsons 2012 *(Continued)*

Baseline characteristics	Unclear risk	Report states that baseline characteristics between the 2 groups were similar, but no mention of statistics.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "It was not possible to mask participants to treatment assignment."
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Quote: "It was not possible to mask the research assistants ascertaining outcomes, but the randomization of practices and analyses of the data were blinded."
Incomplete outcome data (attrition bias) All outcomes	Low risk	Quote: "All treatment evaluations were performed on the principle of intention to treat and were blinded analyses."
Selective reporting (reporting bias)	Low risk	All outcome measures endpoint data reported.
Other bias	Unclear risk	No other information provided.

Sandberg 2015

Study characteristics	
Methods	Year: October 2006–April 2010 Location: Eslow, Sweden Trial method: RCT (individually randomised)
Participants	Total number randomised: 153 Mean age: intervention group 81.4 years; control group 81.6 years Sex: intervention group 65% women; control group 68.5% women Frailty status: no frailty assessment used Inclusion criteria • Living in own home (and not NH or sheltered housing) within the municipality chosen for the study • Age ≥ 65 years • Dependence in ≥ 2 ADLs • ≥ 2 hospital admissions or ≥ 4 outpatient/primary care visits in previous 12 months Exclusion criteria • Inability to communicate verbally • Cognitive impairment according to MMSE (< 25 points) • Special accommodation
Interventions	Name of intervention: case management programme Why (aim): to understand effect of the case management programme for frail older people on healthcare utilisation What (materials): in-person visits, telephone consultations

Sandberg 2015 *(Continued)*

	What (procedures): the programme comprised 4 parts: "traditional case management (assessment, care coordination, home visits, telephone calls, advocacy), general information (about the healthcare system, social activities, nutrition, exercise etc.), and specific information (related to the participant's specific health status, individual needs and medication) and safety (the availability of the nurse or physiotherapist by cell phone during working hours)." Who: nurses and physiotherapists who were also case managers How: 1 home visit per month Where: primary care When and how much: 1 home visit per month over 12 months Tailoring: not specified Modifications: not specified How well (planned): not specified How well (actual): not specified Comparison: no specific description given: physician reviewed the medications in the control group (no detail of what then happened). The physicians were available if there were any problems with control group participants identified by the researchers.
Outcomes	Mortality: number of individuals who died Change in place of residence to a nursing or residential home: not reported QOL: EQ-5D, EQ-5D-VAS Serious adverse effects: not reported Function-physical: not reported Function-cognitive: not reported Function-emotional: not reported Function-social: social participation, number of social participation activities (formal and informal groups; 13 questions); performance and importance of leisure activities (17 questions) Healthcare use: total number of hospital stays, length of stay, outpatient care visits and contacts with physicians in outpatient care Social care use: use of municipal home services (hours of help with IADLs, PADLs, at night); use of municipal home care (hours of municipal home care, day, evening, night); use of informal care (hours of help with IADLs, PADLs) Healthcare costs: total costs including municipal home care, intervention, informal care costs Social care costs: informal care costs Patient satisfaction with care: not reported
Notes	Time points measured: 6 and 12 months Time points reported: 6 and 12 months Funding: "Faculty of Medicine at Lund University, Governmental Funding of Clinical Research within the NHS (ALF) and Swedish Research Council; Swedish Institute for Health Sciences, Region Skane, Johan and Greta Koch's Foundation, Swedish Association of Health Professionals, Swedish Society of Nursing, and Sodra Sveriges Sjukskoterskehem." Ethical approval: Regional Ethics Review Board (NCT01829594)

Sandberg 2015 *(Continued)*

Conflicts of interest: None declared

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Insufficient information provided to make a judgement.
Allocation concealment (selection bias)	Low risk	Quote: "The randomization included sealed envelopes containing information about the group to which they had been assigned, with equal chances of being allocated to each group."
Baseline outcome measurements	Low risk	Quote: "There were no significant differences between intervention and control groups in the number of self-reported diagnosis groups, in the number of self-reported health complaints, in the five most common self-reported health complaints, in functional dependency, in the risk of depression or in cognitive impairment at baseline."
Baseline characteristics	Low risk	Quote: "No significant differences between intervention and control group were found in demographics or socioeconomics at baseline."
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Quote: insufficient information provided to make a judgement.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "Structured interviews were carried out in both groups at baseline and every third month in the space of one year by researchers working independently of the nurses and physiotherapists."
Incomplete outcome data (attrition bias) All outcomes	Low risk	Quote: "The analyses were made according to the Intention-To-Treat (ITT) principle."
Selective reporting (reporting bias)	High risk	Main outcomes differ between trial registration and published paper.
Other bias	Low risk	No other apparent source of bias.

Spoorenberg 2018

Study characteristics

Methods	Year: October 2011–March 2013 Location: Groningen, the Netherlands Trial method: RCT stratified into 3 risk profiles (robust, frail, or complex)
Participants	Total number randomised: 1456 (602 eligible for this review) Mean age: intervention group 80.6 years, control group 80.8 years Male/female proportion: control group 394 women; intervention group 405 women Frailty status: assessed using Groningen Frailty Indicator

Spoorenberg 2018 *(Continued)*

	Inclusion criteria • Age ≥75 years • Registered with participating GP • Living at home or in a home for the elderly Exclusion criteria • Long-term admission to a NH (not just for rehabilitation) • Alternative type of integrated care • Participation in another research study
Interventions	Name of intervention: Embrace Why (aim): "to evaluate the effects of the population-based, person-centred and integrated care service Embrace on patient-reported outcomes at 12 months" What (materials): in-person meetings What (procedures): Embrace is a "person-centred and integrated care service for community-living older adults" delivered through regular community meetings "in which self-management abilities were encouraged and during which local healthcare and welfare organisations provided information on health maintenance, physical and social activities, and dietary recommendations. In addition, frail people and those with complex care needs received individual support from a case manager." Who: multidisciplinary team comprising nursing home physician and 2 care managers (district nurse and social worker) trained in the principles and methods of Embrace How: through regular Embrace community meetings Where: community setting When and how much: 12 months Tailoring: not specified Modifications: not specified How well (planned): not specified How well (actual): not specified Comparison: care as usual
Outcomes	Mortality: number of individuals who died (monitored) Change in place of residence to a nursing or residential home: not reported QOL: EQ-5D, EQ-5D-VAS Serious adverse effects: not reported Function-physical: level of frailty, Groningen Frailty Indicator self-report V (15 items; primary outcome for complex care needs and frail clusters only), modified Katz scale (Katz-15) 15 items covering ADLs and IADLs; INTERMED for the Elderly Self Assessment (biopsychosocial and healthcare domains; primary outcome for the complex care needs group only); SM (self-management) scales × 2 Function-cognitive: not reported Function-emotional: not reported Function-social: not reported Healthcare use: not reported

Spoorenberg 2018 *(Continued)*

	Social care use: not reported Healthcare costs: total costs, including health and care use, informal care Social care costs: not reported Patient satisfaction with care: not reported
Notes	Time points measured: baseline and 12 months Time points reported: baseline and 12 months Funding: Netherlands Organisation for Health Research and Development Ethical approval: Medical Ethical Committee of the University Medical Center of Groningen waived ethical approval (NL2893) Conflicts of interest: none declared

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "After stratification, we performed an anonymised and computerised balanced randomisation process within each GP practice."
Allocation concealment (selection bias)	Low risk	Centralised randomisation scheme.
Baseline outcome measurements	Unclear risk	Insufficient information provided to make a judgement.
Baseline characteristics	Low risk	Quote: "There were no statistically significant differences in the baseline characteristics."
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information provided to make a judgement.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "Data collectors (volunteers available when necessary for helping filling in questionnaires, and help desk assistants) were blinded for randomisation and stratification, as were the data analysts (SS and RU) until the point of data analysis."
Incomplete outcome data (attrition bias) All outcomes	Low risk	Quote: "We performed intention-to-treat (ITT) analyses [...] for the whole sample and per profile. Missing data were imputed at item level by multiple imputation techniques, with the fully conditional specification approach-which uses the Bayesian framework."
Selective reporting (reporting bias)	High risk	Main outcomes are different between the protocol and published results.
Other bias	Unclear risk	Quote: "Our finding of no clear benefits for Embrace on the outcomes measured could be due to the duration of the intervention, the nature of the intervention, the selection of outcomes or methodological limitations."

Suijker 2016

Study characteristics	
Methods	Year: December 2010–May 2014 (duration of participation: 3 years) Location: community in North-West Netherlands Trial method: RCT (cluster-randomised, general practices)
Participants	Total number randomised: 2283 (24 GP practices) Mean age: intervention group 82.6 years; control group 82.9 years Sex: intervention group 65.2% women; control group 62.7% women Frailty status: no frailty assessment used Inclusion criteria • Age ≥ 70 years • Increased risk of functional decline based on Seniors at Risk- Primary Care (ISAR-PC) Exclusion criteria • Life expectancy < 3 months • Dementia • Inability to understand Dutch • Plan to move or spend a long time abroad • Living in NH
Interventions	Name of intervention: nurse-led multifactorial care Why (aim): preventing disability in community-living older people at increased risk of functional decline What (materials): systematic CGA, individually tailored multifactorial interventions, multiple follow-up home visits What (procedures): systematically administered CGA, individually tailored care treatment plan (CTP) consisting of multifactorial interventions, nurse-led care co-ordination with multiple follow-up visits Who: community care registered nurse (CCRN) employed by 1 home-care organisation followed a formal 10-day training How: "nurse-led care coordination consisted of elements of case management, self-management and patient-centered care, which were derived from several chronic care models [...] During the intervention, the CCRN worked in close collaboration with the GP and maintained contact with other healthcare professionals (e.g., occupational therapists, physiotherapists, etc.) and the participant's caregiver(s)." Where: community, person's home When and how much: 1 year, number of interventions: 0–7, number of home visits: 1–8 Tailoring: not specified Modifications: not specified How well (planned): not specified How well (actual): not specified Comparison: usual care (Dutch healthcare system)
Outcomes	Mortality: number of individuals who died

Suijker 2016 *(Continued)*

	Change in place of residence to a nursing or residential home: not reported QOL: HRQOL, EQ-5D, self-perceived QOL, Cantril's ladder (range 0–10) Serious adverse effects: not reported Function-physical: ADLs, modified Katz-ADL index (15 items) Function-cognitive: not reported Function-emotional: emotional wellbeing, RAND-36 Function-social: not reported Healthcare use: hospitalisations, after-hours GP care Social care use: not reported Healthcare costs: total costs Social care costs: not reported Patient satisfaction with care: not reported
Notes	Time points measured: 6, 12, 18, and 24 months Time points reported: 6, 12, 18, and 24 months Funding: ZonMW "The Netherlands Organization for Health Research and Development" (ZonMw no. 313020201) Ethical approval: "Medical Ethics Committee of the Academic Medical Center, University of Amsterdam, The Netherlands (protocol ID MEC10/182)." Conflicts of interest: none declared

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	An independent statistician performed the computerised cluster randomisation.
Allocation concealment (selection bias)	Low risk	Participants were blinded through a postponed informed consent procedure.
Baseline outcome measurements	Unclear risk	No information provided.
Baseline characteristics	Unclear risk	No information provided.
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participants and personnel blinded.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome assessors blinded.
Incomplete outcome data (attrition bias)	Unclear risk	Quorum diagram.

Suijker 2016 *(Continued)*
All outcomes

Selective reporting (reporting bias)	Low risk	Results provided in supplementary documents.
Other bias	Unclear risk	No information reported.

van Hout 2010

Study characteristics	
Methods	Year: 1 July 2002–30 April 2007 (duration of participation: 1 year) Location: a region in the Netherlands (not further specified) Trial method: RCT (individually randomised)
Participants	Total number randomised: 651 Mean age: intervention group 81.3 years; control group 81.5 years Sex: intervention group 72.2% women; control group 68.8% women Frailty status: frail defined as self-reported score in the worst quartile of at least 2 of 6 "self-reported functional health domains (COOP–WONCA charts)" (full name of 'COOP–WONCA' not given; scoring range: 1 (excellent) to 5 (very bad)): overall health ≥ 4; physical fitness ≥ 5; changes in health ≥ 4; daily activities ≥ 4; mental health ≥ 3; social activities ≥ 3 Inclusion criteria • Age ≥ 75 years • Living at home • Frailty (defined above) Exclusion criteria • Terminal illness • Dementia symptoms • Living in residential homes • Participation in other research projects
Interventions	Name of intervention: preventive home visits by nurses Why (aim): prevent function decline, institutionalisation, and mortality What (materials): multidimensional assessment, individualised care plans What (procedures)**:** preventive home visiting programme Who: nurses How: assessment of health risks and care needs (Resident Assessment Instrument–Home Care version (RAI-HC)), nurses recommending interventions based on the Resident Assessment Instrument manual and a nationally issued nursing guideline, design and execution of individually tailored care plans; nurses left a copy of the care plan at a person's home to inform other visiting health professionals and to encourage them to add notes to the care plan, "nurses visited a patient at least four times a year in order to execute and monitor the care plan, evaluate changes in care needs, and adapt the care plan when needed", in case of urgent medical matters, the nurses were allowed to consult the primary care physicians (PCPs), after 1 year, the nurses reassessed the older person and repeated the protocol.

van Hout 2010 *(Continued)*

	Where: community, patient's home When and how much: 12 months, baseline session 45–75 minutes, followed by ≥ 4 sessions during next 12 months Tailoring: not specified Modifications: not specified How well (planned)**:** not specified How well (actual): not specified Comparison: usual care varied from no care to regular PCP visits to home care involvement.
Outcomes	Mortality: number of individuals who died Change in place of residence to a nursing or residential home: time until institutionalisation (placement in nursing home or home for disabled older persons) QOL: SF-36 mental component (0-100) Serious adverse effects: not reported Function-physical: COOP-WONCA charts, SF-36 physical component (0–100), disabilities in ADLs, IADLs (GARS) Function-cognitive: not reported Function-emotional: not reported Function-social: not reported Healthcare use: hospital admission (≥ 1), acute hospital visit (≥ 1) Social care use: not reported Healthcare costs: not reported Social care costs: not reported Patient satisfaction with care not reported
Notes	Time points measured: 6 and 18 months Time points reported: main outcomes: 6 and 18 months, other outcomes: 18 months Funding: Netherlands Organization for Health Research and Development Ethical approval: ethical committee of the VU Medical Center Conflicts of interest: none declared

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "we used Pocock's random number table and assigned up to 10 blocks per practice. An independent statistician kept the assignment lists and assigned individuals to the intervention or control groups."
Allocation concealment (selection bias)	Low risk	Quote: "An independent statistician kept the assignment lists and assigned individuals to the intervention or control groups."

van Hout 2010 *(Continued)*

Baseline outcome measurements	Unclear risk	No details regarding collection of some baseline outcomes.
Baseline characteristics	Low risk	Quote: "Although initial analyses revealed baseline imbalance on three variables (previous falls, presence of family caregiver), none of these differed substantially (<10%) and did not effect the affect estimates."
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Quote: "PCPs were blinded to whether their listed patients received preventive home visiting by a nurse or usual care"; "Data entry personnel were blinded for group assignment as well."
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "Primary care physicians were blinded for the group assignment in order to minimise contamination. Data entry personnel were blinded for group assignment." Comment: all self-report, or objective medical records data.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Both ITT and per-protocol analyses were performed.
Selective reporting (reporting bias)	Low risk	Data for all outcomes reported.
Other bias	Unclear risk	No other information given.

ADLs: activities of daily living; CGA: comprehensive geriatric assessment; CHS: Cardiovascular Health Study; CSQ-8: client satisfaction questionnaire; ED: emergency department; EMR: electronic medical record; EQ-5D: EuroQol five-dimension questionnaire; EQ-5D-3L: EuroQol five-dimension, three-level questionnaire; EQ-VAS: EuroQol visual analogue scale; GARS: Groningen Activity Restriction Scale; GP: general practitioner; HRQOL: health-related quality of life; IADLs: instrumental activities of daily living; ITT: intention-to-treat; MMSE: Mini Mental State Examination; NH: nursing home; OARS: Older American Resources and Services Multidimensional Functional Assessment Questionnaire; QOL: quality of life; RAND-36: RAND Corporation 36-item health-related quality of life instrument; RCT: randomised controlled trial; SF-12: Medical Outcomes Study 12-item Short-Form Health Survey; SF-20: Medical Outcomes Study 20-item Short-Form Health Survey; SF-36: Medical Outcomes Study 36-item Short-Form Health Survey; SIPA: System of Integrated Care for Older Persons.

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

Study	Reason for exclusion
Bandinelli 2006	Wrong intervention and setting: comprehensive assessment by multidisciplinary team and management of medical problems in a day hospital setting, including drug management, surgery, family counselling, and rehabilitation.
Blom 2016	Wrong population and intervention: Individuals aged ≥ 75 years in 59 general practices with a combination of problems related to 4 health domains. Participants with problems in ≥ 3 domains received "an integrated care plan using a functional geriatric approach."
Boult 2001	Wrong setting: intervention delivered in outpatient setting.
Burns 1995	Wrong setting: intervention delivered in outpatient setting.
Clarkson 2006	Wrong intervention: "care management with additional clinical assessment by old age psychiatrist or geriatrician."

Study	Reason for exclusion
Counsell 2007	Wrong population: not frail population but people aged ≥ years seen by primary care clinician (≥ 1 visit in last 12 months), with "an income less than 200% of the federal poverty level".
Daniels 2011	Wrong population: aged ≥ 65 years with ≥ 1 visit to a primary care clinician in the past 12 months.
de Stampa 2014	Wrong study design: quasi-experimental study.
Di Polina 2017	Wrong intervention: geriatric assessment and multidisciplinary team management with no active case management.
Ekdahl 2016	Wrong intervention: CGA without case management.
Engelhardt 1996	Wrong population: frequent attenders of an outpatient clinic.
Hall 1992	Wrong intervention: multidisciplinary team health promotion intervention.
Imhof 2012	Wrong population: people aged ≥ 80 years, not defined specifically as frail (no definition or (proxy) measure of frailty), who were able to consent and "expressed an interest in the study."
June 2009	Wrong study design: non-randomised study.
Li 2010	Wrong intervention: CGA without case management, but follow-up referrals and care planning to different agencies.
Montgomery 2003	Wrong population: older adults recently discharged from hospital with good social support.
Montserin 2010	Wrong intervention: CGA and trained nurse-led group health promotion session + educational visit by geriatrician.
Newcomer 2004	Wrong population: individuals aged ≥ 65 years with ≥ 1 long-term condition (not frail population).
Noel 2004	Wrong study design: non-randomised study.
Parsons 2017	Wrong setting: intervention delivered in residential care or the older person's own home, and no separate data for participants living at home.
Ploeg 2010	Wrong intervention: nurse-led comprehensive assessment, collaborative care planning, health promotion and referrals to community healthcare and social care services, with follow-up monitoring rather than active case management.
Reuben 1999	Wrong population: "older adults who had failed a screen for at least one of four conditions".
Rockwood 2000	Wrong intervention: CGA without case management.
Ruikes 2016	Wrong study design: non-randomised study.
Schapira 2022	Wrong setting: intervention delivered in hospital and then residential care or the older person's own home, and no separate data for participants living at home.
Sommers 2000	Wrong population: older adults with ≥ 2 chronic conditions.
Stuck 2000	Wrong intervention: annual multidisciplinary team assessments and follow-up care planning from trained nurses.
Zimmer 1985	Wrong intervention: multidisciplinary team care planning intervention by GP, nurse, and social worker.

CGA: comprehensive geriatric assessment; GP: general practitioner.

Characteristics of ongoing studies *[ordered by study ID]*

Allen 2011

Study name	After discharge care management of low income frail elderly (AD-LIFE)
Methods	Randomised trial, parallel assignment
Participants	Adults aged ≥ 65 years; confirmed or probable dual eligible to receive Medicare and Medicaid; ≥ 1 chronic illness; ≥ 1 impaired ADLs or ≥ 2 impaired IADLs; and discharged home
Interventions	Intervention: participants receive a phone call from a nurse within 48 hours of hospital discharge, during which a home visit is booked. The home visit is done within 7 days of discharge, with the goal of performing a comprehensive assessment, establishing goals, and generating an individualised care plan. The intervention is delivered by a core team (geriatrician, nurse care manager, advanced care nurse, social worker, and geriatrics-certified pharmacist) and extended team experts (psychologist, cardiologist, pulmonologist, endocrinologist, and occupational therapist). Comparison: usual care
Outcomes	• Cognitive function • Physical function • ED visits • Hospitalisations • NH admission • QOL • ADLs • IADLs • Depression • Falls • Access to care • Satisfaction • Caregiver strain
Starting date	Not reported
Contact information	Susan Hazelett, Summa Health System instrumental
Notes	Contact author emailed for further information (20. February 2020)

Kinchin 2018

Study name	Older Persons ENablement And Rehabilitation for Complex Health conditions (OPEN ARCH)
Methods	Multicentre randomised trial using a stepped-wedge cluster design. GP practices will be randomised into ≥ 10 clusters and will recruit 10–12 participants each.
Participants	Older people with multiple chronic conditions and emerging complex care needs

Kinchin 2018 *(Continued)*

Interventions	Comprehensive, multidimensional geriatric assessment with care co-ordination conducted in community settings
Outcomes	Primary outcomes • ED presentations • hospital admissions • inpatient bed days • allied health and community support services Secondary outcomes • Functional status • QOL • Patient satisfaction Cost-effectiveness of the intervention will also be assessed (i.e. "change to cost outcomes, including the cost of implementing the intervention and subsequent use of services, and the change to health benefits represented by quality adjusted life years").
Starting date	Registered 6 February 2017 with the Australian New Zealand Clinical Trials Registry (ACTRN12617000198325p)
Contact information	
Notes	

NCT01568801

Study name	Singapura program of all inclusive care for the elderly (SingaPACE)
Methods	Randomised trial, parallel assignment
Participants	Adults aged ≥ 60 years, classified as frail, willing to participate, residing in the catchment area
Interventions	Intervention: integrated programme of community-based healthcare and social care based on intake and ongoing evaluation by the SingaPACE team Comparison: usual care
Outcomes	Primary outcomes • Number of emergency care events, ED visits, or acute care hospitalisations Secondary outcomes • Admission to NH • Length of stay in acute care • Patient QOL • Caregiver burden
Starting date	August 2011
Contact information	David Matchar, National University, Singapore
Notes	

NCT04785664	
Study name	Community-based pro-Active Monitoring Program (CAMP) and older adults
Methods	Prospective pragmatic cluster trial
Participants	Older adults aged > 80 years with frailty, "adjusted for relevant parameters: demographic variables, comorbidities, disability, and bio-psycho-social frailty."
Interventions	Community-based proactive monitoring programme
Outcomes	Primary outcomes • Mortality • Acute hospital admission • ED visits • Institutionalisation Secondary outcomes • Level of frailty • Social isolation • Physical disability
Starting date	2021
Contact information	
Notes	

ADLs: activities of daily living; ED: emergency department; IADLs: instrumental activities of daily living; NH: nursing home; QOL: quality of life.

DATA AND ANALYSES

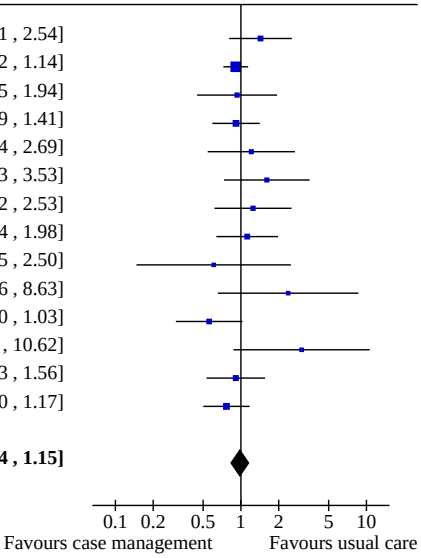
Comparison 1. Case management compared with usual care for mortality

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.1 Mortality at 12 months' follow-up	14	9924	Risk Ratio (M-H, Random, 95% CI)	0.98 [0.84, 1.15]
1.2 Mortality between 6 and 36 months' follow-up	0		Other data	No numeric data

Analysis 1.1. Comparison 1: Case management compared with usual care for mortality, Outcome 1: Mortality at 12 months' follow-up

Study or Subgroup	Case management Events	Total	Usual care Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
Applebaum 2002	25	156	17	152	6.9%	1.43 [0.81 , 2.54]
Béland 2006	116	656	127	653	28.0%	0.91 [0.72 , 1.14]
Bernabei 1998	12	99	13	100	4.4%	0.93 [0.45 , 1.94]
Bleijenberg 2016	50	1446	32	846	11.2%	0.91 [0.59 , 1.41]
Cameron 2013	12	120	10	121	3.8%	1.21 [0.54 , 2.69]
Eklund 2013	14	89	9	92	3.9%	1.61 [0.73 , 3.53]
Gagnon 1999	16	212	13	215	4.7%	1.25 [0.62 , 2.53]
Hoogendijk 2016	20	456	27	691	7.1%	1.12 [0.64 , 1.98]
Kono 2016	3	179	5	181	1.3%	0.61 [0.15 , 2.50]
Metzelthin 2013	9	193	3	153	1.5%	2.38 [0.66 , 8.63]
Parsons 2012	14	169	27	182	6.2%	0.56 [0.30 , 1.03]
Sandberg 2015	10	80	3	73	1.6%	3.04 [0.87 , 10.62]
Spoorenberg 2018	24	309	25	293	7.8%	0.91 [0.53 , 1.56]
Suijker 2016	34	934	51	1074	11.6%	0.77 [0.50 , 1.17]
Total (95% CI)		**5098**		**4826**	**100.0%**	**0.98 [0.84 , 1.15]**
Total events:	359		362			

Heterogeneity: Tau² = 0.01; Chi² = 14.66, df = 13 (P = 0.33); I² = 11%
Test for overall effect: Z = 0.25 (P = 0.80)
Test for subgroup differences: Not applicable



Analysis 1.2. Comparison 1: Case management compared with usual care for mortality, Outcome 2: Mortality between 6 and 36 months' follow-up

Mortality between 6 and 36 months' follow-up

Study	Results	Notes
Applebaum 2002	*Number of individuals who died* IG: 5/88; CG: 4/67	Number of participants at baseline: intervention group (IG): 88; control group (CG): 67. Follow-up: 6 months.
Kono 2012	*Number of individuals who died* IG: 11/161; CG: 20/162	Number of participants at baseline: intervention group (IG): 161; control group (CG): 162. Follow-up: baseline–24 months.
Kono 2016	*Number of individuals who died* 12–24 months: IG: 12/171; CG: 2/172 24–36 months: IG: 7/158; CG: 10/168	Number of participants at baseline: intervention group (IG): 179; control group (CG): 181. Follow-up: 12–24 months and 24–36 months.
Metzelthin 2013	*Number of individuals who died* IG: 6/157; CG: 7/141	Number of participants at baseline: intervention group (IG): 193; control group (CG): 153. Follow-up: 12–24 months.
Parsons 2012	*Number of individuals who died* IG: 10/117; CG: 13/116	Number of participants at baseline: intervention group (IG): 169; control group (CG): 182. Follow-up: 12–24 months.
Suijker 2016	*Number of individuals who died* IG: 56/936; CG: 46/817	Number of participants at baseline: intervention group (IG): 1209; control group (CG): 1074. Follow-up: 12–24 months.
van Hout 2010	*Number of individuals who died* IG: 27/331; CG: 31/320	Number of participants at baseline: intervention group (IG): 331; control group (CG): 320. Follow-up: 18 months.

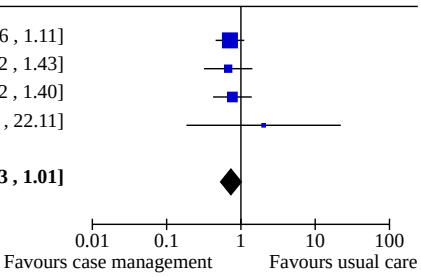
Comparison 2. Case management compared with usual care for change in place of residence to a nursing or residential home

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
2.1 Change in place of residence to a nursing home at 12 months follow-up	4	1108	Risk Ratio (M-H, Random, 95% CI)	0.73 [0.53, 1.01]
2.2 Change in place of residence to nursing or residential home, and days spent in a nursing home or home for the aged, between 6 and 24 months' follow-up	0		Other data	No numeric data

Analysis 2.1. Comparison 2: Case management compared with usual care for change in place of residence to a nursing or residential home, Outcome 1: Change in place of residence to a nursing home at 12 months follow-up

Study or Subgroup	Case management Events	Total	Usual care Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
Applebaum 2002	27	156	37	152	51.8%	0.71 [0.46 , 1.11]
Bernabei 1998	10	99	15	100	18.1%	0.67 [0.32 , 1.43]
Cameron 2013	16	120	21	121	28.3%	0.77 [0.42 , 1.40]
Kono 2016	2	179	1	181	1.8%	2.02 [0.19 , 22.11]
Total (95% CI)		**554**		**554**	**100.0%**	**0.73 [0.53 , 1.01]**
Total events:	55		74			

Heterogeneity: Tau² = 0.00; Chi² = 0.78, df = 3 (P = 0.85); I² = 0%
Test for overall effect: Z = 1.91 (P = 0.06)
Test for subgroup differences: Not applicable



Analysis 2.2. Comparison 2: Case management compared with usual care for change in place of residence to a nursing or residential home, Outcome 2: Change in place of residence to nursing or residential home, and days spent in a nursing home or home for the aged, between 6 and 24 months' follow-up

Change in place of residence to nursing or residential home, and days spent in a nursing home or home for the aged, between 6 and 24 months' follow-up

Study	Results	Notes
Applebaum 2002	*Nursing home admissions* 6 months: IG: 8/156; CG: 12/152 From 12 to 18 months: IG: 16/111; CG: 17/108	Number of participants at baseline: intervention group (IG): 156; control group (CG): 152. Follow-up: 6 months, 12–18 months.
Dalby 2000	*Nursing home admissions* IG: 0/73; CG: 1/69	Number of participants at baseline: intervention group (IG): 73; control group (CG): 69. Follow-up: 14 months.
Kono 2012	*Nursing home admissions (institutionalised)* IG: 5/161; CG: 3/162	Number of participants at baseline: intervention group (IG): 161; control group (CG): 162. Follow-up: 24 months.
Kono 2016	*Nursing home admissions (institutionalised)* IG: 5/171; CG: 2/172	Number of participants at baseline: intervention group (IG): 179; control group (CG): 181. Follow-up: 12–24 months.
Leung 2004	*Admitted to "residential facilities for long-term placement"* IG: 1/45; CG: 2/47 RR 0.52 (95% CI 0.05 to 5.56)	Number of participants at baseline: intervention group (IG): 45; control group (CG): 47. Follow-up: 12 months. CI: confidence interval; RR. risk ratio.
Melis 2008	*Days spent in a home for the aged* IG: mean 24.0 days (SD 58.0); CG: mean 32.0 days (SD 65.0) MD −8.0 days (95% CI −13.46 to 29.46) *Days spent in a nursing home*	Number of participants at baseline: intervention group (IG): 88; control group (CG): 67. Follow-up: 6 months. CI: confidence interval; MD: mean difference; SD: standard deviation.

	IG: mean 4.0 days (SD 16.0) CG: mean 5.0 days (SD 23.0) MD −1.0 days (95% CI −5.74 to 7.74)	
van Hout 2010	Time to institutionalisation IG: 23/331; CG: 20/320 HR 1.04 (95% CI 0.07 to 16.6)	Number of participants at baseline: intervention group (IG): 331; control group (CG): 320. Other outcomes: hospital registry, supplemented with self-report (hospital admission) and primary care or nursing homes records (institutionalisation). Follow-up: 18 months. CI: confidence interval; HR: hazard ratio.

