The effectiveness of Inter-professional working for older people living in the community: A systematic review

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ABSTRACT

Health and social care policy in the UK advocates inter-professional working (IPW) to support older people with complex and multiple needs. Whilst there is a growing understanding of what supports IPW, there is a lack of evidence linking IPW to explicit outcomes for older people living in the community. This review aimed to identify the models of IPW that provide the strongest evidence base for practice with community dwelling older people.

We searched electronic databases from 1 January 1990-31 March 2008. In December 2010 we updated the findings from relevant systematic reviews identified since 2008.

We selected papers describing interventions that involved IPW for community dwelling older people and randomised controlled trials (RCT) reporting user-relevant outcomes. Included studies were classified by IPW models (Case Management, Collaboration and Integrated Team) and assessed for risk of bias. We conducted a narrative synthesis of the evidence according to the type of care (interventions delivering acute, chronic, palliative and preventive care) identified within each model of IPW.

We retrieved 3211 records and included 41 RCTs which were mapped onto the IPW models: Overall, there is weak evidence of effectiveness and cost-effectiveness for IPW, although well-integrated and shared care models improved processes of care and have the potential to reduce hospital or nursing/care home use. Study quality varied considerably and high quality evaluations as well as observational studies are needed to identify the key components of

effective IPW in relation to user-defined outcomes. Differences in local contexts raise questions about the applicability of the findings and their implications for practice in the UK.

We need more information on the process of IPW and evaluations of the effectiveness of different configurations of health and social care professionals for the ongoing care of community dwelling older people.

Key words: Inter-professional working, older people, community dwelling, interventions, team work

What is known about this subject?

- There is policy commitment to closer working between professionals to improve health and social care but this is poorly understood at the user/patient level.
- There is imprecision in the language and terminology used to capture the process of inter-professional working
- There is a lack of evidence linking inter-professional working to explicit outcomes for older people.
- It is not clear how different contexts, systems, professionals, agencies, roles and services influence the effectiveness of inter-professional working

What this article adds

- The process of inter-professional working is poorly documented
- There is a lack of strong evidence of effectiveness and cost effectiveness for inter-professional working
- Integrated models of inter-professional working have the potential to improve processes of care and to reduce hospital use or long term care
- The role of case/care management as an inter-professional related intervention needs further research

INTRODUCTION

Inter-professional working (IPW) is advocated for older people with complex and multiple needs (DH 2005a, 2005b, 2006a, 2006b, 2010). Types of IPW vary according to context, intensity of need, workforce availability and pragmatism (Drennan *et al.* 2005a, West & Markiewicz 2004) but it is not clear how differences in contexts, systems, and the mix of professionals, agencies, roles and services influence IPW and patient outcomes for community dwelling older people (Eklund & Wilhelmson 2009, Zwarenstein *et al.* 2009). Research focusing on IPW (as opposed to education of and collaboration between professionals) has addressed professional co-location, integrated teams, shared assessment processes, shared records, patient/user-held records and use of quality improvement tools to develop collaborative working (Chew-Graham *et al.* 2007, Davey *et al.* 2005, Drennan *et al.* 2005b, Drennan *et al.* 2003, Goodman 2000, Goodman *et al.* 2007, Goodman *et al.* 2005, Goodman *et al.* 2003a, b, Iliffe & Drennan 2000, Iliffe *et al.* 2005, Manthorpe & Iliffe 2003).

There is extensive discussion of theoretical frameworks, pre-requisites, facilitators, barriers and processes for IPW (Dickinson 2006, Glendinning *et al.* 2003, 2004, Reeves *et al.* 2010a, West & Markiewicz 2004) but less about its effectiveness, or how it is experienced by older people and caregivers. In this paper we report the findings of a systematic review examining the effectiveness of IPW for community-dwelling older people with multiple health and social care needs.

OBJECTIVES

This review was part of a larger study (authors) and addressed the following questions:
- What types of IPW interventions are described in the literature?
- How is IPW organised?
- What are the outcomes of different models of IPW?

METHODS

The focus of the review was the process of IPW, which was defined as having one or more of the following features:
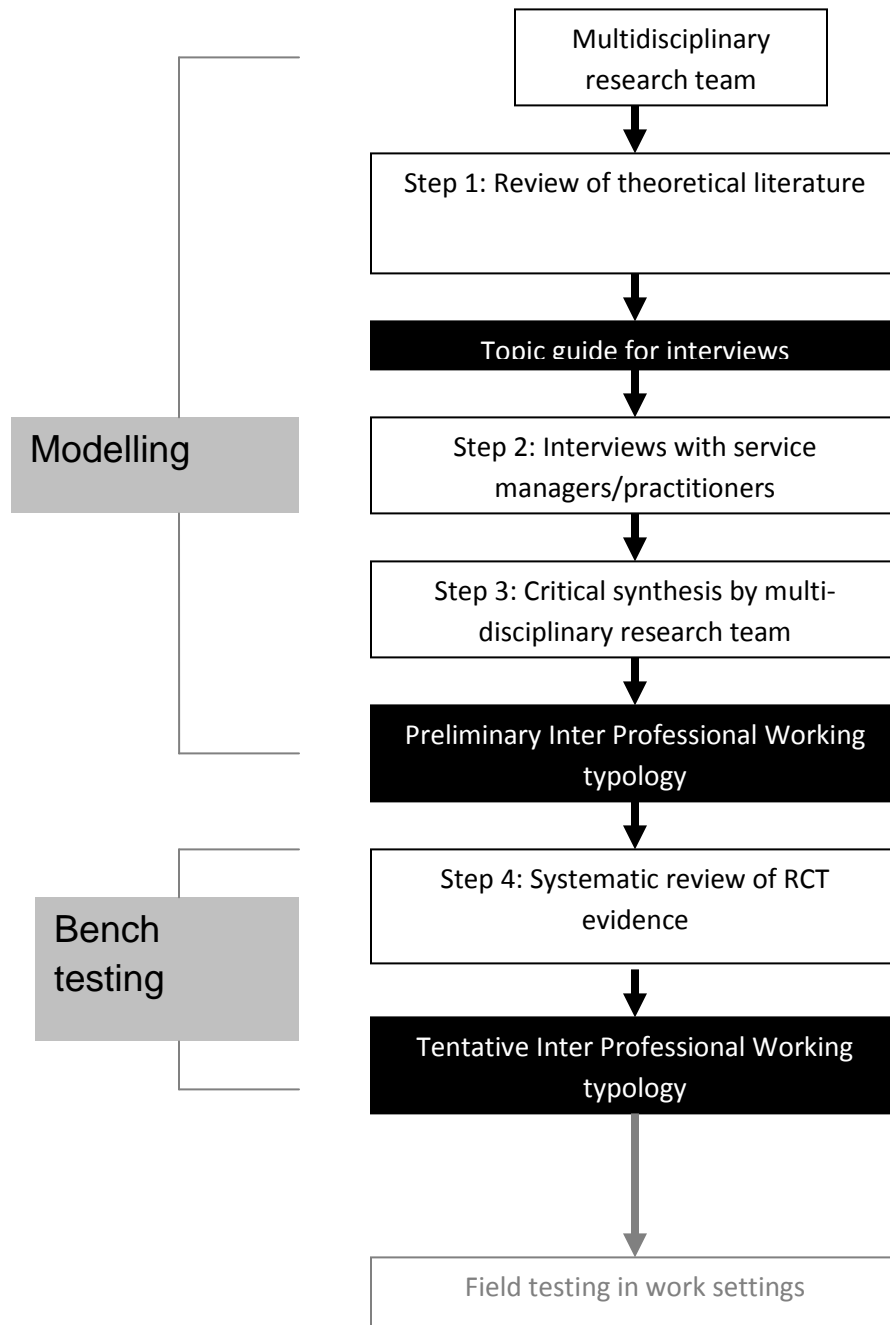
 1. A shared care plan that involved joint decision making by the inter-professional /multidisciplinary team
2. A shared protocol or documents (e.g. care pathways) that involved joint input from an inter-professional /multidisciplinary team
 3. Face to face team meetings or routine team communications about individuals' care plans.

This reflects the subsequent definition of inter-professional practice by Reeves *et al.* (2010a) as activities or procedures incorporated into regular practice to improve collaboration and the quality of care.

A preliminary practice-based classification of IPW models was based on two sources: 1) the theoretical literature on IPW (Glasby 2008, Glendinning *et al.* 2004, Ovretveit *et al.* 1997), and 2) interviews with health and social care providers about their experiences of IPW. This

informed an initial analytic framework on how studies were reviewed, categorised (Figure 1), and further refined *(see IPW Models).*

Figure 1 Methodology of typology development for inter-professional working

The development process was linear; products are shown in black boxes, processes in clear boxes. Text in grey boxes on the left show how steps in the process correspond to the development process used and the different stages of enquiry

Selection criteria

We included randomized controlled trials (RCT) and qualitative studies linked to RCTs that described IPW care for community-dwelling older people aged 65 and over, with multiple long-term conditions. We excluded studies of specific physical diseases but included mental health disorders which are age-related. Studies involving care home residents were included only if the intervention was delivered by primary care practitioners. Studies involving hospital in-patients were excluded unless the intervention was concerned with improving the interface between primary and secondary care for older people. Where the form of IPW was not clear, and the paper met all other criteria for inclusion, we requested further information from authors. We selected outcome measures that were patient relevant and self-reported or validated and consistently given as measures of effectiveness across the studies reviewed. These included changes in health status (e.g. clinical/functional), mortality, quality of life, service utilisation (e.g. admissions to hospital, costs, etc), patient satisfaction and experiences, as well as those related to processes of care (Tables 3-6).

Search procedures

We searched the following English language electronic databases from 1 January 1990 - 31 March 2008: Medline (PubMed), CINAHL, BNI, EMBASE, PsycInfo, DH Data, King's Fund, Web of Science (WoS incl. SCI, SSCI, HCI), TRIP, Cochrane Library including DARE, NTIS, SIGLE, NRR, Dissertation Abstracts, DH and similar websites. In addition, we checked reference lists of relevant papers and reviews and conducted some lateral searching, using the 'Cited by' option on WoS, Google Scholar and Scopus, and the 'Related articles' option on PubMed and WoS'. We applied a British / European / NHS / State Medicine filter to retrieve as many studies as possible relevant to the UK. Searching was conducted by an informaticist (RW), according to our inclusion and exclusion criteria, using terms for community-dwelling elderly people, health services and IPW (see Box 1). Subsequently we updated the searches on PubMed, Cochrane and Campbell Collaboration for systematic reviews published since 2008.

Box1 Search strategy for inter-professional working

MEDLINE, EMBASE, HMIC 1990 – 2008   OVID

(collaboration or cross-organisation* or interagency or multi-professional or multi-professional or intermediate care or multi-disciplinary or multidisciplinary multi-agency or team* or case manag* or (primary care and secondary care) or cooperation or co-operation or ((individual or separate) and budget*) or co-location or cross organisational or interprofessional or inter-professional or joint-working).ti. OR Case Management/ OR Interprofessional Relations.mp. or exp Interprofessional Relations/ OR Case Management.mp. or exp Case Management/ OR Delivery of Health Care, Integrated.mp. or exp "Delivery of Health Care, Integrated"/ OR Organizational Policy.mp. or exp Organizational Policy/ OR Managed Care Programs.mp. or exp Managed Care Programs/ OR ((shared or joint) and assessment).mp. [mp=ti, ab, sh, hw, tn, ot, dm, mf, nm] OR pooled.mp. [mp=ti, ab, sh, hw, tn, ot, dm, mf, nm]

AND
(geriatric* or older or middleage* or middle-age or elderly or elder or senior or frail).ti. OR Frail Elderly.mp. or Frail Elderly/ OR Middle Aged.mp. or exp Middle Aged/ OR Aged.mp. or exp Homes for the Aged/ or exp "Aged, 80 and over"/ or exp Health Services for the Aged/ or exp Aged/ or exp Middle Aged/ OR (Aged, 80 and over).mp. [mp=ti, ab, sh, hw, tn, ot, dm, mf, nm] OR Geriatric Nursing.mp. or exp Geriatric Nursing/ OR Geriatric Assessment.mp. or exp Geriatric Assessment/

AND
community.ti. OR Community-Institutional Relations.mp. or exp Community-Institutional Relations/ OR Community Health Planning.mp. or exp Community Health Planning/ OR Community Health Services.mp. or exp Community Health Services/ OR *Health Care Coalitions/ OR Health Care Coalitions.mp. or exp Health Care Coalitions/ OR Community Mental Health Services.mp. or exp Community Mental Health Services/ OR Long-Term Care.mp. or exp Long-Term Care/ OR Home Care Services.mp. or exp Home Care Services/ OR Advance Care Planning.mp. or Advance Care Planning/ OR Intermediate Care Facilities.mp. or exp Intermediate Care Facilities/ OR Community Health Centers.mp. or Community Health Centers/ OR Assisted Living Facilities.mp. or Assisted Living Facilities/

AND
(England or Scotland or wales or London or Bristol or Great Britain or UK or United Kingdom).tw,ab,cp,in. OR state medicine.mp. or State Medicine/

Search formulation include text and subject headings for several databases. Source: Informaticist (RW)

Screening for study selection

Records identified by the searches were downloaded into Endnote bibliographic database. Titles and abstracts were screened by one author (DT) with a random 10 percent of records independently screened by another researcher (CG) to check for agreement. Uncertainties were resolved by consensus and discussion with members of the research team. Full papers were assessed jointly by DT, CG, VMD, with at least 10 percent independently screened by two authors (CG, FB). All included papers were independently checked which included data extraction for economic analysis (HG). Relevant reviews identified from the updated search were screened independently by DT, CG, SI.

Data extraction and quality assessment

Data were extracted using a piloted form which included types of intervention or service models, providers, participants, outcomes (used at longest follow up), study design and types of inter-professional teams, location, organization and processes of care. Descriptive and outcome data were extracted by two reviewers and checked by a third. Data on resource/service use and costs were extracted by HG. Quality assessment and applicability were conducted on all RCTs by DT in accordance with NICE Methodology Checklists and criteria and each study was assigned a quality rating (NICE 2006). Independent data extraction on functional/clinical outcomes and quality assessment was further conducted in 12 percent of the studies. Where information was inadequate we sought further information from authors (Evidence Tables 1-6).
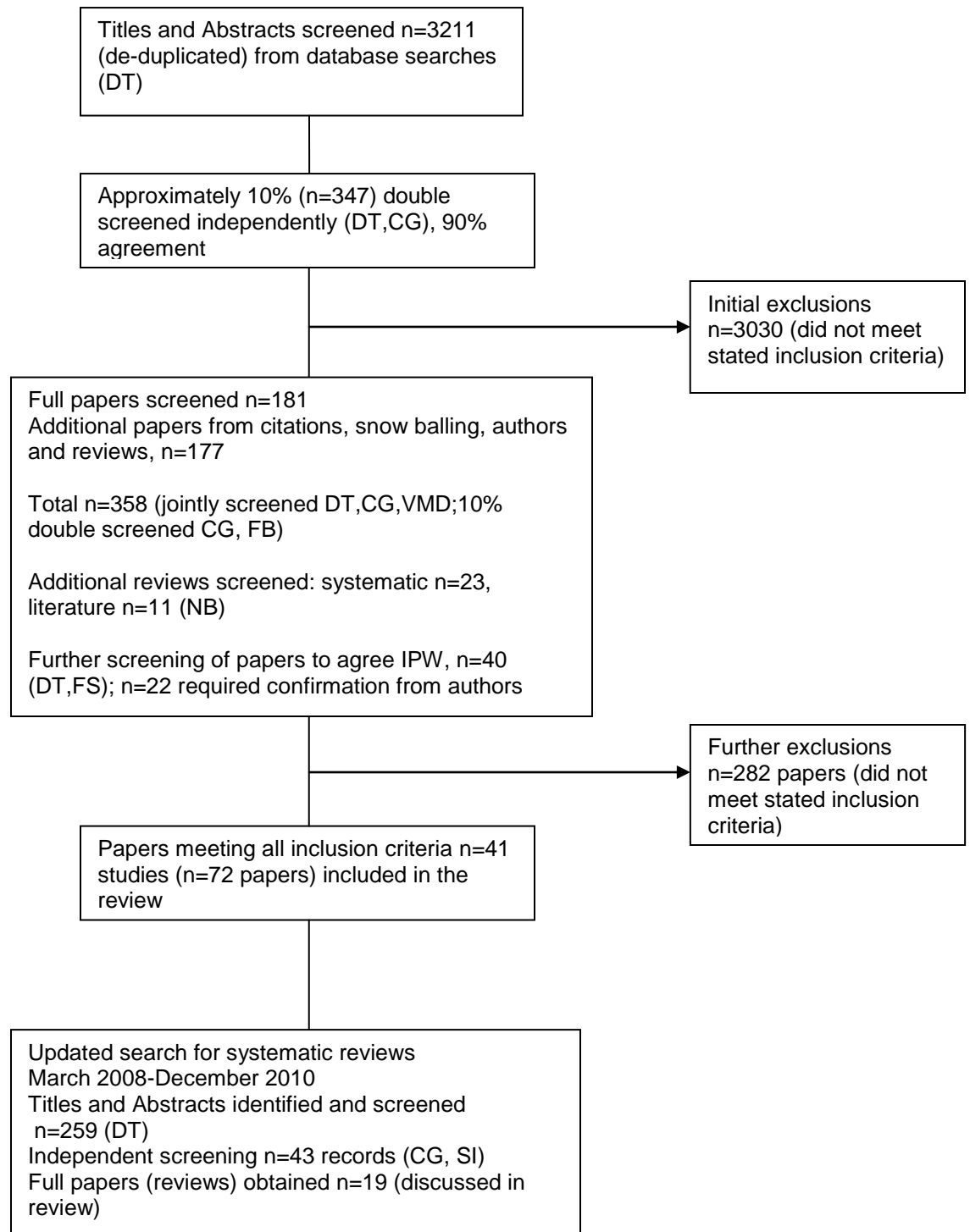
Data synthesis

We synthesised the evidence according to our key research questions and findings are discussed according to the type of care identified within each model of IPW (e.g. acute, chronic, palliative and preventive care). Due to the heterogeneity of participants, follow up periods and outcomes, an overall meta-analysis was not appropriate and data are presented narratively. For resource use and cost data, due to numerous variables, we extracted selected key data from the studies. We updated the findings of this review using systematic reviews identified after March 2008.

RESULTS

We screened 3211 citations published up to March 2008, of which 358 were deemed to be potentially relevant and obtained the full text for further screening. We identified 41 RCTs (reported in 72 papers). We retrieved 259 records from our updated search for systematic reviews, of which we obtained full papers for 19 records (Figure 2).

Figure 2 Flow chart of study selection process

Titles and Abstracts screened n=3211 (de-duplicated) from database searches (DT)

Approximately 10% (n=347) double screened independently (DT,CG), 90% agreement

Initial exclusions n=3030 (did not meet stated inclusion criteria)

Full papers screened n=181
Additional papers from citations, snow balling, authors and reviews, n=177

Total n=358 (jointly screened DT,CG,VMD;10% double screened CG, FB)

Additional reviews screened: systematic n=23, literature n=11 (NB)

Further screening of papers to agree IPW, n=40 (DT,FS); n=22 required confirmation from authors

Further exclusions n=282 papers (did not meet stated inclusion criteria)

Papers meeting all inclusion criteria n=41 studies (n=72 papers) included in the review

Updated search for systematic reviews
March 2008-December 2010
Titles and Abstracts identified and screened
 n=259 (DT)
Independent screening n=43 records (CG, SI)
Full papers (reviews) obtained n=19 (discussed in review)

IPW Models

We identified three models of IPW capturing the breadth of literature reviewed (see Box 2): Included studies were assigned to one of three IPW models of care on the basis of the description in the paper of *how* the delivery of care was organized and the intervention. Consequently, studies that described the intervention as case management or hospital at home, or intermediate care, but described different alignments and configurations of the professionals involved could be allocated to different models of IPW. This could mean that a study that described itself as case management but was reliant on IPW within a set group of professionals having mechanisms for working together (e.g. joint care planning/reviewing) was categorized as integrated care with case management (e.g. Bernabei *et al.* 1998).

Similarly, studies that were focusing on recovery or hospital avoidance would not automatically be categoried the same way if the configuration and organisation of the professionals involved were different. For example, Richards *et al.* (1998) was allocated to integrated care because this was a team created to achieve their goals of care whereas Shepperd *et al.* (1998a) and Garasen *et al.* (2008) were allocated to collaborative care because they involved professionals for whom this was one part of their work.

Characteristics of included studies

Almost half the studies were from the United States (US); the rest from mainland Europe, Australasia, Canada, UK and Hong Kong. Tables 1-3 show descriptive data according to the IPW model, types of care and interventions. Twenty-one studies and 13 studies described 'integrated team' (IT) and 'collaboration' models respectively. Seven studies described the 'case management' model (CM). Even with the broad categorization of IPW models used, some 'hybrid' studies combined one or more IPW models.

Twenty five studies were graded as having high risk of bias (-) (low quality), seven as medium risk of bias (+) (medium quality) and nine as having a low risk of bias (++) (good quality). Comparison groups, study size and follow up period and rates varied considerably and not all studies provided power calculations (Tables 4-6).

Evidence synthesis by IPW models

Findings are presented according to our stated research questions.

What types of IPW interventions are described?

There was considerable heterogeneity in types of service models (Tables 1-3). They ranged from acute care (aiming to shorten stay and provide rehabilitation,e.g. hospital at home (HAH) , intermediate care (IC), discharge planning and care (DP), chronic care (for complex/ long-term conditions), palliative care and preventive care (e.g. geriatric evaluation and management (GEM) with comprehensive geriatric assessment (CGA), falls prevention). Most interventions included assessment, education and monitoring and some studies delivered more than one type of care (Hughes *et al.* 2000, Nikolaus *et al.* 1999). Comparison groups were offered 'usual care' or 'uncoordinated care' without the specified intervention. Although focused on primary care, IPW interventions included diverse groups and settings.

How is IPW organised?
IPW within each model was organized according to the type of care being delivered, although this varied considerably in studies describing similar interventions. The organization was often unclear, particularly in relation to dimensions such as leadership, responsibility, accountability, level of input by different professionals, frequency of meetings, contacts, history and funding). Key organisational elements are summarized in Box 2 *(detailed for each study in tables 1-3).*

What are the outcomes of different models of IPW?
Outcome data are shown in Tables 4-6. There was considerable heterogeneity in the outcomes reported and how they were measured at different follow-up periods. The results are organized according to outcomes and type of care within the IPW models, with a summary of findings in Tables 4-6 for the three models respectively. (*Related papers are shown in the evidence tables).*

Case Management (CM) Model
Four studies described chronic care, one palliative care and two preventive home care with mixed evidence of effect. Four showed some improvement in health outcomes, most improved patient satisfaction, with mixed evidence for service use/costs.

Effectiveness on health, function and quality of life outcomes
None of the five studies reporting on mortality showed any significant group differences (Aiken *et al.* 2006, Engelhardt *et al* 1996, Marshall *et al.* 1999, Stuck *et al.* 1995, Stuck *et al.* 2000).

The studies targeted mostly older women (Beland *et al.* 2006a, Beland *et al.* 2006b, Marshall *et al.* 1999), with moderate to high impairments in activities of daily living (ADL), recently discharged from hospital or people within a 'managed care' system (Kaiser-Permanente) at high risk for poor outcomes (Marshall *et al.* 1999), high service users (Enguidanos & Jamison 2006), and mostly women from low socioeconomic groups (Stuck *et al.* 2000).

Chronic care: Evidence from four low quality (-) studies showed no overall group differences for chronic care, although one reported less decline in mental functioning from before/after comparisons (Leung *et al.* 2004) and one based within a US health maintenance organisation (HMO) reported significant improvements in health and functional status in the intervention group (IG) at two years, with baseline differences affecting the results (Marshall *et al.* 1999). One Geriatric care management (GCM) intervention reported a significant reduction in depression, with a trend towards reduced depression in the group offered purchase of services, although less than half of the participants used this benefit (Enguidanos & Jamison 2006).
Palliative care: Phoenix care improved Quality of Life (QoL), with less decline in physical function and general health (Aiken *et al.* 2006).
Preventive care: Home based GEM prevention with CGA reported some evidence of effect on improving function (ADL/instrumental ADL) (Stuck *et al.* 1995) and reduced disabilities among people at low risk of impairment from one good quality study (Stuck *et al.* 2000), with no

significant effects on general health or cognitive function. The intervention had favourable effects on ADL/IADL in subjects visited by two nurses (A and B) with no effect in subjects seen by nurse C, who identified fewer problems, suggesting that the home visitor's performance may be important.

Effectiveness on resource use
One study reported reduced hospital admissions, emergency room (ER) visits, and acute bed days, with overall cost savings (despite using more community resources) (Leung *et al.* 2004). A Kaiser-Permanente study showed higher service use and costs in the last month of life (Long & Marshall 1999). The SIPA intervention (System of Integrated care for older People) reduced delays in hospital discharge with no difference in overall costs. It reduced hospitalisations among the most disabled and apparently delayed nursing home (NH) moves by lower risk patients (Beland *et al.* 2006a, Beland *et al.* 2006b).

GEM prevention can delay the development of disability and reduce NH admissions (Stuck *et al.* 1995). Patients with low baseline risk were less dependent in ADL risk for NH admissions, whereas high baseline risk patients showed no favourable intervention effects on ADL, but had more NH admissions. The intervention reduced NH use, resulting in net savings in a good quality study (Stuck *et al.* 2000). Among low risk subjects, visited by two nurses (A and B), the intervention reduced NH admissions and resulted in net cost savings in the third year, with no effect in subjects visited by nurse C. Effects could be related to the home visitor's performance in conducting the visits. Palliative care reported no differences in ER visits (Aiken *et al.* 2006).

Processes of care
GCM significantly reduced caregiver burden although a minority of participants used the purchase of services (Enguidanos & Jamison 2006). SIPA improved access to health and social care, increased perceived quality of care and greater patient and caregiver satisfaction (with no supporting data), Other studies reported good satisfaction (Aiken *et al.* 2006, Stuck *et al.* 2000) whereas a managed care programme reported increased satisfaction at 12 months but not at 24 months (Marshall *et al.* 1999). Qualitative data from SIPA model reported better clinical responsibility over the span of services and agencies, information sharing, rapid and flexible use of resources, physician involvement in inter-disciplinary working, and to some extent, financial responsibilities (Beland *et al.* 2006c)

Collaboration Model
Thirteen studies described collaboration. Five focused on acute care, four described chronic care, three preventive home-based care and one outpatient care. Around half reported improved health/functional outcomes; most detecting improved process measures and patient/user satisfaction, with mixed evidence on service use/costs.

Effectiveness on health, function and quality of life outcomes

Acute care: Five studies delivered acute care, of which four were good/medium quality. They included patients at risk of admissions or recently discharged from hospital (Caplan *et al.* 1999, McInnes *et al.* 1999, Naylor *et al.* 1999).

There is evidence of improved QoL and reduced geriatric complications from two good/medium quality (++/+) HAH studies respectively (Shepperd *et al.* 1998a, Caplan *et al.* 1999), with no effect on discharge planning (Naylor *et al.* 1999).

Chronic care: Four studies covered chronic care: one of good quality, targeted people at high risk of 'institutionalization' (Ollonqvist *et al.* 2008). The SA Health Plus trial targeting diverse patient groups reported improved physical function in the IG over time (Battersby *et al.* 2005, 2007), whereas a network rehabilitation model showed no effect on function but improved subjective health (Ollonqvist *et al.* 2008). Two collaborative models improved depression (Chew-Graham et *al.* 2007, Llewellyn-Jones *et al.* 1999), the former reporting no effect on functional ability.

Preventive care: Three home based studies were of low (-), medium (+) and good (++) quality respectively (Byles *et al.* 2004, Hendriks *et al.* 2008a, Hogan *et al.* 2001).
There is no evidence of effect from falls prevention programmes where similar professionals followed a systematic approach to assessment (Hendriks *et al.* 2008a, Hogan *et al.* 2001).
Frequent home assessments and reports to GP may have positive effects on QoL in older Australian war widows (Byles *et al.* 2004). One good quality study of older women with functional impairment receiving outpatient CGA improved physical functioning and QoL, but had no effect on falls despite good adherence to recommendations (Reuben *et al.* 1999).
There were no differences in mortality from eleven studies, except one (+) study of community hospital IC significantly reduced mortality (Garasen *et al.* 2008).

Effectiveness on resource use

Acute care: Two HAH studies showed no overall differences in hospital admissions or service use, although QoL improved with costs shifted to primary care (Shepperd *et al.* 1998b). .
DP with a pre-discharge visit in one (+) study showed no effect on length of stay (LOS) or hospital readmissions, and significantly more patients were recommended for support services due to increased need for home nursing (McInnes *et al.* 1999), although costs implications are unknown. IC at a community hospital was associated with short term reductions in use of primary care services and hospital readmissions, but there were no long-term differences in either outcome (Garasen *et al.* 2008).

Chronic care: The SA generic model reduced admissions, but with no net savings and high coordination costs, although potential gains in survival, QoL and financial savings could be achieved in the longer term (Battersby *et al.* 2005, 2007). Funding re-allocation reduced emphasis on secondary care and increased primary level support. Network rehabilitation programme showed no effect on outcomes, despite more frequent home visits by health and social care staff, although an increase in support/social care was reported (Ollonqvist *et al.* 2008).

Preventive care: Home assessments may increase probability of NH placements. The intensity and frequency of intervention appear important, although the veterans in this study may already have greater access to services and therefore may have lower baseline need for intervention (Byles *et al.* 2004). The intervention may not be considered cost-effective unless targeted to specific groups. Falls prevention showed no effect on any outcomes (Hendriks *et al.* 2008a,b, Hogan *et al.*2001). The cost-effectiveness of a CGA outpatient intervention compared favourably with other medical interventions for modest gains (Keeler *et al.* 1999).

Processes of care

HAH and DP reported high carer and user satisfaction (Caplan *et al.* 1999, Shepperd *et al.* 1998a) and improved quality of care and collaboration (Mckinnes *et al.* 1999). The SA model improved access and benefit. Qualitative data suggested that coordination processes improved confidence, enablement and patient outcomes (Kalucy *et al.* 2000, related to Battersby *et al.* 2005, 2007). Other qualitative reports showed that rehabilitation key workers exercised autonomous practice, but had immense workloads and inadequate resources (Ollonqvist *et al.* 2007). A UK collaborative model was effective and acceptable, although patients reported difficulty engaging with a self-help intervention. It is unclear if the collaboration model or IPW or patient-level intervention or medication management contributed to effectiveness (Burroughs *et al.* 2006, related to Chew-Graham *et al.* 2007). Preventive care interventions showed that effective collaboration can be achieved through IPW with greater confidence in abilities to improve the well-being of users, and greater assurances that GPs were following recommendations and benefiting from collaborative working (Byles *et al.* 2002).

Integrated team model (ITM)

Of the 21 studies describing ITM, many showed improved health/functional ability, reduced caregiver burden, user satisfaction and process measures, including quality of care. Evidence about service use and costs was mixed but over half the studies showed reduced hospital admissions.

Effectiveness on health, function and quality of life outcomes

Acute care: Seven studies covered acute care; three were medium/good quality (Cunliffe *et al.* 2004, Harris *et al.* 2005, Richards *et al.* 1998). They included people at high risk of hospital admissions or recently discharged.

HAH showed no overall improvement on any outcomes, except for a borderline improvement in daily activities (Richards *et al.* 1998). DP improved IADL (Melin *et al.* 1993, Nikolaus *et al*, 1999), general health and ADL (Cunliffe *et al.* 2004), one showed no QoL effect (Weinberger *et al.* 1996); others reduced falls, with improved self-perceived health (Nikolaus and Bach, 2003). A team managed home based primary care (TM/HBPC) intervention, delivering both discharge and palliative care reported improved QoL only among people who were dying, with no difference in the non-terminal group (Hughes *et al.* (2000)

Three studies reported a significant reduction in caregiver strain (Cunliffe *et al.* 2004, Harris *et al.* 2005) with most participants co-resident with caregivers (Hughes *et al.* 2000).

Chronic care: Two low quality studies delivered CM with integrated care and included participants recently discharged from hospital with good social support. The SWING (South Winnipeg Integrated programme) showed no overall improvement in ADL/EADL but improved MMSE scores, increased prescriptions and no effect on caregiver strain (Montgomery & Fallis, 2003). Bernabei *et al*. (1998) showed a significant improvement in mental health, and ADL and IADL, with less deterioration in the IG and a reduction in drug use. One good quality study showed a favourable effect on depression from a psycho-geriatric team, having an extra doctor for people receiving home care, but cost implications are unknown (Banerjee *et al* 1996), whereas the SCC model had no overall effect on health (Sommers *et al*. 2000). However patients with the largest number of contacts with nurse/social worker showed improved function.

Palliative care: Two low quality studies targeted older people living with caregivers and people from low socioeconomic and black and minority ethnic groups respectively (Hughes *et al.* 2000, Brumley *et al.* 2007). The former reported no improvement in physical function, although positive effects on general and mental health were seen in end of life group, and a significant reduction in caregiver burden was reported among others.

Preventive care: A low quality study targeting the frail elderly (GRACE (Geriatric Resources for Assessment and Care for Elders)) found an improvement in mental and general health but not physical function (Counsell *et al*. 2007). A low quality study of a home intervention team (HIT) for older people recently discharged from hospital reported an improvement in cognitive health and IADL, and a reduction in falls and 60% compliance with recommendations (Nikolaus & Bach, 2003).

Eight US studies delivered GEM outpatient care but most were of low quality. Participants were older, high risk or vulnerable, recently discharged or at risk of hospitalisation (Boult *et al.* 2001, Burns *et al.* 2000, Engelhardt *et al.* 1996, Epstein *et al.* 1990, Fordyce *et al.* 1997, Phelan *et al.* 2007).
Most studies showed no improvement in any functional or health outcomes at the longest follow up, although Epstein *et al.* (1990) reported a significant effect at 3 months. Four studies showed no overall group effect (Burns *et al.* 2000, Cohen *et al.* 2002, Engelhardt *et al.* 1996, Silverman *et al.* 1995), although one reported fewer impairments in IADL, improved QoL and cognitive health over time (Burns *et al.* 2000). Another reported significant effect on ADL at 12 months which was not maintained at 24 months, with a significant improvement in mental health (Phelan *et al.* 2007). Boult *et al.* (2001) reported that the GEM group was less likely to lose functional ability or experience health-related restrictions in ADL. Cohen *et al*. (2002) showed no overall effect on physical functioning but some significantly improved QoL measures. Others reported improved health/function (but showed no data, Fordyce *et al.* 1997), improved depression (Burns *et al*. 2000), diagnosis of common problems, reduced family strain in a study reporting family conferences (Silverman *et al*. 1995), and a reduction in adverse drug reactions and in suboptimal prescribing through access to pharmacists (Schmader *et al*. 2004, related to Cohen *et al.*2002).

There were no overall group differences in eighteen studies reporting mortality, except one (-) GEM study showing an increase in mortality (Phelan *et al,* 2007).

Effectiveness on resource use

Acute care: HAH reported more hospital readmissions only in the first ten days, but not thereafter and no differences in care costs (Harris *et al.* 2005). A longer LOS with low costs at 3 months could be attributed to different services' organisational characteristics (Coast *et al.* 1998). DP with a HIT reduced LOS, readmissions and overall costs (Nikolaus *et al*, 1999) (preventive care). Melin *et al.* (1993) showed improved diagnosis and function, greater outpatient care, with no differences in readmissions or cost, but no cost-effectiveness analysis.

The EDRS (Early Discharge and Rehabilitation Service) showed no significant effect on hospital or NH readmissions but decreased hospital stay and day hospital use (Cunliffe *et al.* 2004). A study of discharge planning with post discharge care (Weinberger *et al.* (1996) reported higher readmissions and longer rehospitalisation in the IG but no differences in other service use. TM/HBPC intervention, delivering both discharge and palliative care, reduced readmissions at six months (but not 12 months) only for the non-terminal severely disabled group, with overall high costs (see palliative care) (Hughes *et al.* 2000).

Chronic care: Bernabei's (1998) model suggests a cost-effective approach to reduce admissions to NH or hospital and functional decline in older people without increases in health service use. Montgomery & Fallis (2003) reported significantly faster deployment of home services, greater day hospital use, reduction in LOS, and delayed long-term care usage. The SCC model showed potential for reduced service use, reducing hospital admissions, readmissions and office visits, with overall savings (Sommers *et al.* 2000). The largest number of contacts had the lowest hospital admissions and improved physical function. It is possible that patients with more contacts could be at 'higher risk' for admissions which declined following professional attention.

Palliative care: In one study patients were less likely to visit the emergency department or be admitted to hospital, resulting in significantly lower costs (Brumley *et al.* 2007). The TM/HBPC intervention reduced the number of readmissions only for the non-terminal group with overall high costs, attributed to home care and NH costs (Hughes et al., 2000). Higher costs should be weighed against the improved QOL, satisfaction and carer benefits. Although about half of the CG received private home care (Medicare mainly) they did not report the same satisfaction and QOL gains as the TM/HBPC group.

Preventive care: GRACE reduced acute care use among a high risk group, but it is unclear whether this offset programme costs (Counsell *et al.* 2007). CGA followed by a home intervention, prevented falls and increased community services up-take, with lower LOS, fewer days in long-term care, with overall savings. It had the potential to reduce direct costs of in-patient care and emergency NH admissions (Nikolaus *et al.*1999).

The GEM studies showed mixed evidence on resource use. Eight studies reported on service use of which three provided some economic evaluation with cost data. Some reported no effect

on overall service use (Boult *et al.* 2001) or NH admissions, with higher clinic use and outpatient costs (Engelhardt *et al.* 1996, (related Toseland *et al.* 1996, 1997)), increased service use with no effect on hospitalisations (Burns *et al.* 2000), improved diagnosis with no effect on resource use (Silverman et al 1995), hospitalisations (Phelan *et al.* 2007) or any outcomes (Epstein *et al.* 1990).

Processes of care:

HAH may be acceptable (Harris *et al.* 2005) with patients perceiving higher levels of involvement in decisions (Richards *et al.*1998). There was significant patient satisfaction in DP (Hughes *et al.* 2000, Weinberger *et al,* 1996) (Melin *et al.* 1993) and chronic and palliative care interventions (Montgomery & Fallis 2003, Sommers *et al.* 2000, Brumley *et al.* 2007,) and preventive care interventions (e.g. GRACE) significantly improved the quality of care (Counsell *et al.* 2007). GEM studies showed mixed evidence: on patient satisfaction with two showing no overall effect (Epstein *et al.* 1990, Silverman *et al.* 1995) and two reporting improved patient satisfaction (Morishita *et al.* 1998 (related to Boult *et al.* 2001), Engelhardt *et al,* 1996)). In one study, providers screened significantly more and viewed the IP team favourably (Phelan *et al,* 2007). Improved quality of care was reported by Epstein *et al.* (1990) and Engelhardt *et al.* (1996). A good quality study of home palliative care found the IG was more likely to die at home (Brumley *et al.* 2007).

Training and preparation across IPW models
 Whilst the review did not consider studies on inter-professional education (IPE), some studies mentioned training in delivering the interventions, a component of IPW that may contribute to better outcomes.
In the CM model, Beland *et al.* (2006a,b,c) described prior training/competencies of professionals with continuous quality assessment. Stuck *et al.* (2000) reported that two nurses had a favourable effect on function, NH admissions and costs compared with a third nurse, suggesting that the effect could be related to the home visitor's performance.

Two studies in the collaboration model described prior training workshops for professionals delivering chronic care models. The SA Health Plus trial had a Co-ordinated Care Training Unit that trained and supervised service coordinators with competency assessment and accreditation, reviewed annually. They worked with trained GPs and the model improved processes of care, whereas a shared care model involving training workshops improved patient outcomes (Llewellyn-Jones *et al.* 1999). Professionals delivering frequent home based preventive care and who attended regular training workshops may improve quality of life, but may not be considered cost effective unless targeted to specific groups (Byles *et al.* 2004). In the integrated team model, various studies mentioned training of personnel, of which two acute care interventions improved some health outcomes, although only in the short term (Cunliffe *et al* 2004, Hughes *et al* 2000). The SWING model (CM),reported significantly faster deployment of home services with improved access to services with a delayed need for long term care (Montgomery & Fallis, 2003). The SCC model with training workshops showed potential for

reduced service use and hospital admissions whilst maintaining health, with overall cost savings (Sommers *et al.* 2000), although the largest number of contacts had the lowest hospital admissions and improved physical function. Two preventive studies showed some improved outcomes (Epstein 1990, Phelan 2007) although the latter reported adverse effect on mortality.

Findings from recent reviews

Our updated search since 2008 confirmed sustained interest in IPW and a continuing desire to understand how the components and characteristics of IPW affect outcomes. Further conceptual frameworks of inter-professional education, practice and organization in various settings and populations are emerging (Ehrlich *et al.* 2009, Reeves *et al.* 2010a,b). They highlight the atheoretical nature of the IPW literature and the need to explore how different components and processes impact on practice. Reeves *et al.'s* (2010a) observation that IPW is too often represented as the outcome supports the starting premise of our review that we need to discriminate between the process of IPW and its effectiveness. Our review complements and extends their findings by focusing on the impact of IPW on community dwelling older people. It provides a population-specific analysis of the effectiveness of different models of IPW. Whilst training may improve the effectiveness of multidisciplinary teams in acute care, there is little high quality evidence of effect on outcomes (Buljac-Samardzic *et al.* 2010).

Inter-professional collaboration has the potential to improve outcomes, although studies are few and flawed with methodological limitations and mixed results (Martin *et al.* 2010). Boult *et al.* (2009) identified 15 models of comprehensive care from 123 studies, including meta-analysis, reviews and all study types. Interdisciplinary primary care was reported to reduce health service use, improve survival, and, in heart failure patients, reduce costs. The model included a primary care physician with one or more other health professionals who "communicated frequently with each other". Evidence for a collaborative case management model was mixed, improved quality of care, QoL and survival were documented, although reimbursement of costs to providers in the US needs to be addressed. Their review did not examine other IPW care models (Boult *et al.* 2009). As in our review, teams in different contexts, with various definitions and compositions, were described by Johansson *et al.* (2010). They reviewed 37 qualitative and quantitative studies of various designs and settings, with less than half being RCTs. They reported benefit from team assessments and interdisciplinary interventions in different contexts, highlighting that mutually accepted agreements, common goals and guidelines may promote interdisciplinary team approaches, although the impact on outcomes remains uncertain.

Our review updates a recent review that showed some evidence of benefit for frail older people and reduced health care utilization from seven RCTs of varying quality (identified until 2007) but did not discuss IPW models (Eklund & Wilhelmson 2009). Only two trials comparing home-based multidisciplinary rehabilitation with usual inpatient care found some benefit for caregivers. Increasing contact at home had no effect, and the cost implications of long periods of rehabilitation are unknown (Handoll *et al.* 2009). Multidimensional preventive home visits have the potential to improve functional outcomes among older adults, but the reviews include studies of single and multi-professionals (Bouman *et al.* 2008, Huss *et al.* 2008). One review showed

that multifactorial and some single intervention falls prevention programmes for community dwelling older people may be effective, but it did not look at IPW, for example, home hazard assessment, described as a 'single intervention', actually involved several professionals (Costello & Edelstein 2008). Early discharge or admission avoidance HAH do not provide sufficient evidence of economic benefit or improved health outcomes, although the reviews do not specifically address IPW (Shepperd *et al.* 2009a,b). Øvretveit (2011a,b) suggests that integrated teams provide greater value in terms of lower costs and higher quality, although evidence is largely based on disease-specific programmes and not community focused.

DISCUSSION

We evaluated 41 RCTs describing three models of IPW: case management, collaboration and integrated team, where practitioners from varied disciplines worked together differently according to the type of care being delivered, although the organisation of IPW varied considerably in studies describing similar interventions. IPW has the potential to positively influence outcomes and improve processes of care.

Differentiating between different models of IPW
The IPW and integrated care literature highlights the multiplicity of terms and titles used to describe IPW. By focusing on how IPW is organised and delivered we offer a different perspective to evaluating effectiveness that takes account of context, and the configurations and processes of IPW available for community dwelling older people. By considering the process of care we were able to begin to ask about the impact of different types of IPW for older people living at home. For example whilst discharge planning and rehabilitation in the collaboration model may improve quality of care, the integrated model has the potential to improve short term outcomes. For those with ongoing chronic care needs intensive case management, through inter-organisational agreements, multi-professional support involving protocols and, joint care plans may achieve longer term benefits. However, the role of the case manager within some of the integrated models of care reviewed may have been the most significant element of the intervention. Other information about how different professionals work together within the different models reinforces the overall finding of the review about the need for more detail. For example, the systematically coordinated South Australian trials in the collaboration model had GPs and service coordinators working together empowering the patients (Battersby *et al.* 2007). Integrated team models had professionals (including key workers) within a community GEU and GPs designing and implementing care plans (Bernabei *et al.* 1998), increased contacts (SCC model, Sommers *et al.* 2000), faster deployment of services (SWING, Montgomery & Fallis, 2003) and having additional doctors as key workers with an established team-patient relationship (Banerjee *et al.* 1996). The diversity of participants could affect service coordination models and capacity to benefit from the IPW in the models. More research is needed that can explore how the components and patterns of IPW affect patient/user centred outcomes.

Rigorous evaluations are scarce, especially of UK based interventions, despite the policy emphasis on evidence and the necessity of cross-organisational, public-private collaborations and IPW to support older people. The collaboration model which is in effect much of UK

primary health care not surprisingly showed that effective collaboration can be achieved through IPW and joint working with GPs (Byles *et al.* 2004, Battersby *et al.* 2007). Two UK models delivering chronic care were effective, but their cost implications or effective components of IPW are unclear (Banerjee *et al.* 1996, Chew-Graham *et al.* 2007).

Limitations of the study
As with many reviews, some limitations derive from available evidence. Many studies identified were of low quality, with short-term follow up and high rates of attrition among participants. Our reporting has tried to make it clear which studies were of good quality. Cost-effectiveness evaluations did not generally include full economic appraisals or comparative data, making it difficult to comment on this aspect. Although some studies reported modest effects on outcomes, it is possible the evaluations did not capture the complexity of IPW. Equally, because of the lack of detail on the process of care it is possible that some of the studies included in the review were, evaluating packages of inter-disciplinary services rather than IPW.
We categorised studies in what we judged to be the predominant IPW model, as defined by the theoretical and empirical literature but this may be overly reductive. Our search also excluded disease specific studies because particular features of conditions may shape regimens, resources and care pathways. Although we located broad range material, we may have excluded studies that did not provide adequate detail of IPW. It is possible that new knowledge has emerged since our search, but recent reviews do not suggest this. The complexities of different forms of integration described in the papers are widely recognised (Reed *et al.* 2007) and reflect the different terminologies of IPW (Dickinson 2006). It was not possible to clearly identify the value, or effectiveness, of IPW which has several components in a complex intervention or system of care. Unpacking the nuances of complex interventions in various care and organisational contexts can vary according to the approach taken by each study.

Implications of the review
Although this review highlights the benefit of some IPW models in terms of improved quality of care and outcomes, there is a need to clarify what IPW is trying to achieve and how different models of IPW may determine different outcomes for different groups. Research designs that are more appropriate for complex interventions and examine active ingredients of IPW need to be developed (Campbell *et al.* 2000). IPW models have evolved as rationally-constructed mechanisms for achieving service or clinical objectives, which is why comparative evaluations of say, case management versus integrated team model, are difficult. More descriptive, observation is needed to inform experimental studies.

This review raises key questions about IPW in the delivery and organisation of care for older people with complex needs living at home. Funders might consider if there is a need for greater discrimination between the effects and outcomes of different IPW models for older people with multiple conditions.

The review has demonstrated the importance of understanding the detail and organisation of IPW within different models of working that initially appear to have similar approaches and

names. The literature on integrated work and IPW needs to acknowledge as Glasby *et al* (2011) have noted, that structural solutions alone are not the answer. By considering the effectiveness of different models the review as demonstrated both the importance of understanding more about link between outcomes and how professionals structure their working practices and the need for this to be described in greater detail in interventions that rely on IPW to deliver care for older people living at home.

Conclusion

This review sought to differentiate between the effectiveness of interventions that relied on different models of IPW for the benefit of community based older people. Overall, the proportion of studies demonstrating improved outcomes is similar across the three main IPW models. More than two-thirds reported improved health/functional/clinical and caregiver outcomes and process measures including patient satisfaction. The evidence for service use is mixed, although less than 40 percent of studies showed an increase in service use. However, in the case management and the collaboration model, about a third of studies showed reduction in hospital/nursing home admissions or hospital stays, whereas in the integrated team model over half the studies reported reduced hospital use or long term care. The evidence for costs is mixed.

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Box 2 Organisation of inter-professional working within models

Type of inter-professional working model	Case Management (CM)	Collaboration	Integrated Team
	• Key worker assumed leadership role • Coordinating care, reporting back to professionals • Addressed patient needs in a co-ordinated manner • Professionals usually came from the same organization (e.g. Managed care) but involved other community agencies.	• Different professionals worked together on a patient by patient basis • Usually came from different organizations. • Established methods of working together • Although there is no designated key worker role as in the CM model, members assumed lead roles	• Most professionals came from same organization. • Unlike the CM model, IPW relied on an acknowledged team • Worked almost exclusively with one another dedicated to a particular function (e.g. hospital outreach), joint care planning. • Medical professional(s) were within the team (with or without a clear leadership role) or work alongside the team but outside the organization. • Model did not preclude a case manager
Type of care			
Acute care: Hospital at Home Discharge Planning Intermediate Care		• GPs clinically responsible or have active input, remuneration for pre-discharge visits • Care pathways with multi-disciplinary involvement, protocols • Continuous nursing input • Qualified nurses collaborated with GPs through joint management & patient involvement • Training	•Nurse-led multi-disciplinary team for outreach care • Physician led home care •Continuous medical input, daily nursing review of care plans •Geriatricians clinically responsible and shared with GPs involved as required. •Integrated networks, continuity of care, increased patient contact, trained personnel
Chronic care models: Generic care Network Rehabilitation Mental health Integrated care with CM SCC model	• Intensive CM, trained key worker • Structured, extensive communication routes • Formalizing CM's role, inter-organisational agreements, • Multi-professional support, protocols, joint care plans, regular case meetings • Well coordinated community based teams, physicians involved, • Patients/families involved in care plans. • Mobilize resources flexibly and facilitate transitions into community (SIPA)	• GPs and service co-coordinators (trained) conducted joint assessment & care plans, communicated to service providers • Systematic clinical improvement for protocols •Empowered patients (Partners in health care approach) • Culturally appropriate, good access, support by trained specialists • Extensive co-ordination through inter-agency multi-site networks, joint budgets • Advanced key workers • Shared care with GP/physician, prior training • Nurse managed care, close liaison with professionals, carers' training	•Enhanced role of nurses for CM, care planning by trained coordinator • Joint review by geriatrician and IP team, referral to GP if required • Facilitating better access. •GEU based teams and GPs designed, reviewed, implemented care plans • SCC model had trained teams across three counties and joint care planning with physicians •Established team for psycho-geriatric care had extra doctor as key worker.
Palliative care	•CMs assumed a team leader role • Intensive programme of self		•Lead palliative care physician coordinating care from various providers, involving patients and

(included discharge and home care for terminal and non-terminal patients)	management • IP team had medical director, involved families and community agencies		families • 24 hour services • Input from primary care manager and trained team, had integrated networks, continuity of care.
Preventive care: Home based assessments and care	• Nurse practitioners/qualified public health nurses worked actively with geriatricians and family physicians as required • Structured repeat assessments, used care protocols • Number of professionals and follow-up visits varied in two studies	• Collaboration for patient care through the Divisions of General Practice (Australia) • Aged Care Assessment teams and Community Options • Involved regular training for professionals. •Falls prevention had systematic approach and timely implementation of recommendations • Involved geriatricians, GPs, volunteers, with joint care plans	• GRACE teams (nurses, social workers) used care protocols, and electronic tools extensively • Joint care planning with physicians • HIT (delivering falls prevention and discharge planning) had joint budgets • IP team involved geriatrician, liaison with the GPs • Regular contact with patients
Preventive outpatient care		• A well coordinated care programme • Good collaboration with key professionals • Proactive input from family physician • Involved interdisciplinary case conferences, with a highly personal approach, led by a geriatrician • Patient empowerment	•GEM teams (nurses, social workers, geriatricians) working closely with physicians, geriatric training •Well coordinated services, strong interdisciplinary primary care input • Continuing long term management, 24 hour service • Access to pharmacists • Regular follow up with joint assessments.
IPW Inter-professional working, GP General Practitioner, GEM Geriatric Evaluation & Management, GEU Geriatric Evaluation Unit, HIT Home Intervention Team, SIPA System of integrated care for older people, SCC Senior Care Connection, GRACE Geriatric Resources for Assessment and Care for Elders, SA South Australia			

Table 1 Case Management Model: Key characteristics of included studies according to type of care (acute, chronic, palliative, preventive)

Study ID/Country	Research Aims	Population & Setting	Type of care, intervention IG Intervention Group; CG Control group Sample size (N), Follow up (FU)	Organisation of IPW	Applic ability
Beland 2006a, b,c Canada	To assess a transformation of the organisation and delivery of health and social sciences with intensified community-based interventions for frail elderly persons	Mean age:82.2 yrs; 29% men; 58% lived alone ; Functional disabilities and high service users; participating care givers Setting: Community	**CHRONIC CARE** IG: Integrated services (SIPA) System of integrated care for older people. Care management & geronto-geriatrics model N =606 CG: Usual home care without CM. N= 624 FU 73.7%	MDTs had clinical responsibility for delivering integrated care (health/social services), with a publicly managed and funded system. 2 teams in 2 sites (1 per site), Programme Director CMs (N/SW), CN, OT, PT, dieticians, team and family physicians, home aides, pharmacists (1 site only), community organisers (1 site only). Continuous quality assessment, maintaining staff competence through training Intensive CM appropriate for patients/ caregivers, liaising with family physicians, active follow up throughout the care trajectory. Assessment, care planning/ support, education, monitoring, referral, rehabilitation, protocols	2
Enguidanos 2006, Enguidanos 2003 USA	To determine whether geriatric care management (GCM) and/or purchase of service (POS) intervention would lower barriers to access to community based services	Mean age 79yrs; 66% women, >60% living alone 80% low income, high proportion of ethnic minorities, High service users, activities of daily living	**CHRONIC CARE** IG: GCM 4 groups: 1. Information & referral by mail following telephone interview N= 98 2. Telephone care management (TCM), N =113 3, GCM in home N =117 4. GCM with POS – up to $2000 available over 6 months to help	Telephone: given by 2 SWs (4 phone calls over 4 weeks) (groups 1, 2) GCM: provided by six Ns and SWs (groups 3, 4). Care plan reviewed by team including geriatrician. CM: RN/ Masters level SW. Case conferences included geriatrician and assistant dept. manager. At least 1 home visit, several follow up calls or visits, Approx 20 hrs/ case over 8-9 months. and extensive coordination among both community and KP service providers. Assessment, counselling/advice, care planning/ support, monitoring,	3

		deficiencies, no caregiver Setting: Home	implement care plan. N=123 FU 59.3%	referral, CM	
Leung 2004 Hong Kong	To evaluate the cost benefit of a case management project for older persons in Hong Kong	Mean age IG: 74.4 yrs; 57% men, Older people with history of hospitalisations Setting: Home	**CHRONIC CARE** IG: Case Management N=130 CG: Conventional (often fragmented) health and social services N=130 FU 90.8%	CMs (RN/SW) assumed lead role and served impaired elders, monthly case conferences, budgets not clear. CGA, formulation of care plan, formal referral to integrated services, case conferences, counselling, health education, support groups. Biweekly home visits and/or phone consultations, CMs conducted 361 home visits, 1171 telephone consultations, 145 face to face counselling sessions at the hospital, 424 case discussion meetings and 157 referrals to community health and social services. Stable IDTs, integrated, SW & RN meeting multidimensional needs.	2
Marshall 1999 USA (Long 1999 Related study analysed costs of care in 77 people who died)	1.To evaluate a CM model designed for older people enrolled in Ohio 1.To examine the use and cost of care in the last month of life	Mean age IG 82.5 yrs; around half lived alone; 65% women Enrolees at high risk for poor outcomes, approaching end of life, confined to home, high service use Setting: HMO	**CHRONIC CARE** IG CM coordinated KP services N = 140 CG: Usual care N=152 FU 71.2% (differential FU; CG more likely to live alone and older No. died IG 34, CG 43	Geriatrician served as a physician advisor, Two CMs (N, SW) with geriatric CM experience. Protocol led intervention defined services required. Weekly meetings with geriatrician., care plan developed in liaison with PCPs. Home visit (2-4 hours) for assessment At least 1 home visit every 6 months but up to 1 visit per week for some enrolees. The CM model emphasised the team-developed coordinated care plan, a patient agency, or advocacy model, coordinated by CM.. Assessment, counselling/advice, care planning, support, monitoring, referrals, rehabilitation, protocols	3
Aiken 2006 USA	To evaluate a Phoenix Care program of palliative care for seriously chronically ill	Mean age 68.5 yrs; IG: 58% women, CG: 70% women	**PALLIATIVE CARE** IG: Palliative care: Intensive coordinated CM for disease management and preparation for end	RNs assumed leadership role; MD, SW, pastoral counsellor provided support to CMs. PCP, health plan CM (if applicable), patient/family and community agencies.	2/3

	elders who simultaneously received active treatment from MCO	Setting: Home	of life; N=101 CG: Usual care (provided by the MCOs) N=91 FU 47% 6 months; 38% 9 months (higher in IG) PC not given	CM had caseloads of 20-35 patients, Telephone &home visits, 44 visits by team (mean/ month 3.3-6.3) Assessment, care planning and support, monitoring, medication, referrals, CM, palliative care Focus: self management for physical and mental functioning, utilisation of medical services	
Stuck 1995 USA (Alessi 1997; Rubenstein 1994)	To evaluate the effects of CGA with preventative home visits on disability in older persons living in the community	Mean age 81.0 yrs, 70% women, 64% Living alone Setting: Home	**PREVENTIVE CARE** IG: Annual CGA with preventive home visits, three year follow up N=215 CG: Maintained their usual health care regimen N=199 FU 76.6% (available for data)	Home visits by GN practitioners who, in collaboration with geriatricians, assessed disability, gave specific recommendations, and health education, monitoring, referrals 3 year intervention, annual CGA, in home follow up visits every 3m and telephone as needed. MDT: Weekly face to face team meetings, shared care plan, joint decision s, team leader not specified although GNs consulted with geriatricians Over 90% participants visited by NP	3
Stuck 2000 Switzerland	To evaluate the effects of preventative home visits with annual multidimension al assessments on functional status and nursing home admissions in low risk compared with high risk older persons.	Mean age 82.0yrs, >70% women Setting: Home	**PREVENTIVE CARE** IG: CGA with home visits, two year follow up Low risk N=148, High risk N= 116 CG: Usual care (No assessment, follow up) Low risk N=296 High risk N=231 FU 85.6%	Three qualified public health nurses Annual multidimensional assessment in own homes: CGA by nurses, discussed with geriatrician, developed recommendations and visited every 3 months to monitor implementation/check for new problems, access to therapies An IDT (physical PT, OT, dietician, SW) was available to the nurse for discussing complex problems. Team leader not clear No follow up visits in 3rd year	2

IPW inter-professional working, CM Case manager/management, CN Community nurse, GN geriatric/gerontology nurse, MD Medical Director, N nurse, OT Occupational therapist, PCP Primary care physician; PCPr Primary care provider, PT physiotherapist, RN registered nurse ,SW Social worker, HMO/MCO Managed care organisation, MDT Multidisciplinary team, , IDT Inter-disciplinary team, CGA Comprehensive geriatric assessment, PC Power calculation.Applicability score 1-4 NICE criteria: 1.Applicable across a broad range of

populations and settings; 2. Applicable across a broad range of populations and settings assuming they are appropriately adapted; 3. Applicable only to populations or settings included in the studies, and broader applicability is uncertain;4. Applicable only to settings or populations included in the studies

Table 2 Collaboration Model: Key characteristics of included studies according to type of care (acute, chronic, palliative, preventive)

Study ID/Country	Research Aims	Population & Setting	Type of care, intervention IG Intervention Group; CG Control group Sample size (N), Follow up (FU)	Organisation of IPW	Applica-bility
Caplan 1999 Australia	To compare the effects of treatment of acute illness at home and in hospital	Median age 73 yrs (approx 70% >=65); Men and women recently discharged from hospital Setting: Home vs Hospital	**ACUTE CARE** IG: Hospital at home (HAH) N=51 CG: Conventional care for acute illnesses N=49 FU 87% (only deaths given)	Hospital community outreach team. GPs and nursing home staff received evening lecture before trial. Care provided by a MDT (medical, nursing, allied health); Care pathways developed in collaboration with various departments, and with MDT, GP as primary medical manager. Daily handover meetings and weekly case conferences. HAH patients seen at home, by study N (9x, one visit/day), GP (0.8x),hospital doctor (0.9x), OT(0.2x) Assessment, care planning and support, monitoring medication, rehabilitation, protocols	3
Garasen 2007, 2008, Norway	To evaluate the effect of intermediate care (IC) at a community hospital on readmissions, need of home care services and long term nursing homes	Mean age 80.9 yrs; 78% women (IC), in need of hospital care and expected to return home (excludes psychiatric cases) Setting: community hospital	**ACUTE CARE** IC: Individualised IC at community hospital N=64 IG: Assigned community hospital/care (including IC, those not yet referred), N=72 CG: Usual routine hospital care , N=70 FU 75.3%	IP Teams involved in admission to community hospital; include physicians, community care home facilities, GPs but unclear if involved directly with intervention CNs at point of referral to hospital. Nurse assessment with full patient involvement, trained nurses sent discharge letters to physicians, monitored function at IC and general hospital. Patients transferred to IC within 24 hours of recruitment to study. Step down facility. Trained Nurses: 16.7 man-labours/week, GPs: 37.5 hours/week.. Assessment to manage independently with full patient involvement, care planning, reablement, intermediate care, monitoring, referrals	3
McInnes 1999, Australia	To assess whether GP input into discharge planning for high risk elderly patients improves	Mean age 81 yrs; Over 55% women, Frail elderly in-patients at high risk	**ACUTE CARE** IG: A pre-discharge visit performed by a GP, and recommendations given	Allied Staff, Geriatrician, GPs invited by the geriatrician to make a pre-discharge visit, liaise with hospital staff , assess patient, access medical notes. Team leader not specified-geriatrician leads collaboration with GP,	2

Ranmuthgala 1997	patient outcomes	of readmission, high service users, carer stress, self care dependencies. Setting: Hospital to home	following consultation. N=205 CG: Standard DP alone N=159, (power calculation not reported) FU 57.1%	Assessment, counselling/advice, care planning and support, DP, referrals, rehabilitation, protocols	
Naylor 1999, USA Naylor 1994	To examine the effectiveness of an advanced practice nurse-centred discharge planning and home follow up intervention for elders at risk for hospital admissions	Mean age men and women, 75.5 yrs, 70% had social support; 42% low income, recently discharged from hospital, high risk for poor outcomes Setting: Hospital - Home	**ACUTE CARE** IG: Patients/ caregivers comprehensive DP & home follow up tailored for high risk N=177 CG: routine DP & home care consistent with Medicare regulations N=186 FU 72.2%	Routine discharge plan, managed by patient's physician and primary nurse. Complex cases involved SW. IG received at least I nurse visit Masters-prepared gerontological advanced practice nurses (PN), visiting nurse; physician. PNs planned discharges & home support, collaborated with patient's physician and team. Comprehensive individual protocol covered first 2-4 weeks post discharge, including patient/carer education interdisciplinary communication. Nurse available by phone (2 calls) and 2 home visits in first 2-4 weeks after discharge. Patient & carer assessment (N specialist), referrals, care planning, monitoring, medication, outreach	2
Shepperd 1998a, UK Shepperd 1998b (Cost Minimisatio n)	To compare hospital at home with inpatient hospital care in terms of patient outcomes To compare cost of HAH compared to inpatient care	Mean age 71yrs, Men 34-51% , Manual social class 49-68% across group with hip/knee replacement & elderly care (excluded hysterectomy or COPD from the review) Setting: Hospital - home	**ACUTE CARE** IG: HAH nurse led MD unit Elderly medical N=50; Hip replacement N=37 Knee replacement N=47 CG: Standard inpatient care Elderly medical N=46; Hip replacement N=49 Knee replacement N=39	Nurses, PTs, OTs, pathologists and speech therapists. GPs held clinical responsibility and were reimbursed for patient visits Home care services included nursing, pathology, health professionals. 24 hour nursing care in home, with rehabilitation support, monitoring, medication. Nurse decided discharge from Hospital to Home. The type of care provided is more than is normally available in the community through NHS care	2

			Overall FU 85.7%		
Battersby 2005, 2007, Harvey 2001, Kalucy 2000 Australia	To examine the effects of coordinated care on patient outcomes To effect organisational change at system level in 2 year time frame To develop and test different service delivery and funding arrangements	Mean age *Central Project* 74 yrs, *Western:* 67 yrs *Southern* 73 yrs *Eyre* 63 yrs Men & women,> 70% Health care holders, except for Eyre (IG 47% CG 70%),<10% veterans. Setting: Community	**CHRONIC CARE** Intervention: SA Health Plus = 8 projects in 4 regions IG: Generic model of coordinated care (CCTU) N=3155; Eyre (chronic & complex) N=955 CG: GP Usual care N=1488; Eyre N=402 FU 59.5%; Eyre 47% (data available) Southern (aged care, COPD) Central (Cardiac); Western (Diabetes, COPD); Eyre (Chronic and complex)	Wagner's chronic care model (some projects were with disease specific groups). Partners in health approach Service coordinators (SC): RNs, allied health, PTs, SWs. Co-ordinated Care Training Unit (CCTU) supported/supervised SCs; GPs care coordinators & mentors, paid to develop & oversee care plans. Trained SCs with competency assessment & accreditation (reviewed annually). Clinical groups used evidence based guidelines. SCs used care plan generator which gave guide to recommended services for main conditions over 12 m. GPs conducted medical assessment and agreed services. SCs organised access to services and coordinated patient education, made follow up contacts (phone and face to face) over 12 months. GP contact 1/month, SCs wrote 3 monthly reports, Project leaders (specialists) supported GPs & SCs for reviewing care plans & conducting case conferences for complex cases. Pooled medical fund s for reallocation to reduce emphasis on secondary acute care and increase delivery at primary level.	2
Chew-Graham 2007 Burroughs 2007 (qualitative) UK	To test the feasibility of a collaborative care model for the management of depression in older people: The PRIDE trial (Primary Care Intervention for Depression in the Elderly)	Mean age 75.5 yrs 72%women, 53% living independently in own homes. Mean score for symptoms of depression 5.8 (range 2-9); MMSE >=24 Setting; Community (43 practices in one primary care trust)	**CHRONI CARE** IG: Collaborative care managed by a CPNN=53 CG: Usual GP care N= 52FU 83.8% A nested qualitative study of health professionals and patients regarding the acceptability and effectiveness of intervention	Care managed by a CPN, delivered facilitated self-help programme, close liaison with primary care professionals & psychiatrist according to a defined protocol. Structured assessment, education, manual facilitated self-help intervention (SHADE) sign-posting to other services, e.g voluntary agencies. Referral to the study was by GPs, practice, district and community nurses Intervention12 weeks: six face-to-face sessions in patient's home, five telephone contacts. Compliance ensured by regular supervision of the CPN with the author SHADE. Reviewed progress every 4 weeks, personal and written regular contact with GP	2

Ollonqvist 2008, 2007 Hinkka 2007, 2006 Finland	To compare networked- based rehabilitation programme with use of standard health and social care services on used formal and informal support	Mean age 78.4yrs; 86% women; approx 70% living alone, 42% Living independently at home. High risk of institutionalisation, eligibility for SII care allowance. Setting: rehabilitation centres, patient's home	**CHRONIC CARE** IG: Network based rehabilitation to increase independence living in community N=343 CG: Standard social & health care services N=365 FU 88.8%	Key members of the team: Physician, PT, OT, SW. Team leader unclear. Existing team since 2000 having joint funding budgets Three inpatient periods at rehabilitation centre in 8 months. Individual CGA, home visit (OT,PT), follow up visits for recommendations by MDT; municipality representative took part in two thirds home visits 53 networks operating in 46 municipalities and 12 rehabilitation centres, 44 networks in 41municipalities and 7 rehabilitation centres. Rehabilitation centre for 3 stays, evaluation (5 days), followed by home assessment , rehabilitation (11 days), follow up after 6 months (5 days)	3
Llewellyn-Jones 1999 Australia	To evaluate the effectiveness of a population based, multifaceted shared care intervention for late life depression in residential care	Mean age 84.9 yrs, approx 70% widowed; elderly people with depression and without severe cognitive impairment Setting: Self care residential unit and hostel	**CHRONIC CARE** IG: Shared care intervention for depression N=109 CG: Routine care; N=111 FU 76.8%	a) MD consultation & collaboration, b) training of GPs and carers in detection and management of depression, c) health education programmes Assessment, counselling/advice, care support, monitoring, referrals, rehabilitation, protocols. Care primarily delivered by GPs and residential staff, with specialist help. GP, resident, staff, psycho-geriatric service, project team members met regularly to ensure programme feasibility and acceptability. Regular monthly meetings, team leader not specified.	2
Byles 2004 Australia (Byles 2002 Qualitative)	To assess the effect of home-based health assessments for older Australians on patient outcomes and hospital/nursing home admissions	Community dwelling older veterans & war widows, aged 70 years+; Setting: Home	**PREVENTIVE CARE** IG: 1.Annual visit and report to GP and telephone follow up 2.As group 1 with second report to GP after telephone follow up 3. Six monthly visits and report to GP and telephone follow up after each visit 4.As group 3 with second report to GP after each telephone follow up	Semi structured interviews; telephone follow up; annual visits with reports to GP Home visits, assessments, referrals, advice/counselling, Care planning; Team funding/ team leader not specified Assessments conducted by Ns, SWs, psychologists, PTs, OTs. Each professional attended two regular training workshops. Health professionals collaborated with Divisions of General Practice, Aged Care Assessment teams and Community Options.	3

			N= 942 CG: usual care N=627; FU 69%		
Hendriks, 2005, 2008a; 2008b (economics) Netherlands	To evaluate the effects and costs of a multidisciplinary intervention programme on recurrent falls and functional decline among elderly persons at risk	Mean age 74.5 yrs, 67% women, 43% living alone. Recently discharged from hospital, assessed by GP cooperative for a fall without cognitive impairment Setting: Home	**PREVENTIVE CARE – HOME BASED** IG: Multidisciplinary falls prevention programme N=166 CG Usual Care (no standard approach for systematic assessment of falls risk) N=167; FU=77.5%	Systematic medical assessment by a geriatrician, GN, a rehabilitation physician in the hospital. Summary/Referrals/recommendation sent to patient's GP for action. OT home assessment (3m after ER admission), referred to social services with recommendations. Team leader not clear Involved counselling/advice, care planning, health education/information, referrals	2/3
Hogan 2001 Canada	To evaluate a standardised, multidimensional, in-home assessment for falls prevention in elderly people who had fallen	Mean age 78.0 yrs, Most in private dwelling; 10% residential, 70% high risk of falling (fallen in previous 3 months) Setting: Community-private dwelling (few in residential facility)	**PREVENTIVE CARE-HOME BASED** IG: Standardised Multidimensional Fall assessment program N=79 CG: Home visit from recreational & leisure involvements N=84; FU 85.3%	Assessors: A specialist in geriatric medicine, 2 Ns, 2 OTs, PT who were trained and had volunteered their time to develop and implement the fall assessment program. Team leader not specified. Initial visit was 1-2 hrs; Assessors met to agree care plans (20 mins/subject). Exercise class provided at day hospital. After intervention, return visit after 6 months to document adherence. Assessment, advice, care planning, medication, referrals, provision of aids/devices.	2
Reuben 1999 USA Keeler 1999 (cost effectiveness)	To assess the effectiveness of CGA consultation coupled with an adherence intervention on health outcomes	Mean age75.8 yrs; 63% living alone; >80% women, people with falls, incontinence, depression, or functional impairment (on screening) Setting: Community,	**PREVENTIVE CARE – OUT PATIENT** IG: CGA consultation plus intervention to achieve adherence N=180 CG: usual care from primary care physician plus non-medical	SW, GN practitioner/ geriatrician team, PT (when indicated by falls or impaired mobility); Geriatrician led, with one of six on a rotating basis Interdisciplinary case conference after assessment. Recommendations given to patient and his/her primary physician. Patient phoned by health educator 2 weeks later to discuss recommendations. Adherence monitored at 3 m and 15 m Adherence component designed to empower patients and improve patient-physician communication ; Integration within existing health care systems, makes it suitable for Medicare HMO.	3

		outpatient	recruitment incentives	Community based screening rather than referral or case finding can be conducted by mail or phone.	
			N=183		
			FU 97% completed trial		

IPW inter-professional working, CM Case manager/management, CPN Community psychiatric nurse, DN District Nurse, GN geriatric/gerontology nurse, GP General Practitioner, N nurse, OT Occupational therapist, PN Practice nurse, PT physiotherapist, RN registered nurse ,SW Social worker, MDT Multidisciplinary team, IDT Inter-disciplinary team, CGA Comprehensive geriatric assessment, DP Discharge planning;Applicability score 1-4 NICE criteria: 1.Applicable across a broad range of populations and settings; 2. Applicable across a broad range of populations and settings assuming they are appropriately adapted; 3. Applicable only to populations or settings included in the studies, and broader applicability is uncertain;4. Applicable only to settings or populations included in the studies

Table 3 Integrated Team Model: Key characteristics of included studies according to type of care (acute, chronic, palliative, preventive)

Study ID/Country	Research Aims	Population & Setting	Type of care, intervention IG Intervention Group; CG Control group Sample size (N), Follow up (FU)	Organisation of IPW	Applica-bility
Cunliffe 2004 UK	To evaluate the effect of an early discharge and rehabilitation service (EDRS) in Nottingham (UK)	Mean age 80yrs, 67% women, 67% living alone, recently discharged from hospital, at risk of worse outcomes Setting: hospital (DP) and home	**ACUTE CARE** IG: Early discharge & rehabilitation N=135 CG: Usual hospital care included existing after-care services N=142	Existing team (from 1998): 2 OTs, 2 PTs, 3 nurses, a Community Care Officer (liaising with social services), 7 <u>trained</u> rehabilitation assistants , medical care by hospital doctor and GP as required; no doctors on EDRS team. Team organisation/leader/joint funding unclear; funded by local health authority Assessment, care planning/support, DP, follow-up care, education (skills), monitoring, rehabilitation; EDRS with individual packages of care: up to 4 visits/day, 7 days per week, duration up to 4 weeks	3
Harris 2005 New Zealand	To compare the safety, effectiveness, acceptability and costs of hospital-at-home (HAH) with usual acute hospital inpatient care	Mean age 80 years, Admission prevention, or early discharge Setting: Home	**ACUTE CARE** IG: Nurse led HAH outreach programme N=143 CG: Standard hospital inpatient care N=142 FU 88.8%	Professional MDT support, individualised care planning: OT, PT, SWs, Registrar, consultant geriatricians, patients' GPs. Nurse led MDT coordinated care in patient's home. Consultant geriatrician had lead responsibility, care shared with patent's GP as required. Daily nursing review, intensive home support , 24 hr on-call, live- in home carer. Assessment, counselling/advice, care planning/ support, monitoring, medication, outreach, rehabilitation	2
Hughes 2000 USA Multi centre	To assess the impact of Team Managed Home-Based Primary Care (TM/HBPC) on patient outcomes and costs of care	Mean age 70 yrs, mostly men, >80% lived with care giver, 30% low income. Hospitalised terminally ill patients and/or with functional impairments	**ACUTE & PALLIATIVE CARE** Terminal (N 188) & Non-terminal (N906) groups. IG: DP & post discharge care, TM/HBPC N=981 CG: VA sponsored services, if eligible, (except	Physicians, SWs, dieticians, therapists, pharmacists, health technicians, paraprofessional aides, primary care manager; Monthly Team conferences to discuss protocol; Team leader not specified, home based physician served as PCP. Continuous home care (included palliative care) until maximum patient benefit, or a different level of care was required, 24 hour contact, prior approval of hospital readmission, HBPC team participated in DP and management. 1883 care givers. 2 day training of study personnel. Intervention included integrated networks, screening for high risk, management across	3

		Setting: Home 16 veterans affairs (VA) centres with HBPC programs	HBPC), usual post acute services N=985, Power calculation not reported FU 66.6% (6m), 33.9% (12m) completed trial	organisational boundaries. *Mean visits: 0.85 physician,, 3 nursing,, 0.5 SW/month. Physicians input 24.3 hours/m*	
Melin 1993 Sweden	To examine the impact of a primary home care intervention program on functional status, use and costs of care	Mean age 80.0yrs, 71% women; over 70% widowed or living alone High risk of dependency, recently discharged from hospital Setting: Home	**ACUTE CARE** IG: Coordinated post discharge rehabilitation in the home N=150 CG: Usual post discharge care N=99, Power calculation not reported FU 73.5% (completed data)	Physician led home care with a 24 hour service Team: Project physician, a primary care team physician, DN, PT, OT, assistant nurse, secretary. Care reviewed at weekly team conferences conducted by the project physician, and attended by DN, home service assistant, consultant geriatrician, psychiatrist . Team physician coordinated post hospital care & rehabilitation. Assistant nurse assessed patients; OT, PT conducted home visits & initiated rehabilitation; DN administered 24 hr medical & social services. Care planning/support, monitoring, referrals Home visits: Physician every week day; DN's, nurse assistant, home aides when needed.	2
Nikolaus 1995, 1999, 2003 Germany	To evaluate the effect of a home intervention program by a multidisciplinary team (HIT) on older people with functional decline	Mean age 81.5 yrs; over 70% women; frail elderly recently discharged from hospital Setting: Hospital and home	**ACUTE CARE & PREVENTIVE** IG: CGA & HIT, post discharge falls prevention N=181 AG: (Assessment) CGA with GP recommendations for post discharge care N=179 CG: Usual care N=185; FU 77%	HIT: geriatrician, nurses, PT, OT, SW, secretary; First home visits by OT,nurse or PT, a home visit after discharge, 3m after services in place, one year after randomisation. Team leader not specified, newly created team, joint budgets Patient contact monthly by telephone to discuss falls, related injuries. Assessment, advice, care planning/ support, reablement, monitoring	3
Richards 1998 Coast 1998 (cost effectiveness)	To compare the effectiveness and acceptability of early discharge to a hospital at home scheme with that of	Median age 79yrs; approx 70% women, 51-56% living alone: recently discharged from hospital, and requiring hospital care in absence	**ACUTE CARE** IG: HAH and rehabilitative care N=160	Service provided for health care, with minimum essential domestic tasks DN coordinator, N, senior PT & OT, support workers, 1 OT technician as required Max case load (n=12, for orthopaedic, less for high dependency) at any time	2

UK	routine discharge from acute hospital	of MDT Setting: Hospital and Home	CG: Standard inpatient hospital care N=81 FU 86.3%	Team leader: DN Coordinator; Patient's GP had clinical responsibility, frequency of association not specified. Assessment, care planning/support, monitoring, medication, rehabilitation	
Weinberger 1996 USA	To evaluate the effect of an intervention designed to increase access to primary care after discharge from the hospital, on patient outcomes and resource use	Mean age 63.0 yrs, Older people, mostly men, at risk of readmission; recently discharged from hospital, (hospitalised for general medical conditions) Setting: Inpatient & outpatient (9 VA centres)	**ACUTE CARE** IG: DP & post discharge care by primary care nurse (PCN) and PCP N=695 CG: Usual post discharge care with no access to primary care nurse for assessment N=701 FU 83%	Care provided by one licensed registered VA nurse, one PCP, Study Ns had experience with VA, nurse coordinated care, 9 VA centres. 96 attending physicians (most specialised in internal medicine, few family practice), 6 fellows in general medicine, 12 house staff, mean of 4.8 years of VA experience. PCN assessed patient's post discharge needs; telephoned patient within 2 days after discharge to assess needs, provide advice. PCP and PCN reviewed & updated treatment plans at the first post discharge appointment, monitored progress, used protocols. 89% patient compliance with protocol.	3
Banerjee 1996, UK	To investigate the efficacy of intervention by a psycho geriatric team in the treatment of depression in elderly disabled people receiving home care	Mean age 80.4 yrs, 85% women, 82% living alone, receiving home care from local authority, but not under psychiatric care for depression Setting; Home	**CHRONIC CARE** IG: Team based psychogeriatric home care (Naturalistic model) N=69 CG: Usual GP care N=33; FU=88.4%	Individual package of care and management plan formulated by a MDT. CPNs, OT, medical staff, SW, psychologist for any combination of interventions; each person had key worker, and implemented by researcher. All team members may be assigned any case referred. Existing team. IG differed in their management only by their all being assigned a doctor. Type of care: Physical, psychological, social interventions, assessment (both groups), counselling/advice, care planning/ support, monitoring, medication, referrals, CM	2
Bernabei 1998, Italy	To evaluate an integrated medical & social care programme among frail elderly people living in the community	Mean Age 80.7 yrs, 71% women, multiple geriatric conditions Setting: Community, home	**CHRONIC CARE** IG: Integrated care (medical/social services) & CM, N=99 CG: Usual primary & community care, N=100 FU & power calculation not reported	Community geriatric evaluation unit (GEU) included geriatrician, SWs, Ns, 2 CMs did assessments, reported to GEU. Individualised care plans by GEU in agreement with GPs. MDTs met weekly. Segments of team already existing but integration newly created, joint budgets. CMs conducted initial CGA, and every 2 months after; provided extra help as requested by patients & GPs, latter conducted physical examination; Care included support, DP, medication, rehabilitation, CM	3

Montgomery 2003 Canada	To examine the impact of enhanced access to geriatric assessment and case management on resource use	Mean age 81.4 yrs; 69% Women, 89% good social support; 59% lived alone, frail elderly at high risk of adverse health outcomes, recently discharged from hospital Setting: Home	**CHRONIC CARE** IG: Comprehensive CM with enhanced access to services N=82 CG: Home care coordinator and usual followup N=82 FU 92.7%, Power calculation not reported	Trained Coordinator, geriatrician (If acute care hospitalisation was required clients were referred back to their GP), day-hospital team. Newly created team but referrals from existing team CGA and individual care plan developed upon referral, reviewed with geriatrician & day hospital team, with MD input to patient care. CM, multidimensional assessment (included social support) by trained coordinator, & enhanced access to geriatric medical & day hospital services. Options included home assessment by geriatrician/ team members Day-hospital assessment by appropriate team members & referrals (planned within one week), fu 3 months to ensure provision of required resources	2
Sommers 2000 USA	To examine the impact of an interdisciplinary, collaborative practice level intervention for community dwelling seniors with chronic illnesses	Mean age 78 yrs, approx 70% women, elderly with chronic conditions and at high risk for hospital readmissions. Controls less likely to live alone and use support services Setting: Home	**CHRONIC CARE** PCPs randomised IG: The Senior Care Connection (SCC) intervention N=280 CG: Physicians did not re-review patients N=263 FU 79.4%, Power calculation not given	Close collaboration among a PCP, RN, Master's qualified SW. N/SW divided time among 3 intervention physicians. IP team met 24 times during 18 months; clinicians attended 9 educational sessions taught by geriatricians; team requested continuation of SCC in 2/3 counties, funded locally. 9 teams: Ns/SWs trained to learn team building, strategies to coach patients in chronic disease management. Assessment, discussed by team, risk reduction plan. Monitoring through office visits, phone calls, home visits, coached self management, promoted service use, monthly review. 14 months fu. SCC had at least 1 face to face contact (other than initial home assessment) with N/SW. Patients averaged 34 N/SW contacts, 22 min duration, every 21 days, most by phone	4
Brumley 2007, 2003 USA	To determine whether an in-home palliative care (IHPC) intervention for terminally ill patients can improve patient satisfaction, reduce costs, and increase the proportion of patients dying at	Mean age 73.8yrs, 49% women, most lived in own home/apartment; 33% low annual income Terminally Ill patients, 2 sites with similar demographics except for minority ethnic Colorado 10%; Hawaii	**PALLIATIVE CARE** IG: IHPC program plus usual care N=155 CG: Standard care followed Medicare guidelines for home healthcare N=155	IDT responsible for coordinating & managing care across all settings, home based visits, assessment, counselling, evaluation, planning, care delivery, follow-up monitoring, continuous reassessment of care. Palliative care physician (team leader), patient & family, PCP, N, SW (experienced in symptom management & psychosocial intervention). Spiritual counsellor, bereavement coordinator, home health aide, pharmacist, dietician, volunteer, PT, OT, speech therapist, joined the core team as needed.	

home	63% Setting: home & hospice care, HMO	FU 95.8% (data available) Colorado: HMO contacts outside service providers Hawaii: HMO provides all care, accepts referrals, refers patients to outside providers for hospice care only.	IDT developed care plan according to wishes of the patient/family. Telephone interviews (approx 20 mins) within 48 hours of enrolment IHPC program added three modifications to the standard care: no requirement for physicians to give 6 month prognosis of life expectancy, patients continue to have curative/primary care, and a palliative care physician coordinating care from health care providers.	
Hughes 2000 USA Multi centre *See acute care*	To evaluate a Team Managed Home-Based Primary Care (TM/HBPC) in elderly people living at home *See acute care*	Mean age 70 yrs, mostly men, >80% lived with care giver, impairments 16 VA centres with HBPC programs *See acute care*	**PALLIATIVE & ACUTE CARE** Terminal (N 188) & Non-terminal (N 906) groups. IG:DP & post discharge care, TM/HBPC included palliative care N=981 CG: Usual care & VA services *See acute care*	Physicians, SWs, dieticians, therapists, pharmacists, health technicians, paraprofessional aides, primary care manager; Monthly Team conferences to discuss protocol; home based physician served as PCP. Continuous home care (included palliative care) until maximum patient benefit, or a different level of care was required, 24 hour contact, had care givers. Intervention included integrated networks, screening for high risk, management across organisational boundaries *(see acute care)*	3
Counsell 2007 USA	To test the effectiveness of a geriatric care management model on improving the quality of care for low income seniors in primary care	Mean age 72 yrs, approx. 75% women; 45% living alone, >85% County Medical Assistance Setting: Home	**PREVENTIVE CARE – HOME BASED** IG: GEM, Geriatric Resources for Assessment and Care for Elders (GRACE) N=474 CG: access to all primary and speciality care services available as part of usual care N=477 FU 77.9% (24months)	3 GRACE teams: Nurse practitioner, SW. IDT meeting after assessment, to prepare care plan in collaboration with GP. Patients received 2 years of home-based care management by an IDT guided by 12 care protocols for common geriatric conditions, and web based care management tracking tool. Annual in home reassessment of care plan, support, monitoring, medication, referrals. Integrated pharmacy, mental health, home help, community based inpatient geriatric care. Patient visits as appropriate, - minimum of 1 in-home follow up visit to review care plan, 1 telephone/ face-to-face contact/ month, & face- to- face visit after ER visit or hospitalization.	3
Nikolaus 1995, 1999, 2003	To evaluate a falls prevention programme by a multidisciplinary	Mean age 81.5 yrs; over 70% women; frail elderly recently discharged from	**PREVENTIVE CARE-HOME BASED & ACUTE CARE**	HIT: geriatrician, nurses, PT, OT, SW, secretary; First home visits by OT,nurse or PT, a home visit after discharge, 3m after services in place, one year after randomisation. Team leader not specified, newly created team, joint budgets	3

Germany	team (HIT) *See acute care*	hospital Setting: Hospital and home	IG: CGA & HIT, post discharge falls prevention N=181 AG: CGA plus recommendations N=179 CG: Usual care N=185, FU 77%	Patient contact monthly by telephone to discuss falls, related injuries. Assessment, advice, care planning/ support, reablement, monitoring *See acute care*	
Boult 2001, USA Boult 1994, 1998, Morishita 1998	To measure the effects of outpatient GEM on high-risk older person's functional ability, use of health services and satisfaction	Mean age 78.8 yrs, 55% men, most in independent residence, high risk for hospital/nursing home admissions, recently discharged from hospital Setting: Ambulatory clinic in community hospital	**PREVENTIVE CARE - OUTPATIENTS** IG: CGA and GEM N=294 CG: Usual care from physician N=274 FU 97% completed interviews, power calculation not given	3 existing teams each with Geriatrician, GN, N, SW, delivered primary care A 4-step enrolment & CGA process, 24 hours on call services, IDT diagnosed and treated all problems, developed care plans together, included referrals, used protocols, assigned individual responsibility for specific follow up actions. Liaison with PCP. Individual team members met patients monthly. Home visit by GEM SW. 2 visits to GEM clinic to see GN & geriatrician, (free transport if needed), plus telephone contact.. Average intervention 6 months then discharged to PCP with recommendations. Each team had case load of 45-52 active patients, clinic one day per week, with average of 11.5 patients. Visits approx 90 mins. *Contacts:* nurses 23.5/week,total weekly time by staff 216 mins; *Referral* services used most frequently were physician consultations 44.9% for GEM	3
Burns 2000, 1995 USA	To compare the effectiveness of long-term primary care management by an interdisciplinary geriatric team with usual ambulatory care	Mean age 71.7 yrs, mostly men, VA. High risk, recently discharged from hospital, activities of daily living (ADL) deficits, multiple conditions (excluded terminal ill, dementia, risk of nursing home	**PREVENTIVE CARE - OUTPATIENT** IG: GEM clinic, Individualised follow up indefinitely N=60 CG: Usual care. In-patient evaluation/rehabilitation provided in extended care units/rehabilitation units.	IDT: physicians, NPSW, psychologists, clinical pharmacists. GEM team did not always control hospital admission, which could occur via other mechanisms (e.g. emergency room, speciality clinics). Initial assessment involved the entire team (2 hours), team individualised plans including follow up & aftercare, long term management, referrals, rehabilitation Follow up in GEM clinic, was with most clinically appropriate health care professionals/team members for ongoing care and consultations. No set scheduled return visits for patients.	3

		admissions) Setting: Outpatient Clinic	N=68 FU 76.6% (deaths reported)		
Cohen 2002 USA (See Schmader 2004)	To assess the effects of inpatient units and outpatient clinics for geriatric evaluation and management on survival and functional status	Mean age 74.2 yrs, men, hospitalised on a medical or surgical ward, frail elderly, high risk of hospitalisation Setting: Multi centre randomised trial at 11 VA medical centres; (Hospital inpatient and outpatient clinic)	**PREVENTIVE CARE - OUTPATIENT** IG 4 group design: inpatient GEM or usual care followed by outpatient GEM or usual care. N=692 CG received all appropriate hospital services except for those provided by the team on the GEM Unit. N=696; FU 78.6%	GEM inpatient & outpatient teams, each consisting of a geriatrician, SW, N followed standard GEM protocols for screening ,developing care plan, preventive and management services. Included CGA to evaluate the caregiver's capabilities, patient's social situation, care plan discussed twice a week by GEM team. Counselling/advice, care planning, monitoring, medication, rehabilitation, coordinating services, use of protocols.	3
Schmader 2004 USA (see Cohen 2002	To evaluate inpatient or outpatient GEM on adverse drug reactions & suboptimal prescribing	Demographics as above; frail elderly people at risk of adverse drug reactions and under-prescribing of medications.	**PREVENTIVE CARE** GEM Outpatient As above 11 VA clinics	All 11 inpatient and outpatient GEM programmes had a core team that included a geriatrician, SW, and nurse. Pharmacists performed regular assessments and recommendations regarding medications in seven inpatient and six outpatient teams. Teams without a regular pharmacist had access to one to review medications. For GEM patients, teams implemented evaluation and management protocols.	3
Englehardt 1996 USA Toseland 1996; 1997	To compare the effectiveness , service use and costs of outpatient GEM with usual primary care	Mean age 71.7 yrs, VA, frail elderly, high risk, recently discharged from hospital> = 2 ADL limitations, not receiving oncology, rehabilitation home or day care Setting: Outpatient Medical Clinics	**PREVENTIVE CARE- OUTPATIENT** IG: GEM, with CGA & coordination with other providers within and outside VA. N=80 CG: Usual primary care N=80 FU 76.9%	GEM team: NP, a board certified geriatrician, SW. GEM provided CGA, care planning/support, monitoring, referrals, rehabilitation, care management Care provided by NP, Geriatrician served as consultant to NP and supervised patients' care. SW coordinated team activity and addressed patient s' and caregivers' psychosocial/ financial needs and referrals. Social work services rendered on a consultation rather than a routine basis	3
Epstein 1990 USA	To evaluate the benefits of CGA for elderly ambulatory patients on mortality,	Mean age 77 yrs, approx 50% women, te, low socio-economic status, high risk (re-	**PREVENTIVE CARE - OUTPATIENT**	CGA included 2 hour examination by a geriatrician, GNP, a geriatric SW. Geriatricians examined patients & reviewed records. Nurse conducted assessment	3

	health care use, satisfaction and health status	hospitalisation); recently discharged from hospital Setting: Out patient Mixed setting-HMO; Co-location-Rhode Island & Providence, RI.	IG: GEM team, extra medical attention, including CGA N=185 SO: Second opinion internist (no special geriatric training); N=210 CG: Usual HMO inpatient care or outpatient care (attending physicians/ house staff); N=205 FU=89.7%	SW reviewed social support, function, economic & environmental issues. Emphasis on minimising the use of multiple different personnel to ensure coordinated care among the teams, hence 10 geriatricians but only 3 N-SW teams(new). Care planning, referrals, use of protocols, targeted continuity of care Team meetings for care planning, consult inpatient & family (15mins). Non structured 1 hour assessment from SO Group.	
Fordyce 1997 USA	To develop and test an assessment which is able to measure changes in participants' health/functional status	Older people aged 65 and over, 55% women 30% low/moderate income, fair or worse health at risk of rehospitalisation. Setting: Hospital outpatient clinic and patients' own home	**PREVENTIVE CARE - OUTPATIENT** Senior Team Assessment and Referral Program (STAR) (Original random assignment IG N=1000, CG N= 1000) IG: GEM Outpatient plus home N=326 CG: Usual medical care; originally drawn from the Kaiser Permanente health plan N=764; FU 75.7% completed evaluations	STAR offered minimally staff intensive model, for a short but comprehensive health appraisal Annual GEM plus in-home evaluation by NP, (appeared to be team leader), findings to STAR team (geriatrician, health educator, geriatric psychiatrist), recommendations to PCP, participants & PCPrs. NP undertook CM, usually by phone, to monitor implementation of recommendations, Weekly team meeting and regular CM follow up by Team Conferences. Good ongoing communication among STAR team, NP and PCPs. Assessment, counselling/advice, care planning /support, monitoring, referrals, CM	3
Phelan 2007 USA Cluster randomised trial	To evaluate the effect of a team of geriatrics specialists on the practice style of primary care providers (PCPs), the functioning of their patients aged 75 and older and hospital admissions	Mean age 81 yrs, 65% women, 45% living alone, vulnerable patients recently discharged from hospital Setting: HMO Outpatient clinics	**PREVENTIVE CARE - OUTPATIENTS** PCPs (Intervention & Control Practices) IG: Senior Resource Team (SRT) assessment screening & evaluations N=434	SRT: geriatric specialist clinicians, geriatrician, gerontological advanced RN practitioners, (off site) pharmacist with specialised geriatric training. Nurses conducted full assessments (1 hour), follow up (face to face & telephone) after 2 weeks during which time team discussed medications, care plans. Gerontologist met patient on return visit. Goals set. Medication changes as needed and other interventions. Pharmacists made recommendations on medication to the advanced nurses before follow up. Geriatrician and nurses reached consensus on patient priorities after assessment. Care support, advice monitoring, reablement	4

			CG: Usual care N=442 FU 78%	SRT met weekly to address team operations and ensure that they were following a standard approach with each patient. Team leader not specified	
Silverman 1995 USA	To evaluate the process and outcome of outpatient consultative geriatric assessment compared with traditional community care.	Mean age 74.6 yrs, over 75% women, 59% lived alone, 68% low income Medicare or Medicaid with instability (change in health status) Setting: Hospital Outpatient clinic (Geriatric Assessment Unit (GAU))	**PREVENTIVE CARE - OUTPATIENTS** IG: Outpatient consultative geriatric assessment. CG: Usual care from physicians in the community	Core assessment team: an internist (specialist) in geriatric medicine, GN, geriatric SW. Team leader not clear Team provided outpatient CGA & evaluation, generated a comprehensive care plan . (About 4 hours/patient). Family conferences conducted after assessment to discuss the treatment plan with patient/family. GAUs did not provide any rehabilitative services directly, accepted referrals directly from families, social services, physicians, recommendations communicated to referring physicians by telephone and/or letter; some were implemented directly by the GAUs. The format for communication was not standardised.	4

IPW inter-professional working, CM Case manager/management, GEM Geriatric Evaluation & Management, CPN Community psychiatric nurse, DN District Nurse, GN geriatric/gerontology nurse, GP General Practitioner, N nurse, OT Occupational therapist, PCP Primary care physician, PN Practice nurse, PT physiotherapist, RN registered nurse ,SW Social worker, MDT Multidisciplinary team, IDT Inter-disciplinary team, CGA Comprehensive geriatric assessment, DP Discharge planning, HMO Health maintenance organisation

Applicability score 1-4 NICE criteria: 1.Applicable across a broad range of populations and settings; 2. Applicable across a broad range of populations and settings assuming they are appropriately adapted; 3. Applicable only to populations or settings included in the studies, and broader applicability is uncertain;4. Applicable only to settings or populations included in the studies

Table 4 Case Management Model: Outcomes according to type of care (acute, chronic, palliative, preventive)

Study ID/Country (Quality - low, + medium ++ good)	Effectiveness on health, function & quality of life outcomes	Effectiveness on resource use	Processes of care	Evidence summary
Beland 2006a,b,c Canada (-)	**CHRONIC CARE: SIPA model** 12 months Health, level of activity, functional limitations, ADL(Barthel Index, BI): IADL(Older Americans Resources Services, OARS): No difference Cognitive health (short portable mental state questionnaire): No difference Depression (Geriatric depression scale, GDS) : No difference	22 months Awaiting placement in acute care IG 5%, CG 10%, p=0.001 Care accessed: home health care (increased) OR 1.72 (95% CI 1.20,2.46) home social care (increased) OR 2.16 (95% CI1.60, 2.91) Alternate level of care (reduced) (bed blockers OR 0.52 (95% CI 0.33,0.82) ED, hospital, NH: No difference *Costs for SIPA* Community care 44% higher Hospital & NH 22% lower Home health care increased with no. of chronic diseases Cost savings for NH greatest for people with <4 chronic diseases; NH costs for users living alone < CG Hospitalisations < CG for people with low ADL	Patient & carer satisfaction increased (no data) Equivalent or improved quality of care (CSQ-10) (no data) Access for health & social care increased Qualitative data: Achieved clinical responsibility, on call services, information sharing between providers, rapid &flexible use of resources Inter-disciplinary working with physicians input *Other:* CM is learning process Financial responsibility concerned with costs Better co-operation with physicians & collaboration with partners/providers required	SIPA reduced bedblockers, hospital utilisation, for those with increased ADL disability, improved access, satisfaction, QoL, overall cost neutral
Enguidanos 2006,2003 USA (-)	**CHRONIC CARE: Geriatric care management with purchase of services (POS)** 12 months (Data not given) ADL (Katz): No difference	ER visits, physicians visits, hospitalisations: No difference	44% participants used POS, >50% for domestic use. Barriers: Establishing contractual agreements between	Evidence of no effect on any outcomes.

	Cognitive (Telephone Interview for Cognitive Status): No difference		agencies	
	Depression: Non-significant trend for reduced effect in POS		Locating appropriate service	
			Delaying use of POS benefit	
	Other			
	Care giver burden (Burden Interview Scale): Reduced in both groups (p<0.001)			
	Deaths: No difference			
Leung 2004 Hong Kong (-)	**CHRONIC CARE: Intensive CM** 6 months Minimum Data Set-Home care assessment Mental function: No difference (ns trend for improvement) No health problems: No difference Continence: MD -0.19 (-0.3, -0.05) Mood symptoms: IG -0.9, p<0.006, CG -0.9, ns Behavioral symptoms ; No difference (ns trend for improvement)	Hospital admissions (unplanned) (decreased) , IG -36.8%, CG -20.4%, p=0.01 Hospital bed days (decreased), IG -53.1% , CG -4.4%, p<0.05 ER, community nursing, day hospital use: No difference Informal support: IG +0.8, p<0.006 CG +0.8,p<0.006; trend for improvement over time (IG +266.7, CG =200) *Costs:* Savings in acute hospital care & community services compared with IG	CMs conducted 361 home visits, 1171 telephone consultations, 145 face to face counselling sessions at the hospital, 424 case discussion meetings, 157 referrals to community health & social services	CM improved mood symptoms, continence, reduced hospital admissions, length of stay, with savings in total health care costs, and a non significant trend towards improved mental functioning, behavioural and informal support
Marshall 1999 USA (Long 1999) (-)	**CHRONIC CARE: CM** 24 months Inconsistent results for all outcomes, baseline differences affected results Self-administered survey	Visits: OP/ED No difference; increased 12 m (p<0.01) *Costs:* IG consumed resources in excess of Kaiser Permanente (KP) average adjusted per capita costs, Hospital: reduced Substitution of OP for inpatient care and decrease in total cost of care in IG relative to CG did not occur.	Satisfaction: No difference 24m Satisfaction: Improved (12m) IG +0.08, CG -0.23, p<0.01	CM did not improve health outcomes and was not effective in changing inappropriate service use pattern or reducing total costs Service use & costs higher in last month of life.

	ADL: IG +0.18; CG +1.4, p<0.01 IADL :IG -0.08, CG +0.38, p<0.05; Health status: No difference, Improved 12 m Deaths: No difference	Analysis in those who died: Costs of IG higher in last month (p = .068). Hospital admissions & OP visits: increased (ns)		
Aiken 2006 USA (-)	**PALLIATIVE CARE:** Phoenix care home based CM 9 months *Physical and mental functioning* SF- 36 (over time): IG > CG,p<0.05 General health, IG >CG p<0.05 Overall difference, p <0.05 Deaths: No difference (*One third died in first 3 months affecting statistical power of study*	ED/ER use: No difference No cost data	IG reported having greater information for self-management, handle emergency, ability to resume an activity they enjoyed. Better prepared for end of life: OR 4.47,(95%[CI:1.10, 18.1) Symptom Control: 78%, 90%, 92% reported at least one symptom at time 0, 3 and 6 m	Phoenix palliative care can improve health & function, with better self management of illness, awareness of relevant resources
Stuck 1995 USA (-) (Alessi 1997, Rubenstein 1994)	**PREVENTIVE CARE** 3 years Research & Service Orientated multilevel assessment instrument (RSO-MLA) Prevention of disability ADL: No difference Dependency ADL IG 12% CG 22%; adj OR 0.4 (95% CI 0,2, 0.8), p=0.02 (improved) IADL : MD 3.0 (95% CI 0.60, 5.40), p=0.02 (improved) ; Dependency: IADL: No difference	Permanent NH home admission(decreased) RR 0.42 (95% CI 0.19, 0.89) Hospital: No difference Decreased no of short stays (1-7 days) among persons with fair/poor self perceived health OR 0.4 (95% CI 0.2,1.0),p=0.05 Cost: Mean visits 10.9 (+/- 3.2) by nurses, extra physician visits, less savings (less NH days), plus non-pay. 4.1 disability free years, i.e. cost of $6000 per disability free	Over 90% participants visited by nurses. No of recommendations: 5694 (mean 28.8/subject) No. of new problems: mean 19.2 Compliance: 47% full, 14% partial, 37% not adhered	CGA can delay the development of disability and reduce permanent NH stays, with no effect in acute hospital or short term nursing home admission. Fewer NH days did not offset cost of intervention and higher physician visits.

	Deaths: No difference	year gained. 692 NH days avoided by intervention, i.e. cost of $35 per day prevented. No changes in use of in home & support services		
Stuck 2000 Switzerland (++)	**PREVENTIVE CARE** 3 years RSO-MLA instrument Dependency ADL/IADL: No difference, adjusted p=0.03 *Low risk*: less dependent in ADL :RR 0.69 (95% CI 0.48-1.00), adjusted OR 0.6 (0.3-1.0, p=0.04) *High risk*: No differences. *Health status low risk group (adjusted for baseline variables) at 2 years:* General health (COOP): No difference Affect (Geriatric depression scale): No difference **Subgroups according to nurses in Zip code areas: Low risk group** *Nurses A and B*: ADL: OR 0.2 (95% CI 0.03,0.07), p=0.009; IADL :OR O.4 (95% CI 0.2,0.7), p=0.005 (improved) Nurse C*: No difference* **High risk group** *Nurses A and B:* ADL & IADL: No	Ever admitted to NH: No difference *Low risk* : No difference *High risk* : (increased) RR 1.93 (95% CI 1.24, 3.00); (adjusted OR 2.1 (95% CI 1.1, 1.4,p=0.02) **Subgroups according to nurses in Zip code areas: Low risk group** *Nurses A and B* NH admissions: (decrease) OR 0.2 (95% CI 0.0-0.6), p=0.004; *Nurse C:* No difference **High risk group** NH admissions (increased) : OR 6.9 (95% CI 2.0-2.8, p=0.002) Deaths: IG 30% CG 19% OR 1.8 (95% CI 0.9-3.7), p=0.06, ns increase **Costs:** **Low risk Areas A and B:** Costs include preventive home visits, ambulatory care (increased visits to primary care professionals) NH use. Home visits: Reduced in year 3 (no follow up) Reduced NH admissions resulted in net savings of $1403 per person/ year,(off set home visit & ambulatory costs)	No. problems identified in IG Nurse A and B > Nurse C, p<0.001 >70% subjects reported home visits were helpful 38% felt more confident discussing problems with their physician 30% increased activity 69% in ZIP code C vs. 52% ZIP A/B, p=0.04, were sorry that visits had stopped	Patients with low baseline risk were less dependent in ADL risk for NH admissions, resulting in net savings. High baseline risk patients had unfavourable increase in NH admissions. Effects could be related to the home visitor's performance in conducting the visits

	differences Deaths: RR 1.40 (95% CI 0.99, 1.97), ns increase			
Data for longest follow up; IG Intervention Group, CG Control Group, RR Relative risk; OR Odds Ratio; CI Confidence Interval; MD Mean difference ; ns Non significant, p< 0.05 significant; SIPA System of Integrated care for older people, ADL Activities of daily living; IADL: Instrumental ADL, CM Case management, ED Emergency department; OP Outpatient, NH Nursing home, QoI Quality of life				

Table 5 Collaboration Model: Outcomes according to type of care (acute, chronic, palliative, preventive)

Study ID/Country (Quality - low, + medium ++ good)	Effectiveness on health, function & quality of life outcomes	Effectiveness on resource use	Processes of care	Evidence summary
Caplan 1999 Auatralia (++)	**ACUTE CARE: Hospital at home (HAH)** 6 months Geriatric complications: Prop of adverse events (decreased) RR 0.72 (95% CI 0.27, 1.93) Urinary & bowel complications reduced significantly but small numbers Deaths: No difference	Unplanned hospital readmissions (small numbers), ns reduction Service use: Nurse 9.0 (one visit per day), GP 0.8, Hospital doctor 0.9, PT 0.2, OT 0.1; Costs: None	Satisfaction survey (mean score 1=excellent) (Draper & Hill) : Patient: IG 1.1 (95% CI1.0,1.2), CG 2.0 (95% CI 1.7, 2.3), p<0.0001 Carer : IG 1.1 (95% CI 1.0,1.2), CG 1.9 (95% CI 1.4, 2.4), p=0.0001, GP: no difference Response rates patients/carers higher in IG (IG78% CG 40%; IG 55% CG. 27% respectively; GPs IG63% CG 37%.)	Home treatment can provide a safe alternative to hospitalisation for selected patients and may be preferable for some older patients, with high patient and carer satisfaction
Garasen 2008 Norway (+) (Garasen 2007 shorter follow up)	**ACUTE CARE:** Intermediate care (IC) in community hospital 12 months: no significant differences between IC group and IG; results shown between IG and CG (did not aim to evaluate health/function) Deaths (decreased): RR 0.57(95% CI 0.31, 1.04), adjusted p= 0.03 Survival (days) IG 335.7 (95% CI 312.0-359.4) IC 335.2 (95% CI 309.8-360.5), p<0.02 CG 292.8 (95%CI 264.1-321.5)	Hospital admissions: No difference No days in hospital: No difference Need for NH care: No difference Need for home care: No difference Days at risk: IG 335.7 (95% CI 312.0-359.4), CG 292.8 (264.1-321.5),adjusted p=0.01 *At shorter follow-up 26 weeks:* Readmissions: IG19.4% CG 35.7%, p=0.03 Long term NH admissions: ns increase	None reported	IC at community hospital is equal alternative to prolonged hospital care, with no effect on need for long term primary level care or hospital use. Fewer were in need of community care services and significantly fewer died. Readmissions reduced significantly at 26 weeks

		Independent of community care IG 25% CG10.0%, p=0.02.		
McInnes 1999 Australia (+) Ranmuthgala 1997	**ACUTE CARE: GP input in Discharge Planning** No health outcomes reported	26 weeks post discharge Length of stay, days to first admission, readmission to hospital: No difference Service use: 52% received GP visit Support services : No difference (ns increase) Recommendation for support services (increased) OR 1.63 (95% CI 1.05-2.54; p=.03) (due to home nursing) Community nursing (increased): OR 2.10 (95% CI 1.29-3.41), p=0.002 Supported accommodation, meals on wheels, home care: No difference Costs: None	Patient satisfaction: RR 1.28 (95% CI 1.14, 1.44) Return home well prepared :RR 1.14 (95% CI 1.05,1.24) Discussion of discharge plan:OR 5.01 (95% CI 2.28,11.00), p < 0.0001 80% IG receiving a pre-discharge visit report found it useful. *GP survey:* 71% would undertake discharge visits with remuneration; 53% complied with request to make remunerated visit; GPs less likely to make visit if only practitioner and if patients more dependent or from NH	Intervention patients were significantly more likely to be recommended for community services, be satisfied and receive enhanced quality of care through better hospital-GP collaboration.
Naylor 1999, 1994 USA (-)	**ACUTE CARE: Comprehensive discharge planning & follow up home care** 4 weeks Functional status (Enforced social dependency scale): No difference Depression (Centre for epidemiological studies depression scale): No effect Deaths: No difference	%readmitted at least once (decreased): RR 0.55 (95% CI 0.39, 0.78), p<0.001 Multiple readmissions (decreased): RR 0.43 (95% CI 0.22, 0.84), p<0.01 Time to first readmission longer in IG p <.001 Visits: Acute care, physicians, ER, home: No difference *Cost:* Total and per patient: CG >2x compared with IG, p<0.001	Patient satisfaction: No difference IG received at least 1 nurse visit	Intervention showed no significant effect on functional status. It reduced readmissions, lengthened the time between discharge and readmission and decreased the costs of providing healthcare

		Savings for Medicare at 6 m: Cost/ patient IG $3630 CG $6661, p<0.001 (re-hospitalisations) Total readmissions: IG $427217, CG $1024218, p<0.001 * cost values were standardized for unequal follow-up by converting to costs per week in the study		
Shepperd UK 1998 a (++) Shepperd 1998b Cost minimisation	**ACUTE CARE:** HAH 3 months (Excluded data for chronic obstructive pulmonary disease, COPD) *Elderly medical (EM) Care* QoