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Document Version:
Publisher's PDF, also known as Version of record

Published In:
The Lancet Healthy Longevity

Effectiveness of holistic assessment-based interventions for adults with multiple long-term conditions and frailty: an umbrella review of systematic reviews

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Holistic assessment-based interventions (HABIs) are effective in older people admitted to hospital, but it is unclear whether similar interventions are effective in adults with multiple long-term conditions or frailty in the community. We conducted an umbrella review to comprehensively evaluate the literature on HABIs for adults (aged ≥18 years) with multiple long-term conditions, and frailty. We searched eight databases for systematic reviews reporting on experimental or quasi-experimental studies. Of 9803 titles screened, we identified 29 eligible reviews (14 with meta-analysis) reporting on 14 types of HABIs. The evidence for the effectiveness of HABIs was largely inconsistent across different types of interventions, settings, and outcomes. We found evidence of no benefit from hospital HABIs on health-related quality of life (HRQoL) and emergency department re-attendance, and evidence of no benefit from community HABIs on overall health-care utilisation rates, emergency department attendance, nursing home admissions, and mortality. The best evidence of effectiveness was for hospital comprehensive geriatric assessment (CGA) on nursing home admissions, keeping patients alive and in their own homes. There was some evidence of benefit from community CGA on hospital admissions, and from CGA spanning community and hospital settings on HRQoL. Patient-centred medical homes had beneficial effects on HRQoL, mental health, self-management, and hospital admissions.

Introduction

The number of people with multiple long-term conditions (also known as multimorbidity) is progressively increasing, posing considerable challenges to health and social care systems.[1,2] Although age is the strongest risk factor, multimorbidity is common at all ages, particularly in people from socioeconomically disadvantaged communities. Since there are more middle-aged than older adults, in absolute terms, there are more adults aged under 65 years with multiple long-term conditions than aged 65 years or older.[1–3] Having multiple long-term conditions is associated with poor health outcomes (eg, reduced health-related quality of life [HRQoL], poor mental health, and high treatment burden) and an increased risk of adverse events (eg, hospital admissions, adverse drug events, and mortality).[4] Multiple long-term conditions commonly contribute to frailty, which is a cumulative decline in psychological, physical, and social functioning.[5,6] In people aged 64–85 years, frailty is mainly related to concurrent multiple long-term conditions, but largely to functional deficits in people older than 85 years.[7] Frailty status on admission to hospital is predictive of multiple adverse health outcomes,[8] including premature mortality.[9] Health systems need effective and sustainable interventions to improve health outcomes and mitigate the risks of adverse events for people with multiple long-term conditions and frailty.[1,2,10,11]

Several systematic reviews[10,12–15] have examined the effectiveness of various complex interventions in improving health outcomes for these populations. This literature can be hard to interpret because there is heterogeneity in the components of complex interventions that have the same name and considerable overlap between interventions with different names.[10,13,15–17] However, a core component of complex interventions in this field is the use of holistic assessment and intervention, which is not bounded by single conditions, and the UK National Institute for Health and Care Excellence (NICE) has highlighted the need for evidence on the effectiveness of such interventions in people with multiple long-term conditions.[2]

We defined holistic assessment-based interventions (HABIs) as those that systematically identify individuals' medical, psychological, social, and functional capabilities and needs to develop personalised care and follow-up.[18] This model of care is commonly used among older adults with frailty where it is most often called a comprehensive geriatric assessment (CGA).[19] The effectiveness of CGA for older adults has been studied extensively for inpatients and, to a lesser extent, in community-dwelling older adults.[15,20–23] Evidence suggests that initiating CGA on hospital admission increases the likelihood of older adults being alive and living in their homes compared with those receiving usual care.[20] A recent umbrella review of CGA in older adults concluded that it reduces nursing home admissions, risk of falls, pressure sores in hospital settings, and decreases the risk of physical frailty in community-dwelling older adults.[23] In practice, however, interventions named as CGA are heterogeneous in their components. For instance, a recent review of CGA interventions used in integrated care programmes found 21 types of CGA that differed by implementation settings, instruments used, team composition, procedures, and the number and type of life domains addressed.[24] Additionally, focusing on studies that label the intervention as CGA ignores trials of HABIs with different names (eg, discharge planning and integrated care), which deploy many of the same components as CGA. Furthermore, it is important to examine the effectiveness of HABIs implemented in different settings (hospital, community, or both) and in

younger adults with multiple long-term conditions for whom the evidence base is particularly lacking.[10,11] Therefore, the aim of this umbrella review was to comprehensively evaluate the literature on HABIs targeting adults (aged ≥18 years) with multiple long-term conditions and frailty in both hospital and community settings.

Methods

This umbrella review followed Joanna Briggs Institute (JBI) methodological guidance[25] and reporting guidelines[26] for umbrella reviews. The protocol was registered with PROSPERO (CRD42022363217). The full methods are reported in the published protocol[27] and, therefore, only summarised here.

Search strategy and selection criteria

We systematically searched MEDLINE (Ovid), Embase (Ovid), PsycINFO (Ovid), CINAHL Plus (EBSCO), Scopus, ASSIA (ProQuest), Cochrane Library, and TRIP Medical Database for peer-reviewed literature published between Jan 1, 2010, and Sept 26, 2022 to ensure present-day relevance of evidence. The search strategy combined subject terms and keywords relating to the target population and intervention with database-specific filters for systematic reviews (appendix pp 2–3). No language restrictions were applied to the search strings. We further manually searched the reference lists of the included systematic reviews. Eligible systematic reviews (appendix p 4) were those evaluating holistic assessment-based interventions in the community, hospital, or both settings in adults aged 18 years and older with multiple long-term conditions (defined as ≥2 long-term health conditions)[28] and frailty (defined as a frailty phenotype, using a frailty deficits model, or validated frailty index or measure). Reviews describing complex interventions on the basis of the assessment of needs in two or more health domains were included irrespective of how the review labelled the intervention (eg, CGA and integrated care). The primary outcomes of interest were HRQoL, physical and cognitive function, mortality, unscheduled hospital admission, unscheduled care attendance, and nursing home admission. Secondary pre-specified outcomes were length of hospital stay, adverse drug events, geriatric syndromes, and other outcomes (experience of care) identified from reviews. We included reviews with and without meta-analysis reporting on randomised controlled trials and other strong quasi-experimental study designs (eg, controlled before and after studies, and interrupted time series analysis).

Selection process

After removing duplicate reviews with EndNote version 20·3 (Clarivate Analytics, Philadelphia, PA, USA), the RIS file was transferred into Covidence (Veritas Health Innovation, Melbourne, VIC, Australia). Two reviewers (SA and NM-N) independently screened the titles and abstracts against eligibility criteria, followed by full-text screening of potentially eligible reviews. At the full-text review stage, only reviews published in English were included due to resource and time constraints. At every stage of screening, disagreements were resolved by discussion and consensus, with the involvement of a third reviewer (BG) if required.

Data collection

We used an adapted JBI tool[25] to extract data on review characteristics, target populations, search strategy, complex interventions, contexts and settings, analysis, health outcomes, and results. For reviews with no meta-analysis, a summary of the authors' primary interpretation of findings was extracted. For meta-analyses, we extracted data on pooled effect sizes (eg, risk ratio [RR], odds ratio [OR], weighted mean difference [WMD], or standardised mean difference [SMD]) with corresponding 95% CI and p values. For reviews describing multiple types of health interventions, results pertinent to HABIs were extracted.

Quality assessment

The quality of methods in the reviews was assessed with the JBI Critical Appraisal Checklist.[25] NM-N and LH assessed 15 systematic reviews each (52%), and SA assessed a random sample of 20 (69%) reviews. Selection was performed over two rounds, whereby every second review was randomly selected. Between the assessors, we aimed to ensure that most systematic reviews were double assessed for quality. Disagreements in ratings were discussed and resolved by consensus. The JBI tool consists of 11 items that were scored as: met, not met, unclear, and not applicable. The tool was not intended to generate an overall score, but we rated review quality as high, moderate, low, or critically low on the basis of weaknesses in critical domains (items 1–3 and 5–10; appendix p 13).

Analysis of the degree of overlap in studies

We developed a citation matrix to calculate the degree of overlap in primary studies with the corrected covered area (CCA) formula and the thresholds proposed by Pieper and colleagues[29] to define slight (CCA=0–5%), moderate (6–10%), high (11–15%) and very high (>15%) overlap.

$$CCA = \frac{N-r}{rc-r} = \frac{731-485}{(485 \times 37)-485} = 1 \cdot 4\%$$

CCA equation: N is the total number of publications in evidence synthesis (including double counting), r (rows) is the number of index publications, and c (columns) is the number of included reviews.

The overall degree of overlap between reviews on this measure was slight (CCA=1·4%). To further assess the overlap and identify pairs of reviews with high overlap,[30] we calculated the proportion of primary studies from one

review found in another review and eliminated those with more than 40% overlap in primary studies.

Data summary

Primary synthesis was narrative given the heterogeneity of the evidence and grouped by implementation setting (hospital, community, or both). We identified the type of intervention in terms of both how the review authors named it and our own categorisation (eg, multicomponent interventions or transitional care). We mapped the intervention components described in every selected review to the domains of the adapted sustainable integrated chronic care models for multimorbidity: delivery, financing, and performance (SELFIE) framework for integrated care for multiple long-term conditions.[31] Following JBI guidance for umbrella reviews, no reanalyses of effect sizes were attempted,[25] but we made an overall assessment of the quality of evidence for key outcomes using the GRADE principles.[32]

The methods reported in the review protocol[27] were followed in full. However, in the overall assessment of the certainty of evidence for outcomes, we were guided by the quality and consistency of evidence reported by all included reviews and not only updated reviews because by addressing overlap, we included the most up-to-date systematic review evidence available.

Results

Search results and study characteristics

The search identified 9803 records with 7715 titles and abstracts screened after removing duplicates and 95 full-text reviews that were examined (figure 1; appendix pp 5–7). 32 reviews were eligible for inclusion and a further five eligible reviews were identified by searching reference lists of these 32 reviews. We removed eight older, highly overlapping reviews,[33–40] leaving 29 reviews with low overlap in primary studies that were included (median 8% overlap and interquartile range 5–14%; figure 2). Of the 29 included reviews, 14 (48·3%) were published between 2018 and 2022 (table 1), with the total number of included primary studies ranging from four[22] to 85.[59] 12 (41·4%) of 29 reviews reported only on randomised controlled trials (RCTs),[10,12,20,42,47,51,56,57,60–63] whereas seven (24%) reviews included more non-randomised study designs than RCTs.[22,43,46,48,52,54,64] Six (4·8%) reviews did not specify where the included interventions were implemented.[12,42,54,55,57,61] In the 23 reviews that reported the location, approximately half of the included interventions were implemented in North America (the USA and Canada), Europe (the UK, the Netherlands, Germany, France, Italy, Spain, and Scandinavia), and Australia (appendix pp 8–12).

Three reviews provided no data on participant numbers,[54,56,57] with the remaining reviews reporting data for more than 1000 participants across all included studies. Eight reviews specifically targeted studies of adults with multiple long-term conditions,[10,12,14,43,45,51,59,63] but information

on the baseline number of multiple conditions and measures used was rarely reported. Six reviews included participants with frailty and multiple long-term conditions based on selection by chronological age (>65 years) or high risk of nursing home admission,[22,46,58,61,62] whereas seven reviews selected by high risk of acute hospitalisation (appendix pp 8–12).[41,47,48,50,52,55,60]

Quality assessment

18 (62·1%) of 29 reviews were rated overall as high quality, five (17·1%) as low, and six (20·7%) as critically low (appendix p 13). The low-quality or critically low-quality reviews failed to meet the criteria for duplicate conduct of quality appraisals,[14,43,47,54,64] the application of methods to prevent errors in data extraction,[12,43,53,54,63] and assessment of publication bias.[12,48] Six of the seven reviews reporting on hospital HABIs scored high on method quality, with four reviews (57%) including only
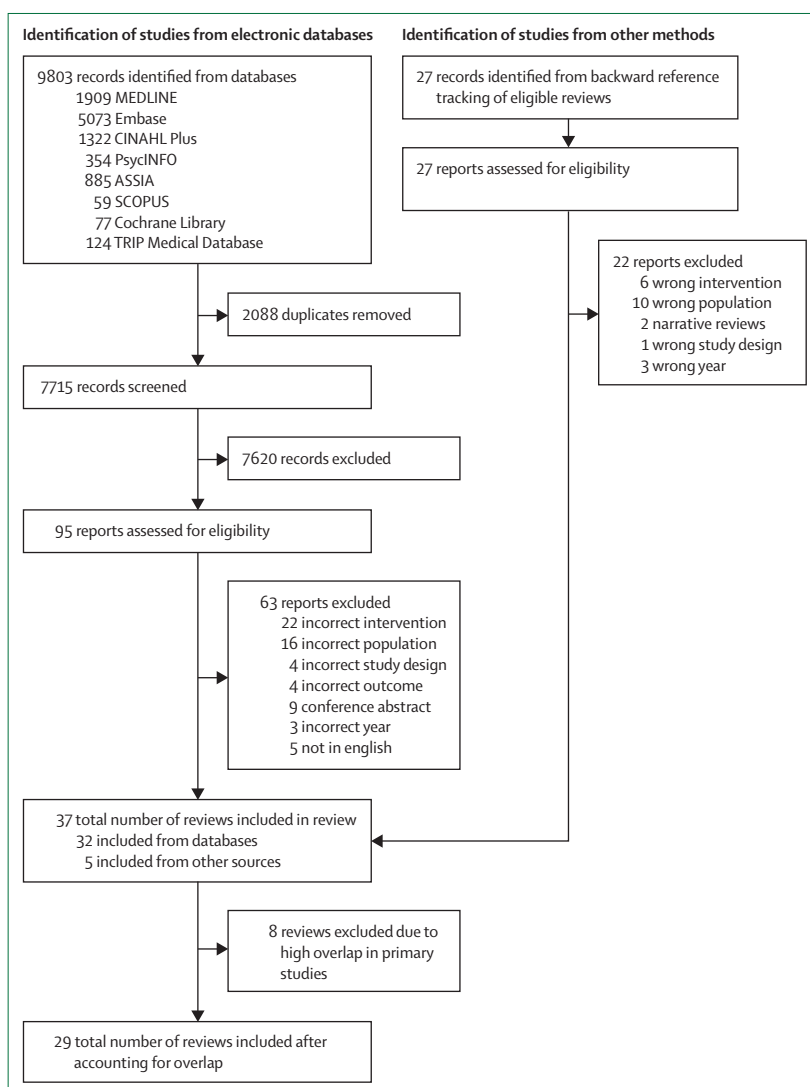
Figure 1: PRISMA flowchart of study search and selection
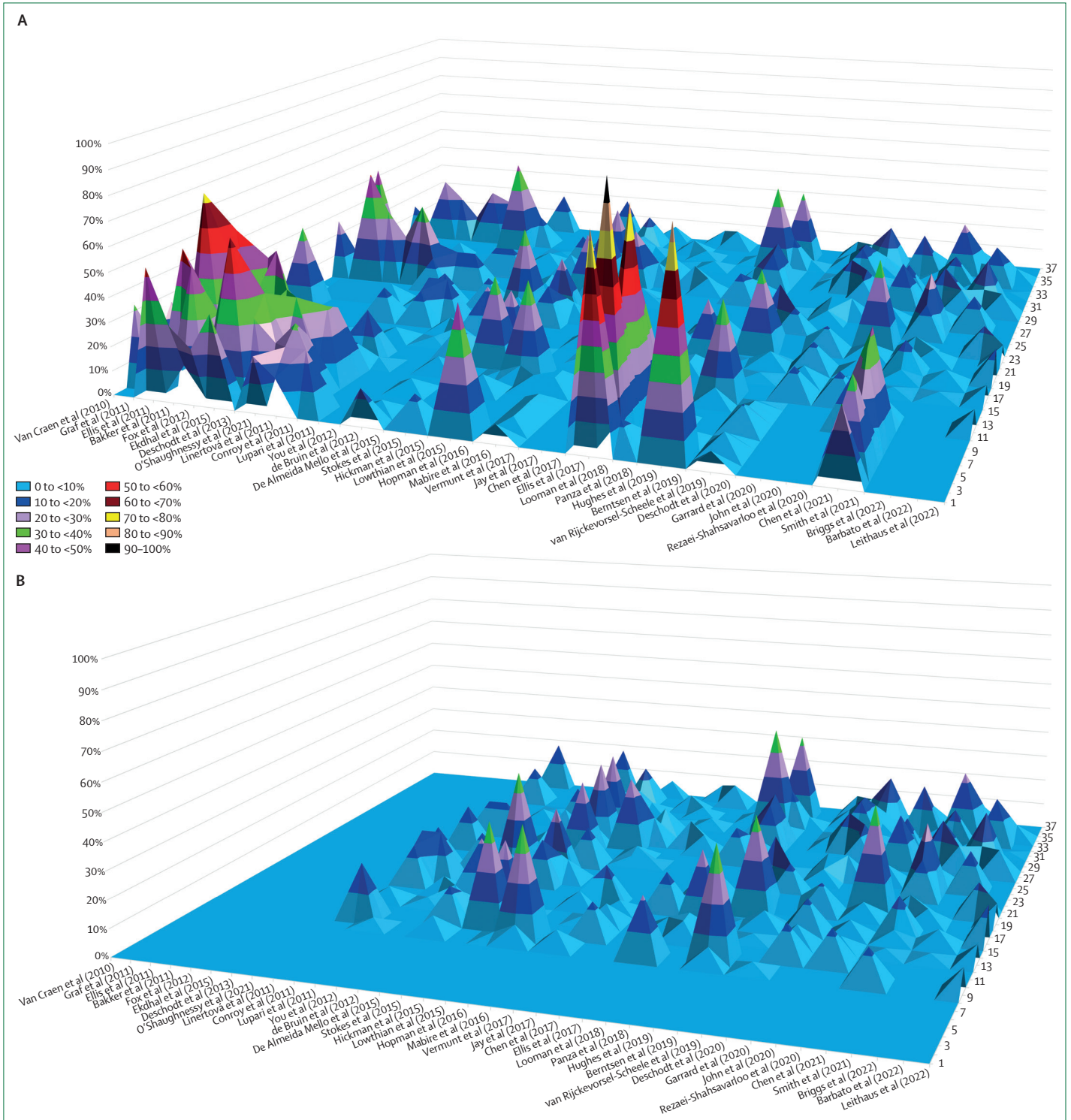
Figure 2: The percentage of overlap in primary studies between reviews before (A) and (B) after removing highly overlapping reviews

Each point on the x and z axes represents a review, with numbers on the z-axis corresponding to the order of reviews on the x-axis. Points on y-axis show the percentage of overlap in primary studies between a pair of reviews; the higher the colour coded peaks, the greater the percentage of overlap in primary studies.[10,12,14,20,22,33-64] (A) illustrates the percentage of overlap in primary studies across 37 reviews, with eight reviews that have near complete or high overlap in primary studies with other reviews listed first. (B) depicts the percentage of overlap across the remaining 29 reviews after removing the highly overlapping eight reviews.

RCTs.[20,42,47,60] Of 14 community-based reviews, only seven scored high on quality. Three community-based reviews[43,46,54,] that scored critically low on quality and one that scored high,[22] included more non-randomised studies than RCTs in their analysis. Four (57%) of the seven reviews examining HABIs in both community

	Complex interventions			Population		Outcomes examined	Key results
	Setting	Review description of included interventions	Categorisation of the interventions	Eligibility criteria	Sample size (n); age (years); sex (%)		
Ellis et al (2017)[20]	Hospital (acute medical ward and geriatric ward)	CGA	CGA	Aged ≥65 years admitted to hospital for acute care or inpatient rehabilitation after an acute admission with medical, functional, or psychosocial issues	Total 13 776; all ≥65 years, sex not reported	Living at home; alive in home; mortality; nursing home admission; dependence; cognitive decline; LoS	Evidence of CGA-based interventions increased the likelihood of patients being alive and living in their own homes, and reduced risk for nursing home admission; no evidence of beneficial effects on mortality and little or no difference in dependence; no conclusive evidence of effects on cognitive function and LoS
Jay et al (2017)[52]	Hospital (acute hospital including ED)	CGA	CGA	Aged ≥65 years presenting non-electively to ED	Total 28 434; all >65 years; >52% women	Hospital admission; hospital readmissions; LoS	Evidence of significant reductions in hospital admission rates from the geriatrician-led CGA, but the degree of variation in the rates ranged from 2·6% to 19·7%; conflicting results in relation to the effects on LoS; no significant difference in readmission rates at 7 days and 30 days of follow-up
Conroy et al (2011)[42]	Hospital (acute hospital including ED)	CGA	CGA	Aged ≥65 years frail older patients discharged rapidly (<72 h) from an acute hospital setting	Total 2287; all ≥60 years; sex not reported	HRQoL; mortality; institutionalisation; functional status; cognition; hospital readmissions	No evidence of positive effects of hospital CGA on mortality, hospital readmission, institutionalisation, functional status, HRQoL, or cognition
Linertová et al (2011)[41]	Hospital (various wards)	Hospital interventions	CGA	Patients ≥75 years admitted to hospital for any medical problem	Range 41–2352; all ≥75 years; 48–83% women	Hospital readmissions	CGA-based interventions that included home care components seem to be more likely to reduce hospital readmission
Mabire et al (2016)[50]	Hospital	Nurse-led discharge planning interventions	Discharge planning	Older inpatients aged ≥65 years discharged home from an acute care setting or a post-acute rehabilitation setting	Total 3964; mean 77 years; sex not reported	HRQoL; hospital readmissions; LoS	Evidence of a significant effect of nurse-led discharge planning intervention on increased LoS; no effect on HRQoL or hospital readmission, except that readmission was lower across studies conducted in the USA
Hickman et al (2015)[47]	Hospital (acute hospital, geriatric unit, orthopaedic, general medical, and surgical wards)	Multidisciplinary team interventions	Multidisciplinary teams	Aged ≥65 years acute care patients	Total 1558; all ≥65 years; sex not reported	Hospital readmissions; mortality; functional decline; ED attendance; LoS	Evidence of beneficial effects of tailored treatment underpinned with clear communication strategies on hospital readmission, ED attendance, mortality, and functional decline
Rezaei-Shahsavarloo et al (2020)[60]	Hospital (acute medical ward, surgical ward, and acute medical geriatric ward)	Hospital interventions	Multicomponent interventions (including CGA)	Patients ≥65 years admitted to hospital who remained overnight or were initially expected to remain overnight	Total 1009; range 73–85 years; 49·7% women	Frailty; hospital readmissions; mortality; patient satisfaction; LoS	Evidence of positive effects of acute elderly unit CGA interventions on physical frailty, hospital readmission, mortality, and patient satisfaction; a single study that used CGA demonstrated LoS was significantly higher in the intervention vs control group
Hughes et al (2019)[55]	Hospital (ED)	ED interventions	Multicomponent interventions	Aged ≥65 years admitted to hospital for acute care	Total 16 141; range 74–86 years; 59% women	HRQoL; ED re-attendance; functional status; patient experience; hospitalisation at ED index; hospitalisation after ED discharge	Evidence of a small positive effect on functional status coming from multicomponent ED interventions based on discharge planning plus case management, but no positive effects on HRQoL, patient experience, hospitalisation at or after the initial ED index visit, or ED return visit; two complex interventions (assessment, referral plus follow-up, and bridge design) and longer duration of follow-up were associated with decreased ED return visits and hospitalisation after the index ED visit

(Table 1 continues on next page)

	Complex interventions			Population		Outcomes examined	Key results
	Setting	Review description of included interventions	Categorisation of the interventions	Eligibility criteria	Sample size (n); age (years); sex (%)		
(Continued from previous page)							
Briggs et al (2022)[62]	Community (home, primary care practices, or other)	CGA	CGA	Aged ≥65 years (mean ≥70 years) living in the community and at risk of nursing home admission or defined as frail	Total 7893; mean ≥70 years; sex not reported	HRQoL; mortality; nursing home admissions; hospital admission; ED attendance; SAE; functional status	Evidence of potential decrease in risk of hospital admissions (median 14-month follow-up) from community CGA but little change in HRQoL (end of follow-up), little or no difference in mortality rates, functional status (end of follow-up), or nursing home admission (median 12-month follow-up), and uncertain evidence of effects on ED attendance; only two complex interventions examined SAE (falls) with no effect on the risk
Garrard et al (2020)[22]	Community (primary care practices)	CGA	CGA	Aged ≥65 years not defined by a specific health condition	Total 2140; mean range 78–81 years; 59–66% women	Hospital admission; mortality; medicines management; acceptability; cost-effectiveness	Evidence of the effects on hospital admission rates from community CGA showed mixed results; however, improved adherence to medication modifications was noted; no improvement in mortality or functional outcomes was established but interventions were widely accepted and potentially cost-effective
Panza et al (2018)[54]	Community (long-term care facilities including nursing homes, care homes, residential homes, and rehabilitation facilities)	CGA	CGA	Mean age >60 years supported in nursing homes, care homes, residential homes, and rehabilitation facilities	Sample size not reported; age not reported; sex not reported	Hospital admission; nursing home admissions; mortality; quality of care	Evidence of potentially positive effects of CGA on quality of care (to a lesser extent on nursing home admissions and mortality if conducted in LTCFs at 12-month follow-up), and hospital admissions for most older people with complex illness; CGA in LTCFs after acute hospitalisation helped to select appropriate care pathways for different patient groups
De Almeida Mello et al (2015)[46]	Community (home)	Home care CGA interventions	CGA	Older people	Range 85–24 724; all >60 years; ≥57·4% women	Functional status; hospital admission; LoS	Evidence of positive effects of CGA alongside case management on reduced hospital admissions, LoS, and potentially on functioning
Stokes et al (2015)[14]	Community (primary care practices)	Case management	Case management	Adults ≥18 years with long-term conditions	Range 54–3432; mean 76 years; 0–77% women	Mortality; health-care use; patient satisfaction; self-assessed health; total cost of care	No evidence of beneficial effects of case management on total care cost, mortality, and utilisation of primary and non-specialist or secondary care; a very small effect favouring case management was found for self-reported health status in the short term, but a strong effect for patient satisfaction in the short terms and long terms; evidence of an increased effectiveness of case management when delivered by a multidisciplinary team involving a social worker
You et al (2012)[44]	Community (aged care setting)	Case management	Case management	Community-dwelling frail older people	Range 60–8095; all ≥65 years; sex not reported	Mortality; physical function; cognitive function; unmet service needs; psychological wellbeing; patient satisfaction; carer satisfaction; carer wellbeing	Some evidence of positive effects of case management on psychological health and wellbeing and unmet service needs; inconsistent results regarding physical or cognitive function and carer stress or burden; limited evidence of effects on the other patient and carer outcomes
Lupari et al (2011)[43]	Community (home)	Nurse-led case management	Case management	Community-dwelling older people ≥65 years with multiple chronic conditions	Total 8783*; all ≥65 years; sex not reported	Hospital admission; patient satisfaction; LoS; caregiver burden; cost-effectiveness	No evidence of beneficial effects of case management interventions on hospital admission, LoS, or costs; a positive effect on the patient, the carer, and the health-care staff (GPs) from service evaluation studies only
							(Table 1 continues on next page)

Complex interventions			Population		Outcomes examined	Key results
Setting	Review description of included interventions	Categorisation of the interventions	Eligibility criteria	Sample size (n); age (years); sex (%)		
(Continued from previous page)						
Barbato et al (2022)[63] Community	Goal-oriented care	Goal-oriented care	Aged ≥18 years with ≥2 chronic conditions (range 2·1–5·0)	Total 4818; working age or older people; more women than men	HRQoL; hospital admission; caregiver burden; patient satisfaction	Evidence of small positive effects on patient satisfaction and caregiver burden from goal-oriented care, but no effects on HRQoL and hospital admission
Vermunt et al (2017)[51] Community (primary care practices and community mental health centre)	Collaborative goal setting	Goal-oriented care	Mean age ≥65 years with chronic diseases or multimorbidity	Range 42–1921; all ≥65 years; sex not reported	Health outcomes; quality of care (patient and carer)	Evidence of positive effects of multicomponent interventions integrating collaborative goal setting on the application of goal setting, and quality of care including rate of complete advance directives and the inclusion of problems, and goals and actions in the individualised care plans
John et al (2020)[59] Community (primary care practices)	PCMH models	PCMH	Patients ≥18 years with ≥1 chronic disease (55% of studies reported on multimorbidity)	Total 60 617; mean range 30–83 years; more women than men	HRQoL; depression; depression remission; self-management; hospital admission; cost-effectiveness	Evidence of positive effects of PCMH care on depression and depression remission, HRQoL, self-management outcomes, and hospital admission; PCMH care is superior to standard GP care in chronic disease management, but not cost-effective when compared to standard care
Berntsen et al (2019)[56] Community (primary care practices)	Community-based whole system complex transformations	PCMH	Aged >60 years described as frail, multimorbid, or having complex needs	Sample size not reported; age not reported; sex not reported	HRQoL; patient satisfaction; physical function; hospital admission; mortality	Evidence of beneficial effects on hospital admissions only from the person-centred medical home veterans' health intervention and home-care visit frequency from the guided care intervention
Deschodt et al (2020)[58] Community	Nurse-led integrated care model	Integrated care	Aged ≥65 years (mean ≥75 years) living at home or in a service flat	Total 13 766; mean range 72–85 years; sex not reported	HRQoL; ADL; hospital admission; ED attendance; nursing home admission; mortality	No evidence of beneficial effects of multidisciplinary team care, high risk screening, tailored holistic assessment, and an individualised care plan on any outcomes of interest
Looman et al (2019)[53] Community	Integrated care models	Integrated care	Community-dwelling frail older people	Range 36–3689; all ≥65 years; sex not reported	ADL and IADL; physical function; mortality; social support; vitality; institutionalisation desire; frailty; caregiver outcomes; health-care use; cost-effectiveness	Weak evidence of benefit from integrated care on frailty, desire for institutionalisation, wellbeing, life satisfaction, and care process outcome; mixed evidence for effects on health care use; limited evidence for cost-effectiveness
Smith et al (2021)[10] Community (primary care practices or other)	Health interventions	Multicomponent interventions	Adults with multiple chronic conditions (mean 3·0–12·7)	Total 4753; mean range 50–81 years, not reported	HRQoL; mental health; clinical outcomes; self-efficacy; health behaviours; health care use; medicine outcomes; quality of health care; patient satisfaction	Evidence of little or no difference in HRQoL, mental health, clinical outcomes, and other psychosocial outcomes from community health interventions; multicomponent interventions based on care coordination and self-management support improved provider behaviour, but had mixed effects on patient satisfaction and little or no effects on the number of medicines or medication adherence
Leithaus et al (2022)[64] Community and hospital (transition from hospital to community)	Transition care models	Transitional care	Aged ≥65 years with a frailty profile (decline in ≥1 functional domain or ≥1 chronic disease)	Range 107–8936; mean range 75–83 years; sex not reported	Hospital readmissions; mortality; ED attendance; intervention costs; LoS	Evidence of positive effects of transitional care models based on a small-sized care team, intensive follow-up, shared decision making, and informal caregiver involvement on hospital readmissions and ED attendance only
Chen et al (2017)[12] Community and hospital (transition from hospital to community)	CoC	Transitional care	Aged ≥65 years with chronic diseases	Total 1394; range 70-79 years; 53% women	HRQoL	Evidence of positive effects of multicomponent CoC on multiple domains of HRQoL, ie, physical function, physical role function, general health, social function, and vitality
						(Table 1 continues on next page)

Complex interventions			Population		Outcomes examined	Key results
Setting	Review description of included interventions	Categorisation of the interventions	Eligibility criteria	Sample size (n); age (years); sex (%)		
(Continued from previous page)						
Lowthian et al (2015)[48]	Community and hospital (ED to home)	Transition strategies	Transitional care	Aged ≥65 years discharged home from ED	Range 345–14 658; all ≥65 years; sex not reported	ED re-attendance; hospital admission; mortality	Evidence of no clinical benefit from transition care models for ED re-attendance (30-day follow-up), hospital admission (30-day follow-up), and mortality (18-month follow-up)
Hopman et al (2016)[49]	Community and hospital (home care organisation, community centre, primary care practices, hospital, specialised clinic, and managed care organisation)	Comprehensive care programme	Comprehensive care	Patients with multimorbidity or frailty	Range 47–1682; age not reported; sex not reported	HRQoL; patient satisfaction; depression; functional status; health care use; mortality; cost; caregiver outcomes	Evidence of some effects of CCP on patient satisfaction, depressive symptoms, HRQoL, and functional status; no evidence of effects on the number of primary care or GP visits or health-care costs or mortality; insufficient evidence for effects on the use of inpatient care, and no evidence of beneficial effects on caregiver-related outcomes
de Bruin et al (2012)[45]	Community and hospital	Comprehensive care programmes	Comprehensive care	Adults aged ≥18 years with multiple chronic conditions	Range 25–65 132; all >50 years; sex not reported	HRQoL; health care use; health-care cost; health behaviour; quality of care; patient satisfaction; caregiver satisfaction; mortality; cognitive functioning; depressive symptoms; functional status	Moderate evidence of beneficial effects of comprehensive care on inpatient health care use and health-care costs, health behaviour of patients, perceived quality of care, and satisfaction of patients and caregivers; insufficient evidence for mental functioning, medication use, and outpatient health care use and health-care costs; no evidence of an effect on cognitive functioning, depressive symptoms, functional status, mortality, HRQoL in terms of physical functioning, and caregiver burden
Chen et al (2021)[61]	Community and hospital	CGA	CGA	Community-dwelling older people	Total 13 261; mean range 72–86 years; sex not reported	HRQoL; caregiver burden; LoS	Evidence of improved HRQoL for older people; reduced caregiver burden from CGA with no effect on LoS; on the basis of subgroup analyses, CGA was superior to usual care for HRQoL only in the subgroup aged >80 years and at ≤3 month follow-up; deference in established results based on HRQoL measures used (EQ-5D vs short form survey-36)
van Rijckevorsel-Scheele et al (2019)[57]	Community and hospital	Health interventions	Multidisciplinary teams	Frail older people	Sample size not reported; range 60–70 years; sex not reported	HRQoL	Evidence of effects of multidisciplinary treatment programmes with geriatric evaluation on HRQoL was inconsistent, with most of interventions reporting no differences between the intervention and control groups; patchy evidence of effects on some sub-domains of HRQoL (eg, physical function, mental health, energy, general health, and bodily pain)

ADL=activities of daily living. CCP=comprehensive care programme. CGA=comprehensive geriatric assessment. CoC=continuity of care. ED=emergency department. GP=general practitioner. HRQoL=health-related quality of life. IADL=instrumental activities of daily living. LoS=length of hospital stay. LTCFs=long-term care facilities. PCMH=patient-centred medical home. SAE=serious adverse events. *Includes samples from eligible study designs only.

Table 1: Summary characteristics of included systematic reviews

and hospital scored high on quality, with three reviews (43%) reporting only on RCTs.[12,57,61]

Intervention components by setting

Eight (27·6%) of 29 reviews reported on four types of hospital HABIs (CGA, discharge planning, multidisciplinary teams [MDTs], and multicomponent interventions; table 2). Almost all reviews reported that the included interventions involved holistic needs assessment, continuity of care, discharge planning, and MDT consultations (appendix p 14). Shared decision making[20,50] and self-management support[41,50] was reported in three reviews, with only one reporting on informal caregiver involvement as a component.[50]

14 reviews reported on six types of community HABIs (CGA, case management, goal-oriented care, the patient-centred medical home [PCMH], integrated care, and multicomponent interventions). Similar to hospital HABIs, holistic needs assessment, continuity of care, and MDT consultations were reported in most of the reviews, as were self-management support, care coordination tailored to needs, and named coordinators or case managers (appendix p 15). Additionally, seven community-based reviews[14,43,44,46,51,53,58] reported the use of informal caregiver involvement, and six[14,46,53,54,56,58] mentioned the use of individual risk prediction tools for care planning.

Seven reviews reported on four types of community and hospital HABIs (transitional care models, comprehensive care models, CGA, and MDTs). Two reviews[45,49] made no explicit reference to holistic needs assessment, but specified individualised treatment and care plan development. Core components, such as care coordination tailored to needs, MDT consultations, named coordinators or case managers and staff training, and knowledge and expertise were commonly reported as components (appendix p 16).

Effects of interventions by outcome

HRQoL was examined in 14 reviews. Of the eight meta-analyses (appendix pp 17–18), only three found statistically significant positive effects of which one[59] focused on community HABIs and the other two[12,61] on both community and hospital HABIs. A meta-analysis of six community CGA interventions including 2188 older patients with frailty showed little change in HRQoL at the end of follow-up (SMD 0·10; 95% CI 0–0·21), with very low certainty of evidence.[62] 22 interventions evaluating the effectiveness of a PCMH in 15 175 patients with long-term conditions aged 18 years and older showed improvements in HRQoL compared with standard care (SMD 0·10, 95% CI 0·04–0·15), with moderate certainty of evidence.[59] Positive changes in multiple domains of HRQoL were established from the meta-analysis of seven transitional care interventions, involving 1394 older people with long-term conditions[12] and eight CGA interventions targeted at community-dwelling older people with complex problems (SMD 0·12, 95% CI 0·03–0·21).[61] Reviews with narrative synthesis of findings consistently reported no evidence of effects from HABIs on HRQoL,[42,45,55–57,] except for one suggesting some positive effect (table 3).[49]

Physical and cognitive function were assessed in 12 reviews. Three meta-analyses[20,58,62] found no statistically significant effect of hospital CGA, community CGA, and nurse-led integrated care models on physical functioning of older patients with frailty or multiple long-term conditions (appendix pp 17–18). Other reviews with narrative descriptions of findings on functional status reported inconsistent results (table 3).[42,44–47,49,53,55,56,]

Seventeen reviews examined unscheduled health-care use including hospital admissions and readmissions, and emergency department attendance and re-attendance. Three reviews with narrative synthesis[10,49,53] and one with meta-analysis[14] that evaluated overall unscheduled health care use found no positive effects; one review did however report moderate evidence of beneficial effects from comprehensive care.[45] 12 reviews examined hospital admission. Of the six meta-analyses,[48,55,58,59,62,63] the two that evaluated effectiveness of community HABIs showed beneficial effects. In a meta-analysis of five PCMH interventions involving 5682 patients aged 18 years and older with one or more chronic diseases (mostly multimorbidity), the admission rates were significantly lower in the intervention group (OR 0·83; 95% CI 0·7–0·98), with moderate certainty of evidence.[59] A meta-analysis of six community CGAs in 1716 patients with frailty aged 65 years and older showed a significant reduction in admissions (RR 0·83, 95% CI 0·70–0·99), with low certainty of evidence.[62] The results from the remaining six narratively synthesised reviews were inconsistent.[22,43,46,52,54,56] Seven reviews examined the effects on hospital readmissions with conflicting results.[41,42,47,50,52,60,64] Of these, two meta-analyses[42,50] evaluating the effect of hospital HABIs (CGA and discharge planning) found no positive effects on readmission rates (table 3; appendix pp 17–18).

Emergency department attendance and re-attendance were evaluated in six reviews. Two meta-analyses found no effect of community CGA[62] and integrated care[58] on emergency department attendance, but two reviews with narrative synthesis found positive effects from hospital MDTs[47] and transitional care interventions.[64] Neither of the two meta-analyses that examined effects on emergency department re-attendance of transitional care[48] and hospital multicomponent interventions[55] found beneficial effects (table 3; appendix pp 17–18).

Five reviews evaluated the effects on nursing home admissions or institutionalisation. Of four meta-analyses,[20,42,58,62] only a Cochrane review[20] found a decreased likelihood of nursing home admission (RR 0·89; 95% CI 0·81–0·98) from 12 hospital CGA interventions including 4459 older people (aged ≥65 years) admitted to hospital for acute care (appendix pp 17–18). A narrative synthesis reported no effects of CGA interventions implemented in long-term care facilities on nursing home admission (table 3).[54]

16 reviews assessed the effects of interventions on mortality rates. None of the six meta-analyses examining mortality[14,20,42,48,58,62] established benefits (appendix pp 17–18). In narrative synthesis, two reviews focusing on hospital HABIs reported the effects on reduced mortality rates from hospital CGA[60] and hospital MDT interventions underpinned by a clear communication strategy.[47] No effects on mortality rates were reported from other narratively synthesised reviews in the community or in both settings (table 3).[22,44,45,49,53,54,56,64]

	Setting	Complex interventions	Service delivery						Leadership and governance				Workforce			Tools and information		
		1	2	3	4	5	6	7*	8	9	10	11*	12	13	14	15	16	17
Ellis et al (2017)[20]	Hospital	CGA	Y	Y	..	..	..	Y	..	Y	Y	..	Y	..	Y	Y	Y	..
Jay et al (2017)[52]	Hospital	CGA	Y	Y	..	..	..	..	Y	..	..	Y	Y	..	..	Y	..	Y
Conroy et al (2011)[42]	Hospital	CGA	Y	Y	..	..	..	..	..	..	..	..	Y	Y	..	..	..	..
Linertová et al (2011)[41]	Hospital	CGA	Y	Y	Y	Y	..	..	Y	..	..	Y	Y	..	..	..	..	..
Mabire et al (2016)[50]	Hospital	DP	Y	Y	Y	Y	Y	..	Y	Y	..	Y	Y	Y	..	..	..	..
Hickman et al (2015)[47]	Hospital	MDTs	Y	Y	..	..	..	Y	Y	Y	Y	Y	Y	..	..	..	..	..
Rezaei-Shahsavarloo et al (2020)[60]	Hospital	MCIs	Y	..	..	..	..	..	..	..	..	..	Y	..	..	..	..	..
Hughes et al (2019)[55]	Hospital	MCIs	Y	Y	..	Y	..	..	..	..	..	Y	..	Y	..	..	..	..
Briggs et al (2022)[62]	Community	CGA	Y	Y	..	..	..	..	..	..	..	..	Y	Y	..	..	..	..
Garrard et al (2020)[22]	Community	CGA	Y	Y	..	..	..	Y	Y	..	Y	..	Y	Y	..	..	..	..
Panza et al (2018)[54]	Community	CGA	Y	Y	..	..	..	Y	..	Y	..	..	..	..	..	Y	..	..
De Almeida Mello et al (2015)[46]	Community	CGA	Y	Y	..	Y	Y	Y	Y	Y	..	..	..	Y	..	Y	..	..
Stokes et al (2015)[14]	Community	CM	Y	Y	Y	Y	Y	..	Y	Y	..	..	Y	..	..	Y	..	..
You et al (2012)[44]	Community	CM	Y	Y	Y	Y	Y	..	Y	Y	..	..	..	..	..	..	..	..
Lupari et al (2011)[43]	Community	CM	Y	..	..	..	Y	..	Y	Y	..	..	..	Y	..	..	..	..
Barbato et al (2022)[63]	Community	GOC	Y	..	Y	..	..	Y	Y	..	Y	..	..	Y	..	..	..	..
Vermunt et al (2017)[51]	Community	GOC	Y	..	Y	Y	Y	Y	Y	Y	..	..	Y	Y	Y	..	..	..
John et al (2020)[59]	Community	PCMH	..	Y	Y	..	..	..	Y	Y	..	..	Y	..	..	..	..	..
Berntsen et al (2019)[56]	Community	PCMH	Y	..	Y	..	..	..	Y	..	..	..	Y	..	..	Y	..	..
Deschodt et al (2020)[58]	Community	IC	Y	Y	Y	Y	Y	..	Y	..	Y	..	Y	Y	Y	Y	Y	Y
Looman et al (2019)[53]	Community	IC	Y	Y	..	..	Y	..	Y	..	Y	..	Y	Y	Y	Y	..	Y
Smith et al (2021)[10]	Community	MCIs	Y	Y	Y	Y	..	..	Y	..	..	..	Y	Y	..	..	..	..
Leithaus et al (2022)[64]	Community and hospital	TC	Y	Y	Y	Y	Y	..	..	..	Y	..	Y	Y	Y	..	Y	Y
Chen et al (2017)[12]	Community and hospital	CoC or TC	Y	Y	..	..	..	Y	Y	Y	..	Y	Y	Y	Y	..	..	..
Lowthian et al (2015)[48]	Community and hospital	TC	Y	..	..	..	..	..	Y	..	..	Y	..	Y	..	..	..	..
Hopman et al (2016)[49]	Community and hospital	CC	..	Y	Y	..	..	..	Y	Y	Y	..	Y	Y	Y	..	Y	Y
de Bruin et al (2012)[65]	Community and hospital	CC	..	..	Y	..	..	..	..	Y	..	..	Y	Y	Y	..	Y	Y
Chen et al (2021)[61]	Community and hospital	CGA	Y	..	..	..	..	..	Y	..	..	..	Y	..	..	..	..	..
van Rijckevorsel-Scheele et al (2019)[57]	Community and hospital	MDTs	Y	Y	..	..	..	..	Y	..	..	Y	Y	..	..	..	..	..
Number of reviews (n=29)	Community and hospital	..	26	21	13	10	9	8	21	13	8	7	22	17	8	8	5	6

The SELFIE framework groups the components of integrated care by service delivery (proactive and person-centred care tailored to the individual and their environment), leadership and governance (provider–patient shared responsibility in the decision-making and care process resulting in individualised care plan), workforce (MDT work across health care, social care, and volunteer work for tailored care), technologies and medical products (user-friendly technologies to support care), information and research (ensuring information continuity and individual risk prediction tools facilitate proactive care), and financing of services by sorting these domains within the micro, meso, and macro levels. Given the lack of information on the concepts falling under technologies and medical products, information and research domains, and higher order levels, we collapsed these domains into one and synthesised the findings at the medication review only. For the components falling under the financing domain, see appendix (pp 14–16). 1=review intervention category. 2=holistic needs assessment or tailored care. 3=CoC. 4=self-management support. 5=treatment interaction or medication review. 6=informal caregiver involvement. 7=goal setting. 8=care coordination tailored to complexity. 9=individualised treatment and care planning. 10=shared decision making. 11=discharge planning. 12=multidisciplinary team consultations. 13=named coordinator or case manager. 14=staff training or knowledge and expertise. 15=individual risk prediction or assessment tools. 16=electronic medical records or patient portals. 17=protocols. MCIs=multicomponent interventions. MDT=multidisciplinary team. CoC=continuity of care. DP=discharge planning. GOC=goal-oriented care. IC=integrated care. MCIs=multicomponent interventions. MDT=multidisciplinary team. CGA=comprehensive geriatric assessment. CM=case management. PCMH=patient-centred medical home. TC=transitional care. Y=yes. *These core components are not part of the original SELFIE framework.

Table 2: Most common core components of holistic assessment-based interventions segregated by setting

Length of hospital stay (LoS) was assessed in nine reviews, with two meta-analyses.[50,61] A meta-analysis of nurse-led discharge planning interventions increased LoS (WMD 0·29, 95% CI 0·24–0·35) in older inpatients ready to be discharged home;[50] the meta-analysis of CGA interventions found no statistically significant effects.[61] Results from narratively described reviews of variable quality were mixed.[20,43,46,47,52,60,64]

Other secondary outcomes of interest including adverse events and geriatric syndromes (eg, frailty, falls, and delirium) were rarely assessed. In a meta-analysis of community CGA interventions involving 1380 older people with frailty, Briggs and colleagues[62] found no benefit to serious adverse events. Two reviews evaluated the effects of interventions on frailty.[53,60] Looman and colleagues[53] found some evidence that integrated care improved frailty status. A meta-analysis of four hospital multicomponent interventions targeted at patients aged 65 years and older who were admitted to hospital showed a significant improvement in frailty scores (effect size 0·35, 95% CI 0·07–0·63) and, in two CGA interventions, a statistically significant improvement in physical frailty.[60]

	Reviews with meta-analysis			Reviews with narrative synthesis			Overall conclusion	Overall quality of evidence
	Total number	Number reporting an effect	Number reporting no effect or uncertain	Total number	Number reporting an effect	Number reporting no effect or uncertain		
Hospital setting								
Health-related quality of life	1	0	1	2	0	2	Little or no effect	High
Functional status	1	0	1	3	2	1	Little or no effect	Low
Hospital admission	1	0	1	1	1	0	Little or no effect	Low
Hospital readmissions	2	0	2	4	3	1	Little or no effect	Low
ED attendance	-	-	-	1	1	0	Positive effect	Low
ED re-attendance	1	0	1	-	-	-	Little or no effect	High
Nursing home admission	2	1	1	-	-	-	Positive effect	High
Living at home	1	1	0	-	-	-	Positive effect	High
Mortality	2	0	2	2	2	0	Little or no effect	Low
Alive at home	1	1	0	-	-	-	Positive effect	High
Length of hospital stay	1	1	0	4	0	4	Little or no effect	Low
Community setting								
Health-related quality of life	5	1	4	1	0	1	Little or no effect	Low
Functional status	2	0	2	4	1	3	Little or no effect	Low
Overall health-care use	1	0	1	2	0	2	Little or no effect	High
Hospital admission	4	2	2	5	3	2	Little or no effect	Low
ED attendance	2	0	2	-	-	-	Little or no effect	High
Nursing home admission	2	0	2	1	0	1	Little or no effect	High
Mortality	3	0	3	5	0	5	Little or no effect	High
Length of hospital stay	-	-	-	2	1	1	Little or no effect	Low
Community and hospital settings								
Health-related quality of life	2	2	0	3	1	2	Little or no effect	Low
Functional status	-	-	-	2	1	1	Little or no effect	Low
Overall health-care use	-	-	-	2	1	1	Little or no effect	Low
Hospital admission	1	0	1	-	-	-	Little or no effect	Low
Hospital readmissions	-	-	-	1	1	0	Positive effect	Low
ED attendance	-	-	-	1	1	0	Positive effect	Low
ED re-attendance	1	0	1	-	-	-	Little or no effect	Low
Mortality	1	0	1	3	0	3	Little or no effect	High
Length of hospital stay	1	0	1	1	0	1	Little or no effect	High

The overall quality of combined evidence for each outcome was assessed using GRADE principles adapted for umbrella reviews. The quality of evidence was deemed high if there were one or more high-quality systematic reviews that were based on at least two high-quality primary studies with consistent results. The quality of evidence was deemed moderate if there were one or more high-quality or moderate-quality systematic reviews based on at least two primary studies of moderate quality with consistent results or one high-quality primary study. The quality of evidence was deemed low if there were one or more systematic reviews of variable quality based on primary studies of moderate quality or inconsistent results in the reviews or inconsistent results in primary studies. In assessing the direction of effects, we were guided by the quality and consistency of evidence reported by systematic reviews. Outcomes for which no evidence was available are not included in the table. ED=emergency department.

Table 3: Summary of findings across all systematic reviews for key outcomes and quality of combined evidence

Overall summary

Findings from five meta-analyses of hospital HABIs suggested that CGA had a beneficial effect on nursing home admissions, keeping patients alive and in their homes,[20] and nurse discharge planning had statistically significant positive effects on LoS.[50] These meta-analyses found no effects on HRQoL, mortality, functioning, hospital admissions and readmissions, and emergency department re-attendance (appendix p 19). Narrative syntheses of hospital HABIs suggested that CGA was effective in reducing physical frailty, hospital admission and re-admissions, and mortality.[41,52,60] Hospital MDT interventions were beneficial for hospital readmissions, emergency department attendance, functioning, and mortality,[47] whereas multicomponent interventions had positive effects on reducing functional decline.[55] Hospital HABIs had no effect on LoS[20,47,52] and hospital readmissions.[52] The overall evidence of effectiveness of hospital HABIs in relation to the same outcomes was often inconsistent, and the combined quality of evidence was low. There was however, high-quality evidence that hospital HABIs have no effect on HRQoL and emergency department re-attendance but might be beneficial for reducing nursing home admissions and for keeping patients with frailty alive and in their homes (table 3).

Findings from six meta-analyses of community HABIs suggested that CGA had beneficial effects on hospital admissions,[62] and that PCMH benefited HRQoL, mental health, hospital admissions, and self-management.[59] Case management was effective in improving self-assessed health and patient satisfaction,[14] and goal-oriented care for improving patient satisfaction.[63] These meta-analyses consistently found no beneficial effects of community HABIs on mortality, functioning, health-care utilisation, emergency department attendance, and nursing home admissions, but inconsistent effects on HRQoL and hospital admissions (appendix p 19). Narrative syntheses found that community CGA was beneficial for hospital admissions, LoS, adherence to medication, functioning, and quality of care.[22,46,54] Some positive effects were found on mental health from case management,[44] hospital admissions from PCMH,[56] and wellbeing, frailty, and quality of care from integrated care.[53] The overall evidence of effectiveness of community HABIs in relation to the same outcomes was largely inconsistent and low in quality, except for no benefits of community HABIs on overall health care use, emergency department attendance, nursing home admissions, and mortality (table 3).

Results from three meta-analyses of community and hospital HABIs suggested that transitional care had positive effects on HRQoL[12] and that CGA had a positive effect on HRQoL and caregiver burden.[61] These meta-analyses found no effects on mortality, hospital admissions, emergency department re-attendance, and LoS (appendix p 19). Based on narrative syntheses, transitional care had beneficial effects on hospital readmissions and emergency department attendance,[64] whereas comprehensive care had a positive effect on mental health, HRQoL, functioning, health care use, and quality of care.[45,49] No beneficial effects were found from comprehensive care and MDT interventions on functioning, mental health, mortality, and HRQoL.[45,57] Overall, there was sparse evidence of the effectiveness of community and hospital HABIs in relation to the same outcomes. The quality of combined evidence was low, except for no benefit from these interventions on mortality and LoS (table 3).

Discussion

Systematic reviews included in this Review largely examined studies targeting older people using various markers of complexity or severity to define eligibility. Limited research targeted younger people with similar vulnerabilities due to multimorbidity.[65] We observed considerable overlap in the core components between interventions with different names, but also substantial heterogeneity in components within the same intervention type and between intervention types. Across all settings, the reported intervention components were predominately from the SELFIE framework domains of service delivery (holistic needs assessment, continuity of care, and self-management support), leadership and governance (care coordination, individual treatment and care planning, and shared decision making), and workforce (MDTs and named coordinators and case managers). Core components in the domains of tools and information (use of assistive technology and e-health tools), and financial incentives and reimbursement were rare.

We found evidence that CGA delivered in an acute hospital setting increased the likelihood of older people with frailty being alive and in their own homes at 3–12 months follow-up.[20] Consistent with conclusions made by Veronese and colleagues,[23] hospital CGA decreased the likelihood of nursing home admissions, which is an important finding given the 3–4 times increased risk of unplanned nursing home admissions in people with frailty following acute hospitalisation.[66] Nurse-led discharge planning increased LoS in discharged older inpatients, with no effect on HRQoL or readmissions.[50] Overall, we found consistent evidence of no benefit of hospital HABIs on HRQoL and emergency department re-attendance.

There was some evidence of the effectiveness of community CGA in reducing hospital admissions in older people with frailty.[62] There was also evidence of benefit from PCMH interventions targeted at people with long-term conditions on HRQoL, mental health, self-management, and hospital admissions.[59] This is consistent with previous studies suggesting that PCMH has a positive effect on patient biomedical outcomes, HRQoL, and service outcomes compared with usual

primary care.[67,68] Overall, we found consistent evidence of no benefit from community HABIs on overall health care use, emergency department attendance, nursing home admissions, and mortality.

For interventions spanning hospitals and communities, there was some evidence that transitional care models have positive effects on HRQoL of people with long-term conditions,[12] but no effect on hospital admissions and emergency department re-attendance.[48] This contradicts another review's conclusions suggesting that discharge planning followed by post-discharge support for hospital inpatients is effective in reducing hospital use.[69] There was further evidence that CGA has a beneficial effect on HRQoL in older people (aged >80 years), and on caregiver burden.[61]

Strengths of the study include the use of a robust search strategy, double screening of retrieved evidence, and robust quality appraisal. To account for the considerable overlap in complex intervention components irrespective of how interventions are labelled, we deliberately chose to include reviews of any intervention type with a holistic assessment at their core. However, a limitation is the difficulty of accurately mapping complex intervention components and delivery modes (eg, core team, complexity, intensity, follow-ups, and if these include any post-intervention strategies) because interventions are highly heterogeneous and we were reliant on what individual studies and the included reviews reported. Additional heterogeneity arises from the inclusion of reviews reporting on complex interventions conducted in various clinical contexts. Most of the research literature focused on interventions in older adults, with only five included reviews targeting adults aged 18 years and older. The reviews provided no segregation of findings on the basis of participant age (or age categories), which is an added source of heterogeneity. A further limitation is that the unit of analysis was the systematic review with potential overlap between reviews in the individual trials examined. Although we carefully addressed overlap by removing highly overlapping reviews,[29,30] some residual overlap was present.

Implications for practice, policy, and further research

This umbrella review helps fill the evidence gap on the effectiveness of HABIs in adults that have multiple long-term conditions and frailty identified under the UK NICE Multimorbidity Guideline.[2,28] The most convincing evidence of effectiveness was for CGA and PCMH on a range of outcomes, but no good evidence was found for the effectiveness of HABIs in general. CGA is standard in geriatric practice and commonly implemented for inpatients. However, CGA is rarely available in non-geriatric hospital care or in the community, partly because it is resource intensive.[28] A PCMH integrates multidisciplinary working with community resources to facilitate shared decision making for patient-identified priorities, with improvements in communication and management continuity. The heterogeneity of interventions examined under the broad terms CGA and PCMH means no simple solution exists for any health and social care system to implement. In practice, we believe that improving care for people with multiple long-term conditions and frailty requires deploying core intervention components (holistic assessment, MDT consultations, continuity of care, care coordination tailored to complexity, individualised treatment and self-management support, and medication review) and examining other components (shared decision making and informal caregiver involvement in care planning, goal setting, staff training, and the use of individual risk prediction tools) for relevance to particular contexts. Other key issues for consideration include context-sensitive methods to identify people with multiple long-term conditions and frailty who should receive the intervention, defining roles and responsibilities of MDT members, and deliberation if rarely used components (eg, financial incentives) are relevant to a particular context. Key barriers to implementing these approaches more widely include high workload, professional time constraints, perverse incentives of payment systems, and poorly integrated computer systems.[67]

There are several implications for research. Although much has been published on the need to open the black box of complex interventions,[70] reviews examined in this work reported challenges in identifying core components of included interventions, with even less clarity on the nature of the usual care comparator. We further observed the inclusion of non-experimental or weak study designs in some reviews. Improved reporting of intervention components and the nature of standard care is required to better interpret which combinations of components are effective in different contexts.[71] Stronger endorsement of the Criteria for Reporting the Development and Evaluation of Complex Interventions in Healthcare[72] and use of RCTs or other strong study designs will improve clarity, transparency, interpretation, and the quality of future implementation research and evidence synthesis in this area. Most of the evidence synthesised was from high-income countries, and there is a need for research in middle-income and low-income countries that are also grappling with the challenges of ageing populations. Furthermore, most of the reviews focused on interventions tested in older adults with frailty, underlying a need for further implementation research targeting younger adults with multiple long-term conditions. Additionally, there was considerable variation in how studies identified at-risk populations to deliver interventions for, and there is a need for research to examine the value of more structured and explicit prediction tools in this context.[73] Finally, the JBI methodology for umbrella reviews[25] provides no standard guidance on how to manage overlap and further development of this methodology is needed.

Conclusion

The evidence for the effectiveness of HABIs with highly overlapping core components was largely inconsistent across types of intervention, settings, and outcomes. We found no evidence of a benefit from hospital HABIs on HRQoL and emergency department re-attendance, and no evidence of a benefit from community HABIs on overall health care use rates, emergency department attendance, nursing home admissions, and mortality. The best evidence of effectiveness was for hospital CGA on nursing home admissions, keeping patients alive and living in their own homes, and some evidence of effectiveness was found for community CGA on hospital admission, and for CGA spanning community and hospital settings on HRQoL. PCMH had beneficial effects on HRQoL, mental health, self-management, and hospital admissions. Heterogeneity in HABIs design means there is no simple solution to follow, and health and social care improvers need to carefully consider their own context when designing similar interventions.

References

1 Palmer K, Carfi A, Angioletti C, et al. A methodological approach for implementing an integrated multimorbidity care model: results from the pre-implementation stage of joint action CHRODIS-PLUS. *Int J Environ Res Public Health* 2019; **16:** 5044.

2 Farmer C, Fenu E, O'Flynn N, Guthrie B. Clinical assessment and management of multimorbidity: summary of NICE guidance. *BMJ* 2016; **354:** i4843.

3 Ho IS-S, Azcoaga-Lorenzo A, Akbari A, et al. Variation in the estimated prevalence of multimorbidity: systematic review and meta-analysis of 193 international studies. *BMJ Open* 2022; **12:** e057017.

4 Soley-Bori M, Ashworth M, Bisquera A, et al. Impact of multimorbidity on healthcare costs and utilisation: a systematic review of the UK literature. *Br J Gen Pract* 2020; **71:** e39–46.

5 Vetrano DL, Palmer K, Marengoni A, et al. Frailty and multimorbidity: a systematic review and meta-analysis. *J Gerontol A Biol Sci Med Sci* 2019; **74:** 659–66.

6 Villacampa-Fernández P, Navarro-Pardo E, Tarín JJ, Cano A. Frailty and multimorbidity: two related yet different concepts. *Maturitas* 2017; **95:** 31–35.

7 Carrasco-Ribelles LA, Roso-Llorach A, Cabrera-Bean M, et al. Dynamics of multimorbidity and frailty, and their contribution to mortality, nursing home and home care need: a primary care cohort of 1 456 052 ageing people. *EClinicalMedicine* 2022; **52:** 101610.

8 Hubbard RE, Peel NM, Samanta M, Gray LC, Mitnitski A, Rockwood K. Frailty status at admission to hospital predicts multiple adverse outcomes. *Age Ageing* 2017; **46:** 801–06.

9 Hao Q, Zhou L, Dong B, Yang M, Dong B, Weil Y. The role of frailty in predicting mortality and readmission in older adults in acute care wards: a prospective study. *Sci Rep* 2019; **9:** 1207.

10 Smith SM, Wallace E, Clyne B, Boland F, Fortin M. Interventions for improving outcomes in patients with multimorbidity in primary care and community setting: a systematic review. *Syst Rev* 2021; **10:** 271.

11 The Academy of Medical Sciences. Multimorbidity: a priority for global health research. April, 2018. https://acmedsci.ac.uk/file-download/82222577 (accessed Sept 5, 2022).

12 Chen HM, Tu YH, Chen CM. Effect of continuity of care on quality of life in older adults with chronic diseases: a meta-analysis. *Clin Nurs Res* 2017; **26:** 266–84.

13 Smith SM, Wallace E, O'Dowd T, Fortin M. Interventions for improving outcomes in patients with multimorbidity in primary care and community settings. *Cochrane Database Syst Rev* 2016; **3:** CD006560.

14 Stokes J, Panagioti M, Alam R, Checkland K, Cheraghi-Sohi S, Bower P. Effectiveness of case management for 'at risk' patients in primary care: a systematic review and meta-analysis. *PLoS One* 2015; **10:** e0132340.

15 Ellis G, Whitehead MA, Robinson D, O'Neill D, Langhorne P. Comprehensive geriatric assessment for older adults admitted to hospital: meta-analysis of randomised controlled trials. *BMJ* 2011; **343:** d6553.

16 Salisbury C, Man M-S, Bower P, et al. Management of multimorbidity using a patient-centred care model: a pragmatic cluster-randomised trial of the 3D approach. *Lancet* 2018; **392:** 41–50.

17 Smith SM, Soubhi H, Fortin M, Hudon C, O'Dowd T. Managing patients with multimorbidity: systematic review of interventions in primary care and community settings. *BMJ* 2012; **345:** e5205.

18 Mills IJ. A person-centred approach to holistic assessment. *Prim Dent J* 2017; **6:** 18–23.

19 Stuck AE, Iliffe S. Comprehensive geriatric assessment for older adults. *BMJ* 2011; **343:** d6799.

20 Ellis G, Gardner M, Tsiachristas A, et al. Comprehensive geriatric assessment for older adults admitted to hospital. *Cochrane Database of Syst Rev* 2017; **6:** CD006211.

21 Sum G, Nicholas SO, Nai ZL, Ding YY, Tan WS. Health outcomes and implementation barriers and facilitators of comprehensive geriatric assessment in community settings: a systematic integrative review [PROSPERO registration no.: CRD42021229953]. *BMC Geriatr* 2022; **22:** 379.

22 Garrard JW, Cox NJ, Dodds RM, Roberts HC, Sayer AA. Comprehensive geriatric assessment in primary care: a systematic review. *Aging Clin Exp Res* 2020; **32:** 197–205.

23 Veronese N, Custodero C, Demurtas J, et al. Comprehensive geriatric assessment in older people: an umbrella review of health outcomes. *Age Ageing* 2022; **51:** afac104.

24 Stoop A, Lette M, van Gils PF, Nijpels G, Baan CA, de Bruin SR. Comprehensive geriatric assessments in integrated care programs for older people living at home: a scoping review. *Health Soc Care Community* 2019; **27:** e549–66.

25 Aromataris EFR, Godfrey C, Holly C, Khalil H, Tungpunkom P. Chapter 10: umbrella reviews. 2020. https://synthesismanual.jbi.global (accessed Sept 5, 2022).

26 Gates M, Gates A, Pieper D, et al. Reporting guideline for overviews of reviews of healthcare interventions: development of the PRIOR statement. *BMJ* 2022; **378:** e070849.

27 Arakelyan S, Lone N, Anand A, et al. Effectiveness of holistic assessment-based interventions in improving outcomes in adults with multiple long-term conditions and/or frailty: an umbrella review protocol. *JBI Evid Synth* 2023; **21:** 1863–78.

28 National Institute for Health and Care Excellence. Multimorbidity: clinical assessment and management. NICE guideline [NG56]. Sept 21, 2016. https://www.nice.org.uk/guidance/ng56 (accessed Sept 10, 2022).

29   Pieper D, Antoine S-L, Mathes T, Neugebauer EA, Eikermann M. Systematic review finds overlapping reviews were not mentioned in every other overview. *J Clin Epidemiol* 2014; **67:** 368–75.

30   Hennessy EA, Johnson BT. Examining overlap of included studies in meta-reviews: guidance for using the corrected covered area index. *Res Synth Methods* 2020; **11:** 134–45.

31   Leijten FR, Struckmann V, van Ginneken E, et al. The SELFIE framework for integrated care for multi-morbidity: development and description. *Health Policy* 2018; **122:** 12–22.

32   Guyatt G, Oxman AD, Sultan S, et al. GRADE guidelines: 11. Making an overall rating of confidence in effect estimates for a single outcome and for all outcomes. *J Clin Epidemiol* 2013; **66:** 151–57.

33   Graf CE, Zekry D, Giannelli S, Michel J-P, Chevalley T. Efficiency and applicability of comprehensive geriatric assessment in the emergency department: a systematic review. *Aging Clin Exp Res* 2011; **23:** 244–54.

34   Van Craen K, Braes T, Wellens N, et al. The effectiveness of inpatient geriatric evaluation and management units: a systematic review and meta-analysis. *J Am Geriatr Soc* 2010; **58:** 83–92.

35   Ellis G, Whitehead MA, O'Neill D, Langhorne P, Robinson D. Comprehensive geriatric assessment for older adults admitted to hospital. *Cochrane Database Syst Rev* 2011; **6:** CD006211.

36   Bakker FC, Robben SHM, Olde Rikkert MGM. Effects of hospital-wide interventions to improve care for frail older inpatients: a systematic review. *BMJ Qual Saf* 2011; **20:** 680–91.

37   Fox MT, Persaud M, Maimets I, et al. Effectiveness of acute geriatric unit care using acute care for elders components: a systematic review and meta-analysis. *J Am Geriatr Soc* 2012; **60:** 2237–45.

38   Deschodt M, Flamaing J, Haentjens P, Boonen S, Milisen K. Impact of geriatric consultation teams on clinical outcome in acute hospitals: a systematic review and meta-analysis. *BMC Med* 2013; **11:** 48.

39   Ekdahl AW, Sjöstrand F, Ehrenberg A, et al. Frailty and comprehensive geriatric assessment organized as CGA-ward or CGA-consult for older adult patients in the acute care setting: a systematic review and meta-analysis. *Eur Geriatr Med* 2015; **6:** 523–40.

40   O'Shaughnessy Í, Robinson K, O'Connor M, et al. Effectiveness of acute geriatric unit care on functional decline and process outcomes among older adults admitted to hospital with acute medical complaints: a protocol for a systematic review. *BMJ Open* 2021; **11:** e050524.

41   Linertová R, García-Pérez L, Vázquez-Díaz JR, Lorenzo-Riera A, Sarría-Santamera A. Interventions to reduce hospital readmissions in the elderly: in-hospital or home care. A systematic review. *J Eval Clin Pract* 2011; **17:** 1167–75.

42   Conroy SP, Stevens T, Parker SG, Gladman JR. A systematic review of comprehensive geriatric assessment to improve outcomes for frail older people being rapidly discharged from acute hospital: 'interface geriatrics'. *Age Ageing* 2011; **40:** 436–43.

43   Lupari M, Coates V, Adamson G, Crealey GE. 'We're just not getting it right' – how should we provide care to the older person with multi-morbid chronic conditions? *J Clin Nurs* 2011; **20:** 1225–35.

44   You EC, Dunt D, Doyle C, Hsueh A. Effects of case management in community aged care on client and carer outcomes: a systematic review of randomized trials and comparative observational studies. *BMC Health Serv Res* 2012; **12:** 395.

45   de Bruin SR, Versnel N, Lemmens LC, et al. Comprehensive care programs for patients with multiple chronic conditions: a systematic literature review. *Health Policy* 2012; **107:** 108–45.

46   De Almeida Mello J, Hermans K, Van Audenhove C, Macq J, Declercq A. Evaluations of home care interventions for frail older persons using the interRAI home care instrument: a systematic review of the literature. *J Am Med Dir Assoc* 2015; **16:** 173.e1–10.

47   Hickman LD, Phillips JL, Newton PJ, Halcomb EJ, Al Abed N, Davidson PM. Multidisciplinary team interventions to optimise health outcomes for older people in acute care settings: a systematic review. *Arch Gerontol Geriatr* 2015; **61:** 322–29.

48   Lowthian JA, McGinnes RA, Brand CA, Barker AL, Cameron PA. Discharging older patients from the emergency department: systematic review and meta-analysis. *Age Ageing* 2015; **44:** 761–70.

49   Hopman P, de Bruin SR, Forjaz MJ, et al. Effectiveness of comprehensive care programs for patients with multiple chronic conditions or frailty: a systematic literature review. *Health Policy* 2016; **120:** 818–32.

50   Mabire C, Dwyer A, Garnier A, Pellet J. Effectiveness of nursing discharge planning interventions on health-related outcomes in discharged elderly inpatients: a systematic review. *JBI Database Syst Rev Implement Reports* 2016; **14:** 217–60.

51   Vermunt NPCA, Harmsen M, Westert GP, Olde Rikkert MGM, Faber MJ. Collaborative goal setting with elderly patients with chronic disease or multimorbidity: a systematic review. *BMC Geriatr* 2017; **17:** 167.

52   Jay S, Whittaker P, Mcintosh J, Hadden N. Can consultant geriatrician led comprehensive geriatric assessment in the emergency department reduce hospital admission rates? A systematic review. *Age Ageing* 2017; **46:** 366–72.

53   Looman WM, Huijsman R, Fabbricotti. The (cost-)effectiveness of preventive, integrated care for community-dwelling frail older people: a systematic review. *Health Soc Care Community* 2019; **27:** 1–30.

54   Panza F, Solfrizzi V, Lozupone M, et al. An old challenge with new promises: a systematic review on comprehensive geriatric assessment in long-term care facilities. *Rejuvenation Res* 2018; **21:** 3–14.

55   Hughes JM, Freiermuth CE, Shepherd-Banigan M, et al. Emergency department interventions for older adults: a systematic review. *J Am Geriatr Soc* 2019; **67:** 1516–25.

56   Berntsen G, Strisland F, Malm-Nicolaisen K, Smaradottir B, Fensli R, Røhne M. The evidence base for an ideal care pathway for frail multimorbid elderly: combined scoping and systematic intervention review. *J Med Internet Res* 2019; **21:** e12517.

57   van Rijckevorsel-Scheele J, Willems RCWJ, Roelofs PDDM, Koppelaar E, Gobbens RJJ, Goumans MJBM. Effects of health care interventions on quality of life among frail elderly: a systematized review. *Clin Interv Aging* 2019; **14:** 643–58.

58   Deschodt M, Laurent G, Cornelissen L, et al. Core components and impact of nurse-led integrated care models for home-dwelling older people: a systematic review and meta-analysis. *Int J Nurs Stud* 2020; **105:** 103552.

59   John JR, Jani H, Peters K, Agho K, Tannous WK. The effectiveness of patient-centred medical home-based models of care versus standard primary care in chronic disease management: a systematic review and meta-analysis of randomised and non-randomised controlled trials. *Int J Environ Res Public Health* 2020; **17:** 6886.

60   Rezaei-Shahsavarloo Z, Atashzadeh-Shoorideh F, Gobbens RJJ, Ebadi A, Ghaedamini Harouni G. The impact of interventions on management of frailty in hospitalized frail older adults: a systematic review and meta-analysis. *BMC Geriatr* 2020; **20:** 526.

61   Chen Z, Ding Z, Chen C, et al. Effectiveness of comprehensive geriatric assessment intervention on quality of life, caregiver burden and length of hospital stay: a systematic review and meta-analysis of randomised controlled trials. *BMC Geriatr* 2021; **21:** 377.

62   Briggs R, McDonough A, Ellis G, Bennett K, O'Neill D, Robinson D. Comprehensive geriatric assessment for community-dwelling, high-risk, frail, older people. *Cochrane Database Syst Rev* 2022; **5:** CD012705.

63   Barbato A, D'Avanzo B, Cinquini M, et al. Effects of goal-oriented care for adults with multimorbidity: a systematic review and meta-analysis. *J Eval Clin Pract* 2022; **28:** 371–81.

64   Leithaus M, Beaulen A, de Vries E, et al. Integrated care components in transitional care models from hospital to home for frail older adults: a systematic review. *Int J Integr Care* 2022; **22:** 28.

65   Barnett K, Mercer SW, Norbury M, Watt G, Wyke S, Guthrie B. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. *Lancet* 2012; **380:** 37–43.

66   Pereira CB, Kanashiro AMK. Falls in older adults: a practical approach. *Arq Neuropsiquiatr* 2022; **80** (suppl 1): 313–23.

67   Jackson GL, Powers BJ, Chatterjee R, et al. The patient centered medical home. A systematic review. *Ann Intern Med* 2013; **158:** 169–78.

68   Friedberg MW, Schneider EC, Rosenthal MB, Volpp KG, Werner RM. Association between participation in a multipayer medical home intervention and changes in quality, utilization, and costs of care. *JAMA* 2014; **311:** 815–25.

69   Damery S, Flanagan S, Combes G. Does integrated care reduce hospital activity for patients with chronic diseases? An umbrella review of systematic reviews. *BMJ Open* 2016; **6:** e011952.

70 Skivington K, Matthews L, Simpson SA, et al. A new framework for developing and evaluating complex interventions: update of Medical Research Council guidance. *BMJ* 2021; **374:** n2061.

71 Hoffmann TC, Glasziou PP, Boutron I, et al. Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. *BMJ* 2014; **348:** g1687.

72 Möhler R, Köpke S, Meyer G. Criteria for Reporting the Development and Evaluation of Complex Interventions in healthcare: revised guideline (CReDECI 2). *Trials* 2015; **16:** 204.

73 Skou ST, Mair FS, Fortin M, et al. Multimorbidity. *Nat Rev Dis Primers* 2022; **8:** 48.