Comparison 3. Case management compared with usual care for quality of life

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
3.1 Quality of life between 3 and 24 months' follow-up	0		Other data	No numeric data

Analysis 3.1. Comparison 3: Case management compared with usual care for quality of life, Outcome 1: Quality of life between 3 and 24 months' follow-up

Quality of life between 3 and 24 months' follow-up

Study	Results	Notes
Bleijenberg 2016	*RAND-36 (physical health)* 6 months: IG2: mean 59.5 points (95% CI 58.6 to 60.3) CG: mean 58.4 points (95% CI 57.4 to 59.4) 12 months: IG2: mean 58.3 points (95% CI 57.3 to 59.3) CG: mean 56.6 points (95% CI 55.1 to 58.1) *RAND-36 (social health)* 6 months: IG2: mean 43.0 points (95% CI 42.3 to 43.8) CG: mean 42.6 points (95% CI 41.6 to 43.6) 12 months: IG2: mean 42.7 points (95% CI 42.1 to 43.2) CG: mean 42.3 points (95% CI 41.7 to 42.9) *RAND-36 (mental health)* 6 months: IG2: mean 70.2 points (95% CI 69.4 to 71.1) CG: mean 69.9 points (95% CI 69,0 to 70.8) 12 months: IG2: mean 69.7 points (95% CI 69.0 to 70.4) CG: mean 68.3 points (95% CI 67.5 to 69.2) *RAND-36 (vitality)* 6 months: IG2: mean 56.7 points (95% CI 55.8 to 57.6) CG: mean 56.6 points (95% CI 55.5 to 57.5) 12 months: IG2: mean 56.0 points (95% CI 55.1 to 56.9) CG: mean 55.0 points (95% CI 53.7 to 56.3) *Perceived quality of life:* 6 months: IG2: mean 7.2 points (95% CI 7.2 to 7.3) CG: mean 7.2 points (95% CI 7.1 to 7.2) 12 months: IG2: mean 7.2 points (95% CI 7.1 to 7.3) CG: mean 7.1 points (95% CI 7.0 to 7.2) *EQ-5D:* 6 months: IG2: mean 0.78 points (95% CI 0.7 to 0.8) CG: mean 0.8 points (95% CI 0.7 to 0.8) 12 months: IG2: mean 0.7 points (95% CI 0.7 to 0.8) CG: mean 0.7 points (95% CI 0.7 to 0.8)	Number of participants at baseline: intervention group 1 (not analysed in this review): 790; intervention group 2 (IG2): 1446; control group (CG): 856. Instrument: RAND Corporation 36-item health-related quality of life instrument (RAND-36; physical, social, mental, vitality subscales); EuroQol Five-Dimension Questionnaire (EQ-5D). Follow-up: 6 and 12 months. CI: confidence interval.

Cameron 2013	3 months: IG: mean 60.6 points (SD 20.1) CG: mean 60.3 points (SD 16.9) MD 0.3 points (95% CI −4.57 to 5.17) 12 months: IG: mean 57.5 points (SD 20.8) CG: mean 57.7 points (SD 19.7) MD 0.2 points (95% CI −5.23 to 5.63)	Number of participants at baseline: intervention group (IG): 120; control group (CG): 21. Instrument: EuroQol Five-Dimension Questionnaire Visual Analogue Scale (EQ-5D-VAS; vertical scale, scores range from 0–100, higher scores represent better quality of life). Follow-up: 3 and 12 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Gagnon 1999	*Physical functioning* IG: mean 46.7 points (SD 29.8) CG: mean 44.1 points (SD 29.9) MD 2.6 points (95% CI −4.01 to 9.21) *Role-physical* IG: mean 49.0 points (SD 44.1) CG: mean 49.1 points (SD 44.3) MD 0.1 points (95% CI −9.72 to 9.92) *Bodily pain* IG: mean 56.2 points (SD 33.1) CG: mean 56.4 points (SD 33.8) MD 0.2 points (95% CI −7.21 to 7.61) *General health* IG: mean 46.2 points (SD 21.6) CG: mean 48.1 points (SD 20.0) MD 1.9 points (95% CI −2.74 to 6.54) *Vitality* IG: mean 42.9 points (SD 25.7) CG: mean 42.5 points (SD 25.0) MD 0.1 points (95% CI −5.52 to 5.72) *Social functioning* IG: mean 69.8 points (SD 33.5) CG: mean 68.9 points (SD 34.8) MD 0.9 points (95% CI −6.78 to 8.58) *Role-emotional* IG: mean 68.2 points (SD 44.0) CG: mean 62.1 points (SD 46.0) MD 6.1 points (95% CI −3.92 to 16.12) *Mental health* IG: mean 60.0 points (SD 24.0) CG: mean 59.7 points (SD 23.2) MD 0.3 points (95% CI −4.94 to 5.54)	Number of participants at baseline: intervention group (IG): 212; control group (CG): 215. Instrument: Medical Outcomes Study 36-item Short-Form Health Survey (SF-36; 10 subscales, scores range from 0–100, higher scores represent better quality of life). Follow-up: 10 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Hoogendijk 2016	*SF-12 mental health* Analysed using linear mixed model analysis adjusting for baseline differences. 1145 participants, 4481 observations Baseline (all groups): 49.9 (10.5) Time-specific intervention effect B: 6 months: −0.22 (95% CI −0.91 to 0.46) P = 0.52 12 months: 0.34 (95% CI −0.55 to 1.22) P = 0.46 18 months: 0.06 (95% CI −1.08,1.20) P = 0.92 24 months: −0.80 (95% CI −2.31 to 0.72) P = 0.30 Little or no difference between groups regardless of time point. *SF-12 physical health* Analysed using linear mixed model analysis adjusting for baseline differences. 1145 participants, 4481 observations Baseline (all groups): 33.8 (9.5) Time-specific intervention effect B: 6 months: −0.25 (95% CI −0.53 to 1.03) P = 0.53 12 months: −0.37 (95% CI −1.38 to 0.64) P = 0.47 18 months: 0.01 (95% CI −1.29,1.30) P = 0.99 24 months: −0.11 (95% CI −1.83 to 1.61) P = 0.90 Little or no difference between groups regardless of time point. *EQ-5D* Analysed using linear mixed model analysis adjusting for baseline differences 1144 respondents (participants), 4556 observations Baseline (all groups): 0.60 (0.28)	Instrument: Medical Outcomes Study 12-item Short-Form Health Survey (SF-12); EuroQol Five-Dimension Questionnaire (EQ-5D). Follow-up: 6, 12, 18, and 24 months. CI: confidence interval.

	Time-specific intervention effect B: 6 months: 0.01 (95% CI −0.01 to 0.03) P = 0.37 12 months: 0.01 (95% CI −0.01 to 0.04) P = 0.24 18 months: 0.03 (95% CI 0.00 to 0.06) P = 0.006 24 months: 0.01 (95% CI −0.03 to 0.05) P = 0.63 Little or no difference between groups regardless of time point.	
Markle-Reid 2006	*SF-36 Physical Health Component Summary score* IG mean 49.1 points (SD 24.6) CG mean 46.7 points (SD 23.4) MD −1.88 points (95% CI −7.02 to 3.25) *SF-36 Mental Health Component Summary score* IG mean 65.1 points (SD 22.4) CG mean 65.2 points (SD 22.1) MD −6.32 points (95% CI −11.04 to −1.59)	Number of participants at baseline: intervention group (IG): 144; control group (CG): 44. Instrument: Medical Outcomes Study 36-item Short-Form Health Survey (SF-36). Follow-up: 6 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Melis 2008	*Cantril's Ladder:* Authors reported intervention effect difference (D)'s change from baseline at 3 months: 0.39 (95% CI −0.26 to 1.03)	Number of participants at baseline: intervention group: 88; control group: 67. Instrument: Cantril's Ladder. Follow-up: 3 months. CI: confidence interval.
Parsons 2012	*Thermometer scale* Treatment effect mean: −1.162 (95% CI −3.52 to 1.20) *Cognitive performance scale* Treatment effect mean: −0.023 (95% CI −0.17 to 0.12) *Depression rating scale* Treatment effect mean: 0.181 (95% CI −0.07 to 0.43) *Changes in health, end-stage disease and symptoms and signs* Treatment effect mean: 0.004 (95% CI −0.10 to 0.11) *Pain scale* Treatment effect mean: 0.009 (95% CI −0.12 to 0.14)	Number of participants at baseline: intervention group: 169; control group: 182. Instrument: EuroQol (measured as secondary outcome, exact definition not specified, although table 2 indicates that EuroQol was measured as a function of thermometer scale; cognitive performance scale; depression rating scale; changes in health, end-stage disease and symptoms and signs; and pain scale). Follow-up: 24 months. CI: confidence interval.
Sandberg 2015	*EQ-5D* IG: mean 0.61 points (SD 0.25) CG: mean 0.60 points (SD 0.23) MD 0.01 points (95% CI −0.07 to 0.09) *EQ-5D-VAS* IG: mean 0.61 points (SD 0.17) CG: mean 0.63 points (SD 0.12) MD 0.02 points (95% CI −0.03 to 0.07)	Number of participants at baseline: intervention group (IG): 80; control group (CG): 73. Instrument: EuroQol Five-Dimension Questionnaire (EQ-5D) and EQ-5D Visual Analogue Scale (EQ-5D-VAS); scores were normalised (divided by 100). Follow-up: 12 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Spoorenberg 2018	*EQ-5D – change from baseline* Frail group: IG: mean −0.02 points (SD 0.11) CG: mean 0.0 points (SD 0.12) MD 0.02 points (95% CI −0.01 to 0.05) Complex care needs group: IG: mean −0.02 points (SD 0.17) CG: mean −0.01 points (SD 0.16) MD 0.08 points (95% CI 0.04 to 0.12) *EQ-5D-VAS* Frail group: IG: mean −1.6 points (SD 16.2) CG: mean −2.9 points (SD 12.4) MD 1.3 points (95% CI −2.96 to 5.56) Complex care needs group: IG: mean −0.5 points (SD 16.1) CG: mean 2.0 points (SD 19.9) MD 2.5 points (95% CI −2.06 to 7.06)	Number of participants at baseline: stratified into 3 strata: robust (854 participants; excluded from analysis due to not frail population); frail (237 participants); and complex care needs (365 participants). Instrument: EuroQol Five-Dimension Questionnaire (EQ-5D) and EQ-5D Visual Analogue Scale (EQ-5D-VAS); scores were normalised (divided by 100). Follow-up: 12 months. CG: control group; CI: confidence interval; IG: intervention group; MD: mean difference; SD: standard deviation.
Suijker 2016	*HRQOL (based on life values)* 12 months: IG: mean 0.74 points (95% CI 0.73 to 0.75) CG: mean 0.74 points (95% CI 0.72 to 0.75) *EQ-5D* 6 months: IG: mean 0.76 points (95% CI 0.75 to 0.77) CG: mean 0.75 points (95% CI 0.73 to 0.76) 12 months: IG: mean 0.74 points (95% CI 0.72 to 0.75) CG: mean 0.72 points (95% CI 0.69 to 0.72) 18 months: IG: mean 0.75 points (95% CI 0.72 to 0.76) CG: mean 0.71 points (95% CI 0.69 to 0.73) 24 months: IG: mean 0.74 points (95% CI 0.72 to 0.75)	Number of participants at baseline: intervention group (IG): 1209; control group (CG): 1074. Instrument: EuroQol Five-Dimension Questionnaire (EQ-5D; possible health states were converted in a utility score, using a Dutch general population validation study); self-perceived quality of life (QOL) assessed using a Cantril's Ladder, where respondents rated their present quality of life on a scale of 0–10. Follow-up: 6, 12, 18, and 24 months. ADL: activities of daily living; CI: confidence interval: HRQOL: health-related quality of life.

	CG: mean 0.72 points (95% CI 0.69 to 0.72) *EQ5D (estimated mean scores adjusted for baseline outcome)* 6 months: IG: mean 0.76 points (95% CI 0.75 to 0.77) CG: mean 0.76 points (95% CI 0.75 to 0.77) 12 months: IG: mean 0.74 points (95% CI 0.73 to 0.75) CG: mean 0.74 points (95% CI 0.69 to 0.72) 18 months: IG: mean 0.74 points (95% CI 0.73 to 0.75) CG: mean 0.72 points (95% CI 0.71 to 0.74) 24 months: IG: mean 0.73 points (95% CI 0.72 to 0.74) CG: mean 0.72 points (95% CI 0.71,0.73) *EQ-5D (estimated mean scores adjusted for baseline age, sex, socio-economic status, level of education, and modified Katz-ADL index score)* 6 months: IG: mean 0.76 points (95% CI 0.75 to 0.77) CG: mean 0.76 points (95% CI 0.75 to 0.77) 12 months: IG: mean 0.74 points (95% CI 0.73 to 0.75) CG: mean 0.74 points (95% CI 0.72 to 0.75) 18 months: IG: mean 0.74 points (95% CI 0.73 to 0.75) CG: mean 0.72 points (95% CI 0.71 to 0.74) 24 months IG: mean 0.73 points (95% CI 0.72 to 0.74) CG: mean 0.72 points (95% CI 0.71 to 0.73) *Self-perceived QOL* 6 months: IG: mean 7.12 points (95% CI 7.05 to 7.19) CG: mean 7.17 points (95% CI 7.09 to 7.24) 12 months: IG: mean 7.01 points (95% CI 6.93 to 7.10) CG: mean 7.02 points (95% CI 6.94 to 7.11) 18 months: IG: mean 6.98 points (95% CI 6.91 to 7.06) CG: mean 6.97 points (95% CI 6.89 to 7.05) 24 months: IG: mean 6.98 points (95% CI 6.91 to 7.06) CG: mean 6.92 points (95% CI 6.83 to 7.01) *Self-perceived QOL (estimated mean scores adjusted for baseline outcome)* 6 months: IG: mean 7.14 points (95% CI 7.08 to 7.20) CG: mean 7.21 points (95% CI 7.16 to 7.27) 12 months: IG: mean 7.04 points (95% CI 6.97 to 7.11) CG: mean 7.07 points (95% CI 6.99 to 7.15) 18 months: IG: mean 7.01 points (95% CI 6.94 to 7.07) CG: mean 7.02 points (95% CI 6.95 to 7.10) 24 months: IG: mean 7.01 points (95% CI 6.95 to 7.07) CG: mean 6.98 points (95% CI 6.90 to 7.06) *Self-perceived QOL (estimated mean scores adjusted for baseline age, sex, socio-economic status, level of education, and modified Katz-ADL index score)* 6 months: IG: mean 7.15 points (95% CI 7.09 to 7.21) CG: mean 7.21 points (95% CI 7.15 to 7.27) 12 months: IG: mean 7.05 points (95% CI 7.09 to 7.21) CG: mean 7.21 points (95% CI 7.15 to 7.27) 18 months: IG: mean 7.01 points (95% CI 6.95 to 7.08) CG: mean 7.03 points (95% CI 6.96 to 7.10) 24 months: IG: mean 7.02 points (95% CI 6.96 to 7.08) CG: mean 6.98 points (95% CI 6.90 to 7.06)	
van Hout 2010	6 months: IG: mean 44.5 points (SD 10.5) CG: mean 45.4 points (SD 10.6) MD 0.9 points (95% CI −0.72, 2.52) 18 months: IG: mean 43.9 points (SD 11.2) CG: mean 45.2 points (SD 11.2)	Number of participants at baseline: intervention group (IG): 331; control group (CG): 320. Instrument: Medical Outcomes Study 36-item Short-Form Health Survey (SF-36; mental component, range 0–100). Follow-up: 6 and 18 months.

	MD 1.3 points (95% CI −0.42, 3.02)	CI: confidence interval; MD: mean difference; SD: standard deviation.

Comparison 4. Case management compared with usual care for serious adverse effects

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
4.1 Serious adverse effects between 12 and 24 months follow-up	0		Other data	No numeric data

Analysis 4.1. Comparison 4: Case management compared with usual care for serious adverse effects, Outcome 1: Serious adverse effects between 12 and 24 months follow-up

Serious adverse effects between 12 and 24 months follow-up

Study	Results	Notes
Cameron 2013	*Adverse events* 2 participants reported back pain that required modification of the intervention, defined as not a major adverse event. *Major adverse events attributable to the intervention* None reported.	Number of participants at baseline: intervention group: 120; control group: 121. Outcome: number of individuals reporting a medical event or injury that arose as a consequence of participating in the trial. Monitored and recorded by clinicians. Follow-up: 12 months.
Parsons 2012	*Adverse events* There was little or no difference between groups. The trial authors reported no "noted treatment effect evident on adverse events, including incidence of falls or number of hospitalizations" but provided no further data.	Number of participants at baseline: intervention group: 169; control group: 182. Outcome: incidence of falls or number of hospitalisations. As reported by the trial authors, no additional data provided. Follow-up: 24 months.

Comparison 5. Case management compared with usual care for change in physical, cognitive, emotional, and social function

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
5.1 Change in physical function between 3 and 24 months' follow-up	0		Other data	No numeric data
5.2 Change in cognitive, emotional, and social function between 3 and 24 months follow-up	12		Other data	No numeric data
5.2.1 Cognitive function	4		Other data	No numeric data
5.2.2 Emotional function	10		Other data	No numeric data
5.2.3 Social function	7		Other data	No numeric data

Analysis 5.1. Comparison 5: Case management compared with usual care for change in physical, cognitive, emotional, and social function, Outcome 1: Change in physical function between 3 and 24 months' follow-up

Change in physical function between 3 and 24 months' follow-up

Study	Outcome	Results	Notes

Applebaum 2002	Physical function	*ADLs* 6 months: IG: mean 1.23 points; CG: mean 1.35 points 12 months: IG: mean 1.15 points; CG: mean 1.26 points *IADLS* 6 months IG: mean 3.56 points; CG: mean 4.00 points 12 months: IG: mean 3.58 points; CG: mean 3.42 points *Overall health status* 6 months: IG: mean 10.5 points; CG: mean 10.3 points 12 months: IG: mean 10.3 points; CG: mean 9.2 points *Health status in last month* 6 months: IG: mean 11.6 points; CG: mean 11.1 points 12 months: IG: mean 11.0 points; CG: mean 12.0 points *Health locus of control* 6 months: IG: mean 18.2 points; CG: mean 18.7 points 12 months: IG: mean 18.8 points; CG: mean 18.4 points	Number of participants at baseline: intervention group (IG): 156; control group (CG): 152. Instrument: number of activities of daily living (ADLs) with help (range 0–6); number of instrumental activities of daily living (IADLs) with help (range 0–7); overall health status (range 0–16; lower score means better health); health status in last month (range 0–16; higher score means better health); health locus of control (range 0–26; low score means self-controlled). Follow-up: 6 and 12 months.
Bernabei 1998	Physical function	*ADLs* IG: AdjM 2.0 points (SD 0.99) CG: AdjM 2.6 points (SD 1.00) MD 0.6 points (95% CI 0.32 to 0.88) *IADLs* IG: AdjM 4.1 points (SD 0.99) CG: AdjM 4.4 points (SD 1.00) MD 0.3 points (95% CI 0.02 to 0.58)	Number of participants at baseline: intervention group (IG): 99; control group (CG): 100. Instrument: activities of daily living (ADLs; 6-item scale, ranging from 0–6) and instrumental activities of daily living (IADLs, 7-item scale, ranging from 0–7). Scales not described, higher scores indicate greater disability. Follow-up: 12 months. AdjM: mean adjusted for baseline measures; CI: confidence interval; MD: mean difference; SD: standard deviation.
Bleijenberg 2016	Physical function	6 months: IG2: mean 1.7 points (95% CI, 1.59, 1.80) CG: mean 1.75 points (95% CI, 1.67, 1.82) 12 months: IG2: mean 1.88 points (95% CI 1.80, 1.96) CG: mean 2.03 points (95% CI 1.93, 2.13)	Number of participants at baseline: intervention group 1 (not analysed in this review): 790; intervention group 2 (IG2): 1446; control group (CG): 856. Instrument: "modified Katz-15 index of activities of daily living (ADLs) and instrumental activities of daily living (IADLs) (range 0–15)". Adjusted for practice and participant baseline characteristics. Follow-up: 6 and 12 months. CI: confidence interval.
Cameron 2013	Physical function	*Mobility (SPPB)* 3 months: IG: mean 5.4 points (SD 2.32) CG: mean 5.72 points (SD 2.3) MD 0.32 points (95% CI −0.29 to 0.93) 12 months: IG: mean 5.83 points (SD 2.82) CG: mean 4.69 points (SD 2.91) MD 1.14 points (95% CI 0.37 to 1.91) *ADLs* 3 months: IG: mean 94.2 points (SD 11.2) CG: mean 93.2 points (SD 13.9) MD 1.0 points (95% CI −2.32 to 4.32) 12 months IG: mean 89.50 points (SD 17.5) CG: mean 86.1 points (SD 24.7) MD 3.40 points (95% CI −2.35 to 9.15)	Number of participants at baseline: intervention group (IG): 120; control group (CG): 121. Instrument: Short Physical Performance Battery (SPPB; gait speed, chair stand, and balance tests; scores range from 0 to 12, higher scores represent more mobility); activities of daily living (ADLs) measured with Barthel Index (10-item scores, range 0 to 100, higher scores indicate lower disability). Follow-up: 3 and 12 months. CI: confidence interval; MD: mean difference.

Eklund 2013	Physical function	*ADLs – improved* 3 months: IG: 42%; CG: 24% OR 2.37 (95% CI 1.20 to 4.68) 6 months: IG: 36%; CG: 28% OR 1.50 (95% CI 0.77 to 2.94) 12 months: IG: 39%; CG: 24% OR 2.04 (95% CI 1.03 to 4.06) *ADLs – maintained* 3 months: IG: 38%; CG: 43% OR 0.79 (95% CI 0.42 to 1.48) 6 months: IG: 32%; CG: 26% OR 1.30 (95% CI 0.66 to 2.59) 12 months: IG: 24%; CG 29% OR 0.76 (95% CI 0.37 to 1.53) *ADLs – decreased* 3 months: IG: 20%; CG: 33% OR 0.51 (95% CI 0.25 to 1.04) 6 months: IG: 31%; CG: 46% OR 0.52 (95% CI 0.27 to 0.98) 12 months: IG: 38%; CG: 47% OR 0.67 (95% CI 0.36 to 1.26) *Self-rated health (secondary outcome)* Change from 6 to 12 months: Relative rank variance: IG: 0.15 (95% CI 0.06 to 0.24); CG: 0.14 (95% CI 0.04 to 0.24) *Sum of symptoms (secondary outcome)* Change from 6 to 12 months: Relative rank variance: IG: 0.20 (95% CI 0.10 to 0.31); CG: 0.16 (95% CI 0.04 to 0.27)	Number of participants at baseline: intervention group (IG): 89; control group (CG): 92. Instrument: activities of daily living (ADLs; number of activities managed independently, from 0–9); self-rated health ("derived from one statement on the Short-Form Health Survey (SF-36): 'In general, you would say your health is. . .' followed by responses on a five-point Likert-type scale: excellent, very good, good, fair or poor."); sum of symptoms ("Symptoms during the previous three months were assessed by one part of the Goteborg quality of life instrument, with yes or no responses. A summary score of 1–30 symptoms was computed for each participant and scores were transformed into a six-grade scale with an interval of five symptoms in each grade"). Follow-up: 3, 6, and 12 months. CI: confidence interval; OR: odds ratio.
Gagnon 1999	Physical function	*ADLs* IG: mean 13.6 points (SD 1.90) CG: mean 13.4 points (SD 2.00) MD 0.2 points (95% CI −0.2 to 0.6) *IADLs* IG: mean 10.5 points (SD 3.00) CG: mean 10.3 points (SD 3.00) MD 0.2 points (95% CI −0.5 to 0.9)	Number of participants at baseline: intervention group (IG): 212; control group (CG): 215. Instrument: Older American Resources and Services Multidimensional Functional Assessment Questionnaire (OARS; scores range from 0–15 for activities of daily living (ADLs) and from 0–14 for instrumental activities of daily living (IADLs), higher scores indicate lower disability). Follow-up: 10 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Hoogendijk 2016	Physical function	*ADLs* Analysed using linear mixed model analysis adjusting for baseline differences. 1147 respondents (participants), 4574 observations Baseline (all groups): 0.9 (1.2) Time-specific intervention effect B: 6 months: 0.01 B (95% CI 0.06 to 0.08); P = 0.84 12 months: −0.07 B (95% CI −0.16 to 0.02); P = 0.10 18 months: −0.04 B (95% CI −0.15 to 0.08); P = 0.53 24 months: −0.04 (95% CI −0.19 to 0.11); P = 0.61 Little or no difference between groups regardless of time point. *Instrumental ADLS* Analysed using linear mixed model analysis adjusting for baseline differences. 1129 respondents (participants), 4443 observations	Instrument: Katz Index for activities of daily living (ADLs) and instrumental activities of daily living (IADLs). Follow-up: 12 months. CI: confidence interval.

		Baseline (all groups):2.6 (1.6) Time-specific intervention effect B: 6 months: −0.08 (95% CI −0.19 to 0.02); P = 0.13 12 months: −0.11 (95% CI −0.24 to 0.03); P = 0.14 18 months: −0.25 (95% CI −0.43 to −0.07); P = 0.007 24 months: −0.16 (95% CI −0.40 to 0.08); P = 0.19 Little or no difference between groups regardless of time point.	
Kono 2012	Physical function	*ADLs* 12 months: IG: mean 89.00 points (SD 14.30) CG: mean 89.80 points (SD 15.10) MD 0.80 points (95% CI −2.42 to 4.02) 24 months: IG: mean 88.10 points (SD 14.70) CG: mean 89.0 points (SD 18.70) MD 0.9 points (95% CI −3.21 to 5.01) *IADLs* 12 months: IG: mean 7.1 points (SD 3.8) CG: mean 7.1 points (SD 3.9) MD 0.0 points (95% CI −2.23 to 2.23) 24 months: IG: mean 7.0 points (SD 3.8) CG: mean 7.0 points (SD 4.0) MD 0.0 points (95% CI −0.95 to 0.95)	Number of participants at baseline: intervention group (IG): 161; control group (CG): 162. Instrument: activities of daily living (ADLs) measured with the Barthel Index; instrumental activities of daily living (IADLs) measured with the Tokyo Metropolitan Institute of Gerontology Index of Competence (13 items, scores range from 0–13, higher scores indicate lower disability). Follow-up: 12 and 24 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Kono 2016	Physical function	*ADLs* 12 months: IG: mean 91.5 points (95% CI 89.5 to 93.5) CG: mean 91.9 points (95% CI 89.1 to 93.1) 24 months: IG: mean 90.0 points (95% CI 87.8 to 92.2) CG: mean 85.0 points (95% CI 83.0 to 87.0) *IADLs* 12 months: IG: mean 7.8 points (95% CI 7.4 to 8.2) CG: mean 7.8 points (95% CI 7.4 to 8.2) 24 months: IG: mean 7.4 points (95% CI 6.8 to 8.0) CG: mean 7.3 points (95% CI 6.9 to 7.7)	Number of participants at baseline: intervention group (IG): 179; control group (CG): 181. ADLs: activities of daily living (ADLs) measured with the Barthel Index, reported as adjusted means with 95% CI; instrumental activities of daily living (IADLs) measured with the Tokyo Metropolitan Institute of Gerontology Index of Competence. Follow-up: 12 and 24 months. CI: confidence interval.
Leung 2004	Physical function	*Functional performance – ADLs* IG: mean 0.3 points (SD 1.0) CG: mean 0.2 points (SD 1.1) MD 0.1 points (95% CI −0.34 to 0.54) *Functional performance – level of transfers* IG: mean 0.4 points (SD 1.2) CG: mean 0.2 points (SD 1.0) MD 0.2 points (95% CI −0.26 to 0.66) *Functional performance – level of continence* IG: mean 0.3 points (SD 0.8) CG: mean 0.0 points (SD 0.2) MD 0.3 points (95% CI 0.06 to 0.54) Participants allocated to IG scored higher on the continence scale (P < 0.05)	Number of participants at baseline: intervention group (IG): 45; control group (CG): 47. Instrument: Minimal Data Set-Home Care (MDS-HC; 6 subscales, higher scores indicate higher disability). Follow-up: 12 months. ADLs: activities of daily living; CI: confidence interval; MD: mean difference.
Melis 2008	Physical function	*GARS-3:* 3 months: Authors reported intervention effect difference (D) from baseline to 3 months: −2.2 (95% CI −4.2 to −0.30) 6 months: Authors reported intervention effect difference (D) from baseline to 6 months: −1.6 (95% CI −3.9 to −0.70)	Number of participants at baseline: intervention group (IG): 85; control group (CG): 66. Instrument: Groningen Activity Restriction Scale-3 (GARS-3; 18 items covering activities of daily living and instrumental activities of daily living, score ranging from 18–72, higher scores represent more disability) Follow-up: 3 and 6 months (effect size is change from baseline)

Metzelthin 2013	Physical function	*GARS* 6 months: IG: mean 32.83 points (SD 10.98) CG: 30.16 points (SD 10.07) MD 0.41 points (95% CI −0.80 to 1.62) 12 months: IG: mean 33.08 points (SD 11.34) CG: mean 30.8 points (SD 10.29) MD 0.47 points (95% CI −0.81 to 1.76) 24 months: IG: mean 34.4 points (SD 11.6) CG: mean 31.5 points (SD 10.9) MD 1.18 points (95% CI −0.35 to 2.71) *GARS ADL* 6 months: IG: mean 17.54 points (SD 5.82) CG: mean 16.17 points (SD 5.13) MD 0.25 points (95% CI −0.44 to 0.94) 12 months: IG: mean 17.81 points (SD 5.90) CG: mean 16.3 points (SD 5.31) MD 0.59 points (95% CI −0.14 to 1.33) 24 months: IG: mean 18.31 points (SD 5.82) CG: mean 16.73 points (SD 5.73) MD 0.77 points (95% CI −0.05 to 1.59) *GARS IADL* 6 months: IG: mean 15.29 points (SD 5.92) CG: mean 14.0 points (SD 5.51) MD 0.17 points (95% CI −0.63 to 0.97) 12 months: IG: mean 15.28 points (SD 6.03) CG: mean 14.51 points (SD 5.69) MD −0.12 points (95% CI −0.93 to 0.68) 24 months: IG: mean 16.08 points (SD 6.35) CG: mean 14.77 points (SD 5.86) MD 0.4 points (95% CI −0.54 to 1.34)	Number of participants at baseline: intervention group (IG): 193; control group (CG): 153. Instrument: Groningen Activity Restriction Scale (GARS; 18 items covering activities of daily living (ADLs) and instrumental activities of daily living (IADLs), score ranging from 18–72, higher scores represent more disability). Follow-up: 6, 12, and 24 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Parsons 2012	Physical Function	*ADLs – short-form (secondary outcome)* Treatment effect mean 0.015 (95% CI −0.21 to 0.24) *ADLs – self-performance (secondary outcome)* Treatment effect mean 0.018 (95% CI −0.11 to 0.14) *ADLs – long-form (secondary outcome)* Treatment effect mean 0.045 (95% CI −0.43, 0.52) *IADLs – difficulty (secondary outcome)* Treatment effect mean 0.052 (95% CI −0.14 to 0.25) *IADLs – involvement (secondary outcome)* Treatment effect mean 0.310 (95% CI 0.04 to 0.58) *IADLs – summary (secondary outcome)* Treatment effect mean 0.671 (95% CI 0.11 to 1.23)	Number of participants at baseline: intervention group (IG): 169; control group (CG): 182. Instrument: activities of daily living (ADLs); instrumental activities of daily living (IADLs). Follow-up: 24 months. CI: confidence interval.
Spoorenberg 2018	Physical function	*Katz-15 – Mean change from baseline* Frail group: IG: mean 2.36 points (SD 2.40) CG: mean 2.24 points (SD 2.57) MD 0.12 points (95% CI −0.53 to 0.77) Complex care needs group: IG: mean 3.87 points (SD 2.86) CG: mean 4.04 points (SD 3.06) MD 0.17 points (95% CI −0.48, 0.82)	Number of participants at baseline: stratified into 3 strata: robust (854 participants; excluded from analysis due to not frail population); frail (237 participants); and complex care needs (365 participants). Instrument: modified Katz scale (Katz-15; 15 items covering activities of daily living (ADLs) and instrumental activities of daily living (IADLs), higher scores represent higher disability). Follow-up: 12 months. CG: control group. CI: confidence interval; IG: intervention group; MD: mean difference; SD: standard deviation.
Suijker 2016	Physical function	*Modified Katz-ADL Index* 6 months: IG: mean 3.11 points (95% CI 2.94 to 3.28)	Number of participants at baseline: intervention group (IG): 1209; control group (CG): 1074.

		CG: mean 3.32 points (95% CI: 3.13 to 3.50) 12 months: IG: mean 3.38 points (95% CI 3.20 to 3.56) CG: mean 3.59 points (95% CI 3.39 to 3.78) 18 months: IG: mean 3.53 points (95% CI 3.34 to 3.71) CG: mean 3.74 points (95% CI 3.54 to 3.93) 24 months: IG: mean 3.27 points (95% CI 3.09 to 3.45) CG: mean 3.48 points (95% CI 3.28 to 3.67) *Katz-ADL (estimated mean scores adjusted for baseline outcome)* 6 months: IG: mean 3.05 points (95% CI 2.94 to 3.15) CG: mean 3.10 points (95% CI 2.98 to 3.21) 12 months: IG: mean 3.33 points (95% CI 3.21 to 3.44) CG: mean 3.38 points (95% CI 3.25 to 3.51) 18 months: IG: mean 3.47 points (95% CI 3.35 to 3.59) CG: mean 3.52 points (95% CI 3.39 to 3.65) 24 months: IG mean 3.20 points (95% CI 3.07 to 3.34) CG: mean 3.26 points (95% CI 3.11 to 3.40) *Katz-ADL (estimated mean scores adjusted for baseline age, sex, socio-economic status, level of education, and modified Katz-ADL Index score)* 6 months: IG mean 3.02 points (95% CI 2.92 to 3.12) CG: mean 3.09 points (95% CI 2.98 to 3.21) 12 months: IG mean 3.31 points (95% CI 3.20 to 3.42) CG: mean 3.39 points (95% CI 3.26 to 3.51) 18 months: IG mean 3.46 points (95% CI 3.33 to 3.58) CG: mean 3.53 points (95% CI 3.40 to 3.66) 24 months: IG mean 3.19 points (95% CI 3.05 to 3.66) CG: mean 3.27 points (95% CI 3.12 to 3.41)	Instrument: 15-item modified Katz-ADL (activities of daily living) Index. Follow-up: 6, 12, 18, and 24 months follow-up. CI: confidence interval.
van Hout 2010	Physical function	IG: mean 51.8 points (SD 10.40) CG: mean 53.0 points (SD 10.5) MD 1.2 points (95% CI −0.41 to 2.81)	Number of participants at baseline: intervention group (IG): 331; control group (CG): 320. Instrument: Groningen Activity Restriction Scale (GARS; disability in activities of daily living (ADLs) and instrumental activities of daily living (IADLs), range 18–72). Follow-up: 18 months. CI: confidence interval; MD: mean difference.

Analysis 5.2. Comparison 5: Case management compared with usual care for change in physical, cognitive, emotional, and social function, Outcome 2: Change in cognitive, emotional, and social function between 3 and 24 months follow-up

Change in cognitive, emotional, and social function between 3 and 24 months follow-up

Study	Outcome	Results	Notes
Cognitive function			
Bernabei 1998	Mental status	IG: AdjM 2.8 points (SD 1.99) CG: AdjM 3.4 points (SD 2) MD 0.6 points (95% CI 0.04 to 1.16)	Number of participants at baseline: intervention group (IG): 99; control group (CG): 100. Instrument: Short Portable Mental Status Questionnaire (SPMSQ; 10 items, scores ranging 0–0, higher scores represent worse cognitive function). Follow-up: 10 months. AdjM: mean adjusted for baseline measures; CI: confidence interval; MD: mean difference; SD: standard deviation.
Kono 2016	Cognitive capacity	12 months: IG: mean change 2.2 points (95% CI 2.0 to 2.4); CG: mean change 2.2 points (95% CI 2.0 to 2.4) 24 months: IG: mean change 2.4 points (95% CI 2.2 to 2.6); CG: mean change 2.2 points (95% CI 2.0 to 2.4)	Number of participants at baseline: intervention group (IG): 179; control group (CG): 181. Instrument: Metamemory in Adulthood Questionnaire (MAQ; capacity subscale, 7 items, scores ranging 5–35, higher scores represent better cognitive function). Follow-up: 12 and 24 months. CI: confidence interval.
Leung 2004	Mental status	IG: mean −0.1 points (SD 1.4) CG: mean −0.2 points (SD 0.8) MD 0.1 points (95% CI −0.37 to 0.57)	Number of participants at baseline: intervention group (IG): 45; control group (CG): 47. Instrument: Minimal Data Set-Home Care (MDS-HC; mental status subscale, higher scores indicate higher disability). Follow-up: 12 months CI: confidence interval; MD: mean difference; SD: standard deviation.
Melis 2008	Mental status	*MMSE:* Authors reported intervention effect difference (D) from baseline to 6 months: −0.5 (95% CI −1.8 to 0.1)	Number of participants at baseline: intervention group (IG): 88; control group (CG): 67. Instrument: Folstein Mini Mental State Examination (MMSE). Follow-up: 6 months CI: confidence interval.
Emotional function			
Applebaum 2002	Mood	6 months: IG: mean 14.90 points CG: mean 15.90 points P < 0.5 12 months IG: mean 15.30 points CG: mean 15.80 points	Number of participants at baseline: intervention group (IG): 156; control group (CG): 152. Instrument: Overall Mood (range 0–20; high score is happier). Follow-up: 6 and 12 months.
Bernabei 1998	Depression symptoms	IG: AdjM 10.9 points (SD 5.0) CG: AdjM 12.8 points (SD 5.0) MD 1.9 points (95% CI 0.50 to 3.30)	Number of participants at baseline: intervention group (IG): 99; control group (CG): 100. Instrument: Geriatric Depression Scale (GDS; 30 items, scores range from 0–30, higher scores represent more depression symptoms). Follow-up: 12 months. AdjM: mean adjusted for baseline measures; CI: confidence interval; MD: mean difference; SD: standard deviation.
Cameron 2013	Depression symptoms	3 months: IG: mean 4.89 points (SD 3.14) CG: mean 4.90 points (SD 3.24) MD 0.01 points (95% CI −0.83 to 0.85) 12 months: IG: mean 4.62 points (SD 3.33) CG: M 4.98 points (SD 3.16) MD 0.36 points (95% CI −0.51 to 1.23)	Number of participants at baseline: intervention group (IG): 120; control group (CG): 121. Instrument: Geriatric Depression Scale (GDS). Follow-up: 3 and 12 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Kono 2012	Depression symptoms	12 months: IG: mean 6.7 points (SD 4.1) CG: mean 6.9 points (SD 4.0)	Number of participants at baseline: intervention group (IG): 161; control group (CG): 162.

		MD 0.2 points (95% CI −0.69 to 1.09) 24 months: IG: mean 7.1 points (SD 4.0) CG: mean 7.2 points (SD 3.8) MD 0.1 points (95% CI −0.88 to 1.06)	Geriatric Depression Scale (GDS; short version, 15-items, scores range 0–15, higher scores represent more depression symptoms). Follow-up: 12 and 24 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Kono 2016	Depression symptoms	12 months: IG: mean 2.2 points (95% CI 2.0 to 2.4) CG: mean 2.2 points (95% CI 2.0 to 2.4) 24 months: IG: mean 2.2 points (95% CI 2.0 to 2.4) CG: mean 2.2 (95% CI 2.0 to 2.4)	Number of participants at baseline: intervention group (IG): 179; control group (CG): 181. Geriatric Depression Scale (GDS; short version, 5-items, scores range from 0–5, higher scores represent more depression symptoms). Follow-up: 12 and 24 months. CI: confidence interval.
Leung 2004	Mood symptoms	IG: mean −0.5 points (SD 1.2) CG: mean −0.2 points (SD 0.7) MD 0.3 points (95% CI −0.12 to 0.71)	Number of participants at baseline: intervention group (IG): 45; control group (CG): 47. Instrument: Minimal Data Set-Home Care (MDS-HC; mood symptoms subscale, higher scores represent more depression symptoms). Follow-up: 12 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Markle-Reid 2006	Depression symptoms	IG: mean 11.9 points (SD 10.2) CG: mean 118.0 points (SD 10.8) MD 2.72 points (95% CI 0.39 to 5.07)	Number of participants at baseline: intervention group (IG): 144; control group (CG): 144. Instrument: Center for Epidemiologic Studies Depression Scale (CES-D). Follow-up: 6 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Melis 2008	Perceived loneliness	Authors report intervention effect difference (D) from baseline to 3 months: 0.10 (95% CI −0.8 to 0.99)	Number of participants at baseline: intervention group: 88; control group: 67. Perceived loneliness, the de Jong-Gierveld & Kamphuis Loneliness Scale (range 0–11) Follow-up: 3 months
Metzelthin 2013	Depression symptoms	6 months: IG: mean 5.72 points (SD 3.49) CG: mean 5.82 points (SD 3.88) MD −0.11 points (95% CI −0.80 to 0.58) 12 months: IG: mean 5.68 points (SD 4.13) CG: mean 5.82 points (SD 3.92) MD 0.78 points (95% CI −0.04 to 1.53) 24 months: IG: mean 5.97 points (SD 4.18) CG: mean 6.10 points (SD 3.78) MD −0.07 points (95% CI −0.90 to 0.77)	Number of participants at baseline: intervention group (IG): 193; control group (CG): 153 (numbers refer to approximate analysis for cluster randomised trials). Instrument: Hospital Anxiety and Depression Scale-depression subscale (HADS-D; 7 items, scores range 0–21, higher scores represent more depression symptoms). Follow-up: 6, 12, and 24 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Suijker 2016	Emotional wellbeing	*RAND-36* 6 months: IG: mean 70.25 points (95% CI 70.2 to 72.29) CG: mean 70.39 points (95% CI 70.31 to 72.41) 12 months: IG: mean 70.08 points (95% CI 68.98 to 71.19) CG: mean 70.33 points (95% CI 69.16 to 71.50) 18 months: IG: mean 70.24 points (95% CI 69.12 to 71.35) CG: mean 69.94 points (95% CI 68.49 to 71.80) 24 months: IG: mean 69.80 points (95% CI 68.67 to 70.92) CG: mean 68.90 points (95% CI 67.71 to 70.09) *RAND-36 (estimated mean scores adjusted for baseline outcome)* 6 months:	Number of participants at baseline: intervention group (IG): 1209; control group (CG): 1704 Instrument: RAND Corporation 36-item health-related quality of life instrument (RAND-36). Follow-up: 6, 12, 18, and 24 months. ADLs: activities of daily living; CI: confidence interval.

		IG: mean 71.25 points (95% CI 70.21 to 72.29) CG: mean 71.39 points (95% CI 70.30 to 72.47) 12 months: IG: mean 70.09 points (95% CI 68.98 to 71.19) CG: mean 70.32 points (95% CI 69.15 to 71.49) 18 months: IG: mean 70.24 points (95% CI 69.13 to 71.35) CG: mean 69.63 points (95% CI 68.48 to 71.79) 24 months: IG: mean 69.80 points (95% CI 68.68 to 70.93) CG: mean 68.89 points (95% CI 67.70 to 70.08) *RAND-36 (estimated mean scores adjusted for baseline age, sex, socio-economic status, level of education, and modified Katz-ADL index score)* 6 months: IG: mean 70.12 points (95% CI 70.07 to 72.16) CG: mean 71.50 points (95% CI 70.42 to 72.59) 12 months: IG: mean 69.90 (95% CI 68.79 to 71.01) CG: mean 70.43 points (95% CI 69.26 to 71.60) 18 months: IG: mean 70.14 points (95% CI 69.01 to 71.26) CG: mean 69.80 points (95% CI 68.64 to 70.96) 24 months IG: mean 69.76 points (95% CI 68.63 to 70.90) CG: mean 69.06 points (95% CI 67.87 to 70.25)	
Social function			
Cameron 2013	Social space	3 months: IG: mean 35.5 points (SD 16.1) CG: mean 30.3 points (SD 13.9) MD 5.2 points (95% CI 1.28 to 9.12) 12 months: IG: mean 34.2 points (SD 16.2) CG: mean 30.9 points (SD 5.5) MD 3.3 points (95% CI 0.07 to 6.53)	Number of participants at baseline: intervention group (IG): 120; control group (CG): 121. Instrument: University of Alabama at Birmingham Life Space Assessment (scores range from 0–120, higher scores represent greater life space). Follow-up: 3 and 12 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Hoogendijk 2016	Social functioning	Analysed using logistic mixed model analysis adjusting for baseline differences. 1140 respondents (participants), 4455 observations Baseline (all groups): 31.7% Time-specific intervention effect: 6 months: OR 1.14 (95 CI 0.89 to 1.46); P = 0.31 12 months OR 0.92 (95 CI 0.67 to 1.27); P = 0.62 18 months OR 1.34 (95 CI 0.91 to 1.97); P = 0.14 24 months OR 1.26 (95 CI 0.76 to 2.10); P = 0.37 No difference between groups regardless of time point.	Instrument: poor social functioning. Follow-up: 12 months CI: confidence interval; OR: odds ratio.
Kono 2012	Social support	12 months: IG: mean 7.1 points (SD 4.2) CG: mean 6.9 points (SD 4.7) MD 0.2 points (95% CI −0.78 to 1.18) 24 months: IG: mean 7.1 points (SD 4.1) CG: mean 7.3 points (SD 4.5) MD 0.2 points (95% CI −0.85 to 1.25)	Number of participants at baseline: intervention group (IG): 161; control group (CG): 162. Instrument: Social Support Scale (scores range from 0–4, higher scores represent more available social support). Follow-up: 12 and 24 months.

			CI: confidence interval; MD: mean difference; SD: standard deviation.
Kono 2016	Satisfaction with social activity	12 months: IG: mean 33.7 points (95% CI 31.9 to 35.5) CG: mean 36.5 points (95% CI 34.7 to 38.3) 24 months: IG: mean 31.2 points (95% CI 29.4 to 33.0) CG: mean 33.9 points (95% CI 32.1 to 35.7)	Number of participants at baseline: intervention group (IG): 179; control group (CG): 181. Instrument: Daily Life Satisfaction related to social activities (14 items, scores range from 14–70, higher scores represent more satisfaction with social activities). Follow-up: 12 and 24 months. CI: confidence interval.
Markle-Reid 2006	Perceived social support	IG: mean 124.9 points (SD 21.9) CG: mean 125.2 points (SD 22.3) MD −5.26 points (95% CI −9.18 to −1.34)	Number of participants at baseline: intervention group (IG): 144; control group (CG): 144. Instrument: Personal Resource Questionnaire (PRQ85; 25-item subscale, maximum score 175 points, higher scores represent more perceived social support). Follow-up: 6 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Metzelthin 2013	Social support and participation	*Social Support:* 6 months: IG: mean 27.03 points (SD 6.36) CG: mean 26.94 points (SD 5.53) MD 0.18 points (95% CI −0.79 to 1.15) 12 months: IG: mean 27.10 points (SD 6.09) CG: mean 27.27 points (SD 6.54) MD −0.12 points (95% CI −1.22 to 0.99) 24 months: IG: mean 26.76 points (SD 5.98) CG: mean 27.35 points (SD 6.27) MD −0.29 points (95% CI −1.37 to 0.79) *Social Participation:* 6 months: IG: mean 0.4 points (SD 0.36) CG: mean 0.46 points (SD 0.40) MD 0.00 points (95% CI −0.04 to 0.03) 12 months: IG: mean 0.35 points (SD 0.32) CG: mean 0.45 points (SD 0.40) MD −0.05 points (95% CI −0.11 to 0.01) 24 months: IG: mean 0.33 points (SD 0.31) CG: mean 0.44 points (SD 0.45) MD −0.04 points (95% CI −0.11 to 0.04)	Number of participants at baseline: intervention group (IG): 193; control group (CG): 153 (numbers refer to approximate analysis for cluster randomised trials). Instruments: Social Support List (SSL; scores range from 12–48, higher scores indicate more social support). Maastricht Social Participation- Consumptive Participation- Frequency subscale (MSPP-CP-F; scores range from 0-3 range, higher scores indicate more social participation). Follow-up: 6, 12, and 24 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Sandberg 2015	Social participation	*Number of social participation activities* IG: median 3.0 (IQR 2 to 5); CG: median 3 (IQR 1 to 4) *Total important leisure activities* IG: median 12 (IQR 9 to 14); CG: median 11 (IQR 9 to 13)	Number of participants at baseline: intervention group (IG): 80; control group (CG): 73. Instrument: social participation (13 questions, scores range from 0–13, higher scores represent more social participation); performance and importance of leisure activities (17 questions, scoring and direction of instrument unclear). Follow-up: 12 months IQR: interquartile range.

Comparison 6. Case management compared with usual care for change in health and social care utilisation

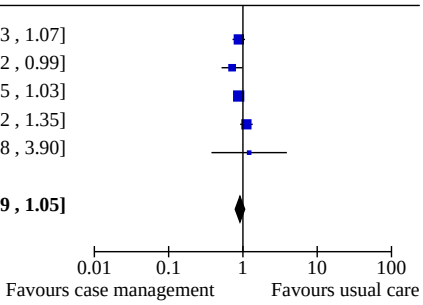
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
6.1 Hospital admissions at 12 months' follow-up	5	2424	Risk Ratio (M-H, Random, 95% CI)	0.91 [0.79, 1.05]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
6.2 Hospital admissions and other health care utilisation data between 6 and 24 months' follow-up	0		Other data	No numeric data
6.3 Change in social care utilisation between 6 and 12 months' follow-up	0		Other data	No numeric data

Analysis 6.1. Comparison 6: Case management compared with usual care for change in health and social care utilisation, Outcome 1: Hospital admissions at 12 months' follow-up

Study or Subgroup	Case management Events	Total	Usual care Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
Applebaum 2002	84	156	93	152	26.6%	0.88 [0.73 , 1.07]
Bernabei 1998	36	99	51	100	14.4%	0.71 [0.52 , 0.99]
Bleijenberg 2016	182	628	236	714	31.0%	0.88 [0.75 , 1.03]
Cameron 2013	74	107	67	108	26.4%	1.11 [0.92 , 1.35]
Kono 2016	6	179	5	181	1.5%	1.21 [0.38 , 3.90]
Total (95% CI)		**1169**		**1255**	**100.0%**	**0.91 [0.79 , 1.05]**
Total events:	382		452			

Heterogeneity: Tau² = 0.01; Chi² = 7.08, df = 4 (P = 0.13); I² = 43%
Test for overall effect: Z = 1.24 (P = 0.22)
Test for subgroup differences: Not applicable



Analysis 6.2. Comparison 6: Case management compared with usual care for change in health and social care utilisation, Outcome 2: Hospital admissions and other health care utilisation data between 6 and 24 months' follow-up

Hospital admissions and other health care utilisation data between 6 and 24 months' follow-up

Study	Results	Notes
Applebaum 2002	*Hospital admissions* 6 months: IG: 39/140; CG: 43/153 Between 12 and 18 months: IG: 36/111; CG: 30/108	Number of participants at baseline: intervention group (IG): 156; control group (CG): 152. Follow-up: 6, 12, and 18 months.
Bernabei 1998	*Cumulative number of days per year spent in nursing home* IG: 1087; CG: 2121 *Cumulative number of days per year spent in hospital* IG: 894; CG: 1367 *Number of participants with emergency department attendance* IG: 6/99; CG: 17/100 *Number of home visits by general practitioners* IG: mean 13.1 home visits (SD 0.8) CG: mean 10.2 home visits (SD 1.1) MD 2.9 home visits (95% CI 2.63 to 3.17) *Number of nursing care hours* IG: mean 13.0 hours (SD 3.0) CG: mean 12.0 hours (SD 3.0) MD 1.0 hours (95% CI 0.16 to 1.84) *Number of home support hours* IG: mean 120.0 hours (SD 20.0) CG: mean 154.0 hours (SD 29.0) MD 34.0 hours (95% CI 27.03 to 40.97) *Meals on wheels* IG: mean 54.0 meals on wheels (SD 12.0) CG: mean 39.0 meals on wheels (SD 10.0)	Number of participants at baseline: intervention group (IG): 99; control group (CG): 100. Follow-up: 12 months. CI: confidence interval; MD: mean difference; SD: standard deviation.

	MD 15.0 meals on wheels (95% CI 11.91 to 18.09)	
Bleijenberg 2016	*Number of hospital admissions* IG2: mean 0.27 hospital admissions (95 % CI 0.24 to 0.31) CG: mean 0.33 hospital admissions (95% CI 0.29 to 0.39) *General practice out-of-hours consultations* IG2: mean 0.96 consultations (95% CI 0.78 to 1.19) CG: mean 0.98 consultations (95% CI 0.81 to 1.17) *Number of emergency department visits* IG2: mean 0.27 emergency department visits (95% CI 0.24 to 0.31) CG: mean 0.33 emergency department visits (95% CI 0.29 to 0.39) *Number of consultations in general practice and home visits* IG2: mean 9.34 consultations and home visits (95% CI 8.17 to 10.68) CG: mean 7.12 consultations and home visits (95% CI 6.00 to 8.46)	Number of participants at baseline: intervention group (not analysed in this review): 790; intervention group 2 (IG2): 1446; control group (CG): 856. Follow-up: 12 months CI: confidence interval.
Dalby 2000	*Service utilisation – visits to family physician* IG: mean 5.2 visits to family physician (SD 4.5) CG: mean 4.0 visits to family physician (SD 3.6) MD 1.2 visits to family physician (95% CI −0.33, 2.73) *Service utilisation – visits to specialist* IG: mean 1.8 visits to specialist (SD 2.1) CG: mean 1.7 visits to specialist (SD 3.3) MD 0.1 visits to specialist (95% CI −0.92 to 1.12) *Service utilisation – visits to emergency department* IG: mean 0.4 visits to emergency department (SD 0.6) CG: mean 0.5 visits to emergency department (SD 1.0) MD 0.1 visits to emergency department (95% CI −0.20 to 0.40) *Service utilisation – hospital admissions (overnight)* IG: mean 0.4 hospital admissions (SD 0.7) CG: mean 0.3 hospital admissions (SD 0.8) MD 0.1 hospital admissions (95% CI −0.18 to 0.38) *Service utilisation – length of stay in hospital (days)* IG: mean 18.8 days (SD 31.9) CG: mean 10.5 days (SD 10.7) MD 8.3 days (95% CI −0.74 to 17.34) *Service utilisation – outpatient procedures* IG: mean 0.04 outpatient procedures (SD 0.2) CG: mean 0.01 outpatient procedures (SD 0.1) MD 0.03 outpatient procedures (95% CI −0.03 to 0.09)	Number of participants at baseline: intervention group (IG): 73; control group (CG): 69. Follow-up: 14 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Eklund 2013	*Number of patients with at least one hospital admission* IG: 52/85; CG: 46/76 *Number of patients with at least one home visit (physician) (primary outcome)* IG: 25/85; CG: 16/76 *Number of patients with at least one visit to an outpatient clinic (nurse) (primary outcome)* IG: 71/85; CG: 63/76 *Number of patients with at least one home visit (nurse) (primary outcome)* IG: 14/85; CG: 10/76	Number of participants at baseline: intervention group (IG): 89; control group (CG): 92. Follow-up: 12 months.
Gagnon 1999	*Mean number of hospitalisations* IG: mean 0.5 hospitalisations (SD 0.8) CG: mean 0.4 hospitalisations (SD 0.7) MD 0.1 hospitalisations (95% CI −0.04 to 0.24) *Mean hospital length of stay (days)* IG: mean 13.0 days (SD 20.7) CG: mean 11.9 days (SD 13.1) MD 1.1 days (95% CI −4.70 to 6.90) *Mean number of emergency department admissions* IG: mean 1.2 emergency department admissions (SD 2.0) CG: mean 0.9 emergency department admissions (SD 1.2) MD 0.3 emergency department admissions (95% CI −0.01 to 0.61)	Number of participants at baseline: intervention group (IG): 212; control group (CG): 215. Follow-up: 10 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Kono 2012	*Hospital admissions* IG: 7/161; CG: 6/162	Number of participants at baseline: intervention group (IG): 161; control group (CG): 162. Follow-up: 24 months
Kono 2016	*Hospital admissions* IG: 9/171; CG: 9/172	Number of participants at baseline: intervention group (IG): 179; control group (CG): 181. Follow-up: between 12 and 24 months.

Leung 2004	*Total number of acute hospital bed-days* IG: mean 9.6 days (SD 12.2) CG: mean 10.7 days (SD 14.8) MD 1.1 days (95% CI −4.53 to 6.73) *Total number of rehabilitation hospital bed-days* IG: mean 8.3 days (SD 15.1) CG: mean 18.5 days (SD 51.1) MD 10.2 days (95% CI −5.56 to 25.96 *Total number of hospital bed-days* IG: mean 18.0 days (SD 22.6) CG: mean 29.1 days (SD 60.0) MD 11.1 days (95% CI −7.84 to 30.01) *Total episodes of unplanned hospital admissions* IG: mean 0.3 unplanned hospital admissions (SD 0.6) CG: mean 0.4 unplanned hospital admissions (SD 1.4) MD 0.1 unplanned hospital admissions (95% CI −0.35 to 0.55) *Total episodes of hospital admission* IG: mean 2.3 hospital admissions (SD 2.5) CG: mean 2.7 hospital admissions (SD 4.0) MD 0.4 hospital admissions (95% CI −0.99 to 1.79) *Total number of attendances at emergency room* IG: mean 0.3 attendances at emergency room (SD 0.5) CG: mean 0.8 attendances at emergency room (SD 1.5) MD 0.5 attendances at emergency room (95% CI 0.03 to 0.97) *Total number of attendances at outpatient department* IG: mean 8.3 attendances at outpatient department (SD 10.1) CG: mean 6.9 attendances at outpatient department (SD 8.1) MD 1.4 attendances at outpatient department (95% CI −2.38 to 5.18) *Total number of attendances at geriatric day hospital* IG: mean 5.0 attendances at geriatric day hospital (SD 9.3) CG: mean 1.5 attendances at geriatric day hospital (SD 4.8) MD 3.5 attendances at geriatric day hospital (95% CI 0.45 to 6.55) *Total number of home visits by community nurse* IG: mean 24.8 home visits (SD 53.3) CG: mean 7.5 home visits (SD 21.3) MD 17.3 home visits (95% CI 0.62 to 33.98)	Number of participants at baseline: intervention group (IG): 45; control group (CG): 47. Follow-up: 12 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Melis 2008	*Total number of hospital stays* IG: mean 4.0 hospital stays (SD 14.0); CG: mean 6.0 hospital stays (SD 16.0) MD 2.0 hospital stays (95% CI −3.33, to7.33) *Physician care: number of health care units used per patient* IG: mean 6.4 health care units (SD 8.2); CG: mean 10.7 health care units (SD 8.9) MD 4.3 health care units (95% CI 1.55 to 7.05)	Number of participants at baseline: intervention group (IG): 88; control group (CG): 67 (sample size re-analysed for cluster design). Follow-up. 6 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Metzelthin 2013	*Number of participants receiving outpatient medical services* IG: 75/81; CG 62/71 RR 1.06 (95% CI 0.95 to 1.18) *Number of participants receiving primary care: General practitioner* IG: 71/71; CG: 63/63 RR 1.00 (95% CI 0.97 to 1.03) *Practice nurse* IG: 70/71; CG: 18/63 RR 3.45 (95% CI 2.33 to 5.10) *Occupational therapist* IG: 22/71; CG: 4/63 RR 4.88 (95% CI 1.78 to 13.40) *Physiotherapist* IG: 46/71; CG: 37/63 RR 1.10 (95% CI 0.84 to 1.44)	Number of participants at baseline: intervention group (IG): 193; control group (CG): 157. Follow-up: 12 months. CI: confidence interval; RR. risk ratio.
Sandberg 2015	*Inpatient care:* *Total number of hospital stays* IG: mean 0.49 hospital stays (SD 0.81) CG: mean 0.48 hospital stays (SD 0.84) MD 0.01 hospital stays (95% CI −0.25 to 0.27) *Total length of stay* IG: mean 4.6 days (SD 15.4) CG: mean 4.1 days (SD 11.7)	Number of participants at baseline: intervention group (IG): 80; control group (CG): 73. Follow-up: 12 months. CI: confidence interval; MD: mean difference; SD: standard deviation.

	MD 0.5 days (95% CI −3.90 to 4.90) *Outpatient care:* *Total number of visits* IG: mean 0.4 visits (SD 0.8) CG: mean 0.8 visits (SD 1.6) MD 0.4 visits (95% CI 0.00 to 0.80) *Total number of contacts with physicians in outpatient care* IG: mean 8.8 contacts (SD 5.6) CG: mean 10.2 contacts (SD 8.2) MD 1.4 contacts (95% CI −0.83 to 3.63)	
Suijker 2016	Hospitalisation 6 months: IG: IR 0.10 (95% CI 0.08 to 0.11); CG: IR 0.11 (95% CI 0.09 to 0.13) 12 months: IG: IR 0.10 (95% CI 0.08 to 0.12); CG: IR 0.11 (95% CI 0.09 to 0.13) 18 months: IG: IR 0.09 (95% CI 0.08 to 0.11); CG: IR 0.10 (95% CI 0.09 to 0.12) 24 months: IG: IR 0.10 (95% CI 0.08 to 0.12); CG: IR 0.11 (95% CI 0.09 to 0.14) *Hospitalisation (estimated mean scores adjusted for baseline outcome)* 6 months: IG: IR 0.10 (95% CI 0.08 to 0.12); CG: IR 0.11 (95% CI 0.09 to 0.14) 12 months: IG: IR 0.11 (95% CI 0.09 to 0.13); CG: IR 0.12 (95% CI 0.10 to 0.14) 18 months: IG: IR 0.10 (95% CI 0.08 to 0.12); CG: IR 0.12 (95% CI 0.09 to 0.14) 24 months: IG: IR 0.11 (95% CI 0.09 to 0.13); CG: IR 0.13 (95% CI 0.10 to 0.15) *Hospitalisation (estimated mean scores adjusted for baseline age, sex, socio-economic status, level of education, and modified Katz-ADL index score)* 6 months: IG: IR 0.11 (95% CI 0.09 to 0.13); CG: IR 0.12 (95% CI 0.10 to 0.14) 12 months: IG: IR 0.11 (95% CI 0.09 to 0.13); CG: IR 0.12 (95% CI 0.10 to 0.14) 18 months: IG: IR 0.11 (95% CI 0.09 to 0.13); CG: IR 0.12 (95% CI 0.10 to 0.14) 24 months: IG: IR 0.12 (95% CI 0.09 to 0.14); CG: IR 0.13 (95% CI 0.10 to 0.15) *After-hours GP care* 6 months: IG: IR 0.04 (95% CI 0.03 to 0.05); CG: IR 0.07 (95% CI 0.05 to 0.09) 12 months: IG: IR 0.05 (95% CI 0.03 to 0.06); CG: IR 0.06 (95% CI 0.04 to 0.08) 18 months: IG: IR 0.04 (95% CI 0.03 to 0.06); CG: IR 0.06 (95% CI 0.04 to 0.08) 24 months: IG: IR 0.04 (95% CI 0.03 to 0.05); CG: IR 0.07 (95% CI 0.05 to 0.09) *After-hours GP care (estimated mean scores adjusted for baseline outcome)* 6 months: IG: IR 0.04 (95% CI 0.03 to 0.05); CG: IR 0.08 (95% CI 0.05 to 0.10) 12 months: IG: IR 0.06 (95% CI 0.04 to 0.08); CG: IR 0.06 (95% CI 0.04 to 0.09) 18 months: IG: IR 0.05 (95% CI 0.03 to 0.06); CG: IR 0.07 (95% CI 0.04 to 0.09) 24 months:	Number of participants at baseline: intervention group (IG): 1209; control group (CG): 1074. Follow-up: 6, 12, 18 and 24 months. ADLs: activities of daily living; CI: confidence interval; GP: general practitioner; IR: incidence rate

	IG: IR 0.07 (95% CI 0.05 to 0.10); CG: IR 0.07 (95% CI 0.05 to 0.10) *After-hours GP care (estimated mean scores adjusted for baseline age, sex, socio-economic status, level of education, and modified Katz-ADL index score)* 6 months: IG: IR 0.04 (95% CI 0.03 to 0.06); CG: IR 0.08 (95% CI 0.06 to 0.11) 12 months: IG: IR 0.06 (95% CI 0.04 to 0.08); CG: IR 0.06 (95% CI 0.04 to 0.08) 18 months: IG: IR 0.05 (95% CI 0.03 to 0.07); CG: IR 0.07 (95% CI 0.05 to 0.09) 24 months: IG: IR 0.08 (95% CI 0.05 to 0.10); CG: IR 0.08 (95% CI 0.05 to 0.10)	
van Hout 2010	*≥ 1 hospital admission* IG: 163/331; CG: 141/320 *≥ 1 acute hospital visit* IG: 128/331; CG: 101/320 OR 1.6 (95% CI 1.04 to 2.4); P = 0.03 "a higher risk on acute hospital visits was found among persons assigned to the intervention group who had two or more chronic diseases"	Number of participants at baseline: intervention group (IG): 331; control group (CG): 320. Follow-up: 18 months CI: confidence interval; OR: odds ratio.

Analysis 6.3. Comparison 6: Case management compared with usual care for change in health and social care utilisation, Outcome 3: Change in social care utilisation between 6 and 12 months' follow-up

Change in social care utilisation between 6 and 12 months' follow-up

Study	Results	Notes
Bernabei 1998	*Number of meals received* IG: mean 54.0 meals received (SD 12.0) CG: mean 39.0 meals received (SD 10.0) MD 15.0 meals received (95% CI 11.91 to 18.09)	Number of participants at baseline: intervention group (IG): 99; control group (CG): 100. Follow-up: 12 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Melis 2008	*Hours of home care* IG: mean 88.6 hours (SD 172.4) CG: mean 63.4 hours (SD 77.7) MD 25.2 hours (95% CI −25.765 to 76.17) *Days spent at day care* IG: mean 6.0 days (SD 21.0) CG: mean 3.0 days (SD 10.0) MD 3.0 days (95% CI −3.26 to 9.26) *Number of days when participants received a meal* IG: mean 44.0 days (SD 66.0) CG: mean 33.0 days (SD 63.0) MD 11.0 days (95% CI −12.28 to 34.28)	Number of participants at baseline: intervention group (IG): 88; control group (CG): 67. Follow-up: 6 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Metzelthin 2013	*Number of participants receiving professional home care* IG: 42/73; CG: 37/65 RR 1.01 (95% CI 0.76 to 1.35) *Number of participants receiving informal care* IG: 24/84; CG: 21/74 RR 1.01 (95% CI 0.61 to 1.65) *Number of participants receiving in-home modifications* IG: 46/75; CG: 40/66 RR 1.01 (95% CI 0.78 to 1.32)	Number of participants at baseline: intervention group (IG): 193; control group (CG): 153. Numbers refer to approximate analysis for cluster randomised trials; sample size varies according to number of respondents per each type of service. Follow-up: 12 months. CI: confidence interval; RR: risk ratio.
Sandberg 2015	*Use of municipal home services:* *Hours of help with IADLs* IG: mean 20.9 hours (SD 48.7) CG: mean 14.9 hours (SD 29.2) MD 6.0 hours (95% CI −6.98 to 18.98) *Hours of help with PADLs* IG: mean 13.7 hours (SD 36.3) CG: mean 15.0 hours (SD 52.7) MD 1.3 hours (95% CI −13.05 to 15.65) *Hours of help at night* IG: mean 2.7 hours (SD 14.6) CG: mean 1.9 hours (SD 7.9) MD: 0.8 hours (95% CI −3.00 to 4.60) *Use of municipal home care:*	Number of participants at baseline: intervention group (IG): 80; control group (CG): 73. Follow-up: 12 months. CI: confidence interval; IADLs; instrumental activities of daily living; MD: mean difference; PADLs: personal activities of daily living; SD: standard deviation.

	Hours of municipal home care (day) IG: mean 15.3 hours (SD 55.8) CG: mean 10.4 hours (SD 34.4) MD 4.9 hours (95% CI −10.08 to 19.88) *Hours of municipal home care (evening)* IG: mean 1.1 hours (SD 6.8) CG: mean 3.1 hours (SD 11.0) MD 2.0 hours (95% CI −0.89 to 4.89) *Hours of municipal home care (night)* IG: mean 0.3 hours (SD 2.9) CG: mean 0.0 hours (SD 0.0) MD 0.3 hours (95% CI −0.37 to 0.97) *Use of informal care:* *Hours of help with IADLs* IG: mean 200.0 hours (SD 324.0) CG: mean 333.0 hours (SD 445.0) MD 133.0 hours (95% CI 9.41 to 256.59) *Hours of help with PADLs* IG: mean 23.0 hours (SD 128.0) CG: mean 64.0 hours (SD 390.0) MD 41.0 hours (95% CI −50.07 to 132.07)

Comparison 7. Case management compared with usual care for change in costs

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
7.1 Change in health service costs, intervention, and other costs between 6 and 36 months' follow-up	0		Other data	No numeric data

Analysis 7.1. Comparison 7: Case management compared with usual care for change in costs, Outcome 1: Change in health service costs, intervention, and other costs between 6 and 36 months' follow-up

Change in health service costs, intervention, and other costs between 6 and 36 months' follow-up

Study	Results	Notes
Applebaum 2002	*Physician services costs:* IG: USD 160; CG: USD 310 *Home health services:* IG: USD 74; CG: USD 261 Little or no difference between groups for other costs.	Number of participants at baseline: intervention group (IG): 156; control group (CG): 152. Other costs: hospice, medical equipment expenditures, Medicare programme, beneficiary payments. Follow-up: 18 months.
Bernabei 1998	*Community health service costs* IG: GBP 744; CG: GBP 919 Difference −19% *Nursing home costs* IG: GBP 644; CG: GBP 1244 Difference −48% *Hospital expenses* IG: GBP 1763; CG: GBP 2688 Difference −34%	Number of participants at baseline: intervention group (IG): 99; control group (CG): 100. Costs calculated using average costs from UK national official statistics (1998); takes into account costs accrued by adding the case managers. Difference between groups as reported by trial authors, insufficient data provided for reanalysis. Follow-up: 12 months
Béland 2006	*Cost of care, % increase, IG group only* Home healthcare: 64% (95% CI 46 to 83) P < 0.05 Home social care: −22% (95% CI −50 to 7) Inpatient care: −5% (95% CI −23 to 13) ED visits: −10% (95% CI −26 to 7) Alternate level of care: 17% (95% CI −28 to 71) Skilled nursing homes: 3% (95% CI −24 to 47) *Mean community care costs* IG: mean USD 12,695; CG: mean USD 9301 Difference USD 3394 *Institutional care costs* IG: USD 23,544; CG: USD 27,314 Difference USD −3,770 *Total costs* IG: USD 36,240; CG USD 36,614 Difference USD −374	Number of participants at baseline: intervention group (IG): 656; control group (CG): 653. Follow-up: 12 months CI: confidence interval.

Cameron 2013	*Total cost per person* IG: mean AUD 25,030 (SD 29,827) CG: mean AUD 22,885 (SD 32,354) MD AUD 2145 (95% CI −6204.94 to 10,494.94)	Number of participants at baseline: intervention group (IG): 120; control group (CG): 121. Costs calculated using local or national costs. Follow-up: 12 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Hoogendijk 2016	Difference in costs USD 356 (95% CI −488 to 1134)	Cost-effectiveness analysis using multilevel regression models of intervention compared to usual care. Follow-up: 24 months. CI: confidence interval.
Kono 2012	*Total healthcare costs* IG: mean JPY 2,016,606 (SD 161,432) CG: mean JPY 2,287,450 (SD 200,535) MD JPY 270,844 (95% CI 226,379.49 to 315,308.51)	Number of participants at baseline: intervention group (IG): 161; control group (CG): 162. Costs calculated using records from prefecture- and municipality-level health insurance plans (2007–2008). Analysis of log-transformed data, as reported by the trial authors; insufficient data provided for reanalysis. Follow-up: 24 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Kono 2016	*Total long-term care service costs* IG: mean JPY 3507 (SD 5400) CG: mean JPY 3562 JPY (SD 5,066) MD JPY 55.0 (95% CI −1122.35 to 1232.35)	Number of participants at baseline: intervention group (IG): 179; control group (CG): 181. Cost calculation not described; currency not described (referred to as "credits"). Follow-up: 36 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Leung 2004	IG: mean USD 155.30 (SD 167) CG: mean USD 139.0 (SD 135)	Number of participants at baseline: intervention group (IG): 45; control group (CG): 47. Costs of informal care Follow-up: 6 months
Markle-Reid 2006	*Total costs of all type of health and social services* Little or no difference between groups (P = 0.98)	Number of participants at baseline: intervention group (IG): 144; control group (CG): 144. Follow-up: 6 months.
Melis 2008	*Total care costs* IG: mean EUR 9713 (SD 10,205) CG: mean EUR 8952 (SD 9757) MD EUR 761.0 (95% CI −2840.95 to 4362.95)	Number of participants at baseline: intervention group (IG): 85; control group (CG): 66. "Costs calculated for unit of care, using the Dutch consumer price index figures (2005). Includes costs associated with healthcare services (e.g., hospitalisation, outpatient care), with the intervention, and other costs (e.g., meals on wheels)". Follow-up: 6 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Metzelthin 2013	*Total costs* IG: mean EUR 26,503 (SD 27,273) CG: mean EUR 20,550 (SD 18,891) MD EUR 5953 (95% CI −633 to 12,538) *Healthcare costs* IG: mean EUR 17,664 (SD 18,277) CG: mean EUR 12,963 (SD 10,439) MD EUR 4701 (95% 540 to 8861)	Number of participants at baseline: intervention group (IG): 193; control group (CG): 153. Numbers refer to approximate analysis for cluster randomised trials. Total costs include healthcare costs (hospital, primary care, long-term care, and prescribed medication), intervention costs (screening, training activities, and implementation), patient and family costs, informal care, and in-home modifications. Calculated from healthcare registries and self-report (2010). Follow-up: 24 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Sandberg 2015	*Total costs* CG: mean EUR 21,920 (SD 32,936) CG: mean EUR 16,762 (SD 17,064) MD EUR 5158 (95% CI −3341.62 to 13,657.62)	Number of participants at baseline: intervention group (IG): 80; control group (CG): 73. Includes healthcare costs, costs associated with the intervention (collected from central records), municipal home care costs (calculated using self-reported service use), intervention costs (case managers' salaries) and informal care (mix of self-reported and central records) costs. Follow-up: 12 months. CI: confidence interval; MD: mean difference; SD: standard deviation.
Spoorenberg 2018	*Total costs* *Frail group:* IG: mean EUR 16,413 (SD 19,628) CG: mean EUR 12,261 (SD 14,428) MD EUR 4152 (95% CI 2373.47 to 5930.53) *Complex care needs group:* IG: mean EUR 24,622 (SD 24,376) CG: mean EUR 19,959 (SD 19,294) MD EUR 4663 (95% CI 2395.33 to 6930.67)	Number of participants at baseline: stratified into 3 strata: robust (854 participants; excluded from analysis due to not frail population); frail (237 participants); and complex care needs (365 participants). Costs were calculated based on health and social care usage, provided by three Dutch sources of reimbursement, as well as self-reported usage of informal care (2012). Follow-up: 12 months.

		CG: control group; CI: confidence interval; IG: intervention group; MD: mean difference; SD: standard deviation.
Suijker 2016	*Total costs* IG: mean EUR 7012 (SE 508) CG: mean EUR 5609 (SE 364)	Number of participants at baseline: intervention group (IG): 1209; control group (CG): 1074. EuroQol Five-Dimension Questionnaire (EQ-5D) used to calculate quality-adjusted life years (QALYs) and health care resource use. Follow-up: 12 months. SE: standard error.

Comparison 8. Case management compared with usual care for patient satisfaction with care

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
8.1 Participant satisfaction with care between 6 and 12 months' follow-up	0		Other data	No numeric data

Analysis 8.1. Comparison 8: Case management compared with usual care for patient satisfaction with care, Outcome 1: Participant satisfaction with care between 6 and 12 months' follow-up

Participant satisfaction with care between 6 and 12 months' follow-up

Study	Results	Notes
Applebaum 2002	*Satisfaction with Medicare Care* 6 months: IG: mean 17.50 points CG: mean 17.70 points 12 months: IG: mean 17.60 points CG: mean 17.60 points *Satisfaction w/ESP (definition of 'ESP' not given by study investigators)* 6 months: IG: mean 26.40 points CG: mean 27.00 points 12 months: IG: mean 26.50 points CG: mean 26.60 All non-significant differences between groups.	Number of participants at baseline: intervention group (IG): 156; control group (CG) 152. Instrument: based on "summary measures from interviews". Follow-up: 6 and 12 months.
Bleijenberg 2016	*Satisfaction with care* 6 months: IG2: mean 8.1 points (95% CI 8.0 to 8.1) CG: mean 8.02 points (95% CI 8.0 to 8.1) 12 months: IG2: mean 8.0 points (95% CI 7.9 to 8.1) CG: mean 7.9 points (95% CI 7.8 to 8.0) P = 0.05; corrected P = 0.29	Number of participants at baseline: intervention group 1 (not analysed in this review): 790; intervention group 2 (IG2): 1446; control group (CG) 856. Instrument: satisfaction with care (range 0–10) Follow-up: 6 and 12 months. CI: confidence interval.
Gagnon 1999	IG: mean 25.0 points (SD 5.2); CG: mean 23.9 points (SD 5.8) MD 1.1 points (95% CI −0.10 to 2.30)	Number of participants at baseline: intervention group (IG): 212; control group (CG) 215. Instrument: Client Satisfaction Questionnaire (CSQ-8; scores range from 8–32, higher scores represent higher satisfaction with care). Follow-up: 10 months CI: confidence interval; MD: mean difference; SD: standard deviation.

APPENDICES

Appendix 1. Search strategies (searched until 23 September 2022)

MEDLINE (Ovid MEDLINE Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE Daily and Ovid MEDLINE) 1946 to date of search

No.	Search terms
1	"aged, 80 and over"/
2	aged/
3	frail elderly/
4	geriatrics/
5	"health services for the aged"/
6	((geriatric? or senior? or elderly or old*) adj2 (person? or people or adult? or patient?)).ti,ab.
7	(frail* adj2 (adult* or elder* or old or senior? or person? or people or patient?)).ti,ab.
8	or/1-7
9	exp delivery of health care, integrated/
10	(integrat* adj1 (care or pathway* or service* or delivery or healthcare or program* or approach* or model*)).ti,ab.
11	(deliver* adj1 (care or healthcare or service*)).ti,ab.
12	((system or systems) adj1 (care or healthcare or service*)).ti,ab.
13	((organis* or organiz*) adj1 (care or healthcare or service*)).ti,ab.
14	patient care planning/
15	((coordinat* or co-ordinat*) adj2 (care or healthcare or service* or program* or approach* or management or team care or team treatment* or team assessment* or team consultation*)).ti,ab.
16	case management/
17	((case or care) adj manag*).ti,ab.
18	(comanag* or co-manag*).ti,ab.
19	comprehensive health care/
20	(comprehensive adj2 (healthcare or care)).ti,ab.
21	care navig*.ti,ab.
22	(collaborat* adj1 (care or manage* or healthcare or service* or program* or approach* or working)).ti,ab.

(Continued)

23	shared care.ti,ab.
24	(holistic adj2 (care or healthcare)).ti,ab.
25	((partner* or joint) adj2 (care or working)).ti,ab.
26	("health* and social care" or "medical care and social care" or "care and social care").ti,ab.
27	(team* adj2 (care or treatment* or assessment* or consultation* or healthcare or service* or program* or approach*)).ti,ab.
28	((multidisciplinary or multi-disciplinary or interprofessional or inter-professional or interdisciplinary or inter-disciplinary or multispeciality or multi-speciality or multiagency or multi-agency or interagency or inter-agency or multi-professional or mulitprofessional or interorganisation* or interorganization* or inter-organisation* or inter-organization* or multiagenc* or multi-agenc* or interagenc* or inter-agenc*) adj2 (team* or care or working or collaboration or intervention* or management or provider? or consultation? or approach* or program* or treatment*)).ti,ab.
29	kaiser permanente.ti,ab.
30	or/9-29
31	8 and 30
32	exp randomized controlled trial/
33	controlled clinical trial.pt.
34	randomi#ed.ti,ab.
35	placebo.ab.
36	randomly.ti,ab.
37	clinical trials as topic.sh.
38	trial.ti.
39	or/32-38
40	exp animals/ not humans/
41	39 not 40
42	31 and 41

Embase (Ovid) 1974 to date of search

No.	Search terms
1	aged/
2	frail elderly/

(Continued)

3	very elderly/
4	geriatrics/
5	elderly care/
6	geriatric care/
7	geriatric nursing/
8	((geriatric? or senior? or elderly or old*) adj2 (person? or people or adult? or patient?)).ti,ab,kw.
9	(frail* adj2 (adult* or elder* or old or senior? or person? or people or patient?)).ti,ab,kw.
10	or/1-9
11	integrated health care system/
12	(integrat* adj1 (system? or care or pathway* or service* or delivery or healthcare or program* or approach* or model*)).ti,ab,kw.
13	(deliver* adj1 (care or healthcare or service*)).ti,ab,kw.
14	((system or systems) adj1 (care or healthcare or service*)).ti,ab,kw.
15	((organis* or organiz*) adj1 (care or healthcare or service*)).ti,ab,kw.
16	patient care planning/
17	((coordinat* or co-ordinat*) adj2 (care or healthcare or service* or program* or approach* or management or team care or team treatment* or team assessment* or team consultation*)).ti,ab,kw.
18	case management/
19	((case or care) adj (manag* or process*)).ti,ab,kw.
20	(comanag* or co-manag*).ti,ab,kw.
21	(comprehensive adj2 (healthcare or care)).ti,ab,kw.
22	care navig*.ti,ab,kw.
23	(collaborat* adj1 (care or manage* or healthcare or service* or program* or approach* or working)).ti,ab,kw.
24	shared care.ti,ab,kw.
25	(holistic adj2 (care or healthcare)).ti,ab,kw.
26	((partner* or joint) adj2 (care or working)).ti,ab,kw.
27	("health* and social care" or "medical care and social care" or "care and social care").ti,ab,kw.
28	(team* adj2 (care or treatment* or assessment* or consultation* or healthcare or service* or program* or approach*)).ti,ab,kw.

(Continued)

29	((multidisciplinary or multi-disciplinary or interprofessional or inter-professional or interdisciplinary or inter-disciplinary or multispeciality or multi-speciality or multiagency or multi-agency or interagency or inter-agency or multi-professional or mulitprofessional or interorganisation* or interorganization* or inter-organisation* or inter-organization* or multiagenc* or multi-agenc* or interagenc* or inter-agenc*) adj2 (team* or care or working or collaboration or intervention* or management or provider? or consultation? or approach* or program* or treatment*)).ti,ab,kw.
30	kaiser permanente.ti,ab,kw.
31	or/11-30
32	10 and 31
33	random*.ti,ab.
34	factorial*.ti,ab.
35	(crossover* or cross over*).ti,ab.
36	((doubl* or singl*) adj blind*).ti,ab.
37	(assign* or allocat* or volunteer* or placebo*).ti,ab.
38	crossover procedure/
39	single blind procedure/
40	randomized controlled trial/
41	double blind procedure/
42	or/33-41
43	(systematic review or literature review).ti.
44	"cochrane database of systematic reviews".jn.
45	exp animals/ or exp invertebrate/ or animal experiment/ or animal model/ or animal tissue/ or animal cell/ or nonhuman/
46	human/ or normal human/ or human cell/
47	45 not (45 and 46)
48	43 or 44 or 47
49	42 not 48
50	32 and 49
51	limit 50 to embase

No.	Search terms
#1	MeSH descriptor: [Aged, 80 and over] explode all trees
#2	MeSH descriptor: [Aged] explode all trees
#3	MeSH descriptor: [Frail Elderly] explode all trees
#4	MeSH descriptor: [Geriatrics] explode all trees
#5	MeSH descriptor: [Health Services for the Aged] explode all trees
#6	((geriatric? or senior? or elderly or old*) near/2 (person? or people or adult? or patient?)):ti,ab
#7	(frail* near/2 (adult* or elder* or old or senior? or person? or people or patient?)):ti,ab
#8	{or #1-#7}
#9	MeSH descriptor: [Delivery of Health Care, Integrated] explode all trees
#10	(integrat* near/1 (system? or care or pathway* or service* or delivery or healthcare or program* or approach* or model*)):ti,ab
#11	(deliver* near/1 (care or healthcare or service*)):ti,ab
#12	((system or systems) near/1 (care or healthcare or service*)):ti,ab
#13	((organis* or organiz*) near/1 (care or healthcare or service*)):ti,ab
#14	MeSH descriptor: [Patient Care Planning] explode all trees
#15	((coordinat* or co-ordinat*) near/2 (care or healthcare or service* or program* or approach* or management or team*)):ti,ab
#16	MeSH descriptor: [Case Management] explode all trees
#17	((case or care) next (manag* or process*)):ti,ab
#18	(comanag* or co-manag*):ti,ab
#19	MeSH descriptor: [Comprehensive Health Care] explode all trees
#20	(comprehensive near/2 (healthcare or care)):ti,ab
#21	(care next navig*):ti,ab
#22	(collaborat* near/1 (care or manage* or healthcare or service* or program* or approach* or working)):ti,ab
#23	shared care:ti,ab
#24	(holistic near/2 (care or healthcare)):ti,ab
#25	((partner* or joint) near/2 (care or working)):ti,ab
#26	((health* near/1 ("social care")) or ("medical care and social care") or ("care and social care")):ti,ab

(Continued)

#27	(team* near/2 (care or treatment* or assessment* or consultation* or healthcare or service* or program* or approach*)):ti,ab
#28	((multidisciplinary or multi-disciplinary or interprofessional or inter-professional or interdisciplinary or inter-disciplinary or multispeciality or multi-speciality or multiagency or multi-agency or interagency or inter-agency or multi-professional or mulitprofessional or interorganisation* or interorganization* or inter-organisation* or inter-organization* or multiagenc* or multi-agenc* or interagenc* or inter-agenc*) near/2 (team* or care or working or collaboration or intervention* or management or provider? or consultation? or approach* or program* or treatment*)):ti,ab
#29	kaiser permanente:ti,ab
#30	{or #9-#29}
#31	#8 and #30

ClinicalTrials.gov

Search terms: "case management" | Older Adults

WHO International Clinical Trials Registry Platform (ICTRP)

case management AND elder*

case management AND old*

case management AND senior*

Cinahl (EBSCO)

No.	Search terms
S1	(MH "Aged") OR (MH "Aged, 80 and Over") OR (MH "Frail Elderly")
S2	(MH "Geriatrics")
S3	(MH "Health Services for Older Persons")
S4	TI (((geriatric? or senior? or elderly or old*) N2 (person? or people or adult? or patient?))) OR AB (((geriatric? or senior? or elderly or old*) N2 (person? or people or adult? or patient?)))
S5	TI ((frail* N2 (adult* or elder* or old or senior? or person? or people or patient?))) OR AB ((frail* N2 (adult* or elder* or old or senior? or person? or people or patient?)))
S6	S1 OR S2 OR S3 OR S4 OR S5
S7	(MH "Health Care Delivery, Integrated")
S8	TI ((integrat* N1 (system? or care or pathway* or service* or delivery or healthcare or program* or approach* or model*))) OR AB ((integrat* N1 (system? or care or pathway* or service* or delivery or healthcare or program* or approach* or model*)))
S9	TI ((deliver* N1 (care or healthcare or service*))) OR AB ((deliver* N1 (care or healthcare or service*)))

(Continued)

S10	TI (((system or systems) N1 (care or healthcare or service*))) OR AB (((system or systems) N1 (care or healthcare or service*)))
S11	TI (((organis* or organiz*) N1 (care or healthcare or service*))) OR AB (((organis* or organiz*) N1 (care or healthcare or service*)))
S12	(MH "Patient Care Plans+")
S13	TI (((coordinat* or co-ordinat*) N2 (care or healthcare or service* or program* or approach* or management or team care or team treatment* or team assessment* or team consultation*))) OR AB (((coordinat* or co-ordinat*) N2 (care or healthcare or service* or program* or approach* or management or team care or team treatment* or team assessment* or team consultation*)))
S14	(MH "Case Management")
S15	TI (((case or care) N0 (manag* or process*))) OR AB (((case or care) N0 (manag* or process*)))
S16	TI ((comanag* or co-manag*)) OR AB ((comanag* or co-manag*))
S17	TI ((comprehensive N2 (healthcare or care))) OR AB ((comprehensive N2 (healthcare or care)))
S18	TI care navig* OR AB care navig*
S19	TI ((collaborat* N1 (care or manage* or healthcare or service* or program* or approach* or working))) OR AB ((collaborat* N1 (care or manage* or healthcare or service* or program* or approach* or working)))
S20	TI shared care OR AB shared care
S21	TI ((holistic N2 (care or healthcare))) OR AB ((holistic N2 (care or healthcare)))
S22	TI (((partner* or joint) N2 (care or working))) OR AB (((partner* or joint) N2 (care or working)))
S23	TI (("health* and social care" or "medical care and social care" or "care and social care")) OR AB (("health* and social care" or "medical care and social care" or "care and social care"))
S24	TI ((team* N2 (care or treatment* or assessment* or consultation* or healthcare or service* or program* or approach*))) OR AB ((team* N2 (care or treatment* or assessment* or consultation* or healthcare or service* or program* or approach*)))
S25	TI (((multidisciplinary or multi-disciplinary or interprofessional or inter-professional or interdisciplinary or inter-disciplinary or multispeciality or multi-speciality or multiagency or multi-agency or interagency or inter-agency or multi-professional or mulitprofessional or interorganisation* or interorganization* or inter-organisation* or inter-organization* or multiagenc* or multi-agenc* or interagenc* or inter-agenc*) N2 (team* or care or working or collaboration or intervention* or management or provider? or consultation? or approach* or program* or treatment*))) OR AB (((multidisciplinary or multi-disciplinary or interprofessional or inter-professional or interdisciplinary or inter-disciplinary or multispeciality or multi-speciality or multiagency or multi-agency or interagency or inter-agency or multi-professional or mulitprofessional or interorganisation* or interorganization* or inter-organisation* or inter-organization* or multiagenc* or multi-agenc* or interagenc* or inter-agenc*) N2 (team* or care or working or collaboration or intervention* or management or provider? or consultation? or approach* or program* or treatment*)))
S26	TI kaiser permanente OR AB kaiser permanente
S27	S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26

(Continued)

S28	S6 AND S27
S29	PT randomized controlled trial
S30	PT clinical trial
S31	TI (randomis* or randomiz* or randomly) OR AB (randomis* or randomiz* or randomly)
S32	(MH "Clinical Trials+")
S33	(MH "Random Assignment")
S34	S29 OR S30 OR S31 OR S32 OR S33
S35	S28 AND S34
S36	S35 Limiters - Exclude MEDLINE records

PDQ Evidence

(title:(old* OR elder* OR senior* OR aged) OR abstract:(old* OR elder* OR senior* OR aged)) AND (title:(case manag*) OR abstract:(case manag*))

CRD databases: Dare, HTA, NHS-EED

(case NEXT manag*) AND (old* OR elder* OR senior* OR aged) IN DARE

HISTORY

Protocol first published: Issue 8, 2018

CONTRIBUTIONS OF AUTHORS

ES and JS conceived the protocol for the review.
ES, ZK, AZ, KS, JW, JS, TS, TC, DGB, and DMW identified and screened relevant trials.
ES, AZ, JW, TS, DGB, and DMW extracted data from included trials.
ES, DGB, and DMW compiled summary tables of the results and led on writing the review.
ES, IB, TC, DGB, and DMW assessed data and analysed the results.
ES, ZK, and DMW performed risk of bias assessments from included trials.
TC, DGB, and DMW developed the summary of findings table and graded the evidence.
ES, ZK, AZ, KS, JW, DW, IB, NS, TC, JS, TS, DGB, and DMW read and commented on the manuscript.
Secured funding for the review: not applicable.

DECLARATIONS OF INTEREST

ES: no relevant interests; registered physiotherapist working in research and education (University of Southampton).
ZK: none known.
AZ: none known.
KS: none known.
JW: no relevant interests; Consultant AHP in Clinical Gerontology, King's College Hospital, London, UK; works for 11 hours a week in NHS role; member of the British Geriatrics Society, which has a position on comprehensive geriatric assessment (that has crossover with the subject of the review); member of the special interest group for rehabilitation and member of the conference organising committee for the Royal Osteoporosis Society (not aware if they have an established opinion relating to the subject of this review).
DW: no relevant interests; Consultant Physician and Geriatrician, Kings College Hospital NHS Foundation Trust London, UK; member of the British Geriatrics Society.
IB: none known.
NS: London Safety and Training Solution Ltd (consultant).
JS: no relevant interests; affiliated to NHS England.
TS: none known.

TC: none known.
DGB: no relevant interests; Associate Editor, Cochrane Effective Practice and Organisation of Care (not involved in the editorial process of this review).
DMW: none known.

The views and opinions expressed are those of the authors and not necessarily those of the Systematic Reviews Programme, the UK National Health Service (NHS), or the National Institute of Health and Care Research (NIHR).

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Internal sources

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- National Institute for Health Research (NIHR); King's Improvement Science, UK

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DIFFERENCES BETWEEN PROTOCOL AND REVIEW

See Sadler 2018 (protocol).

Background

Why it is important to do this review

We did not examine the impact of case management for integrated care of older people with frailty on carer and provider outcomes due to the lack of data in the included trials.

Methods

Types of participants

We provided information on how we ascertained the eligible population with respect to frailty status in the included trials.

Type of outcome measures

Due to lack of or insufficient data in the included trials, we changed or refined the following outcomes.

Primary outcomes

We changed 'living at home or change in place of residence (nursing or residential home)' to 'change in place of residence to a nursing or residential home'. We changed 'serious adverse events' to 'serious adverse effects' and changed its definition from 'hospitalisation from falls or fracture, permanent disability or mortality' to 'medical event or injury triggered by participating in the trial'. The rationale for this change was that the former definition included events that were already captured by other outcomes (e.g. mortality).

Secondary outcomes

Change in function

We added activities of daily living (ADLs) and independent ADLs, which were both included in a number of trials in this review. We clarified that change in function encompassed physical, cognitive, emotional, and social function, and reported these further domains of function narratively in the results section owing to variation in outcomes reported and units and time points of measurement across trials.

Change in healthcare and social care utilisation

We omitted 'admission to a nursing or residential care home', as this relates to the primary outcome 'change in place of residence to a nursing or residential home'. We also changed the last outcome to 'patient satisfaction with care' and omitted 'patient, carer and provider experience and acceptability' owing to a lack of data on these outcomes in the included trials. Regarding carer outcomes, one trial examined a carer satisfaction outcome measure (according to the publication) but did not provide numerical data (Béland 2006). Another trial examined a caregiver burden outcome measure (according to the publication) but provided no numerical data, simply stating there was no difference between the intervention and control group arms (Parsons 2012). We reported patient satisfaction with care narratively in this review, as few trials provided data on this outcome.

Selection of studies

We increased the number of review authors screening records to 10, and we specified in the manuscript how this task was divided among these review authors.

Data extraction and management

We also increased the number of review authors extracting data to six, and we specified in the manuscript how this task was divided among these review authors. We did not extract information on 'fidelity assessment and acceptability of the intervention', as the included trials provided insufficient information in this regard.

Assessment of risk of bias in included studies

We omitted assessment of additional bias domains for cluster-RCTs (recruitment bias, baseline imbalance, loss of clusters, incorrect analysis, compatibility with individually randomised trials, contamination) as indicated in Higgins 2019, as all included cluster-RCTs took clustering into account and used mixed-effects regression models in their statistical analysis; upon discussion we decided that the criteria recommended by the Cochrane EPOC group were adequate (EPOC 2017b).

Summary of findings and assessment of the certainty of the evidence

Finally, we increased the number review authors grading the evidence to three, and specified in the manuscript how this task was divided among these review authors.

NOTES

The protocol was based on standard text and guidance provided by Cochrane Effective Practice and Organisation of Care (EPOC). We used Review Manager Web computer software RevMan Web 2020) to conduct the analyses and write this Cochrane Review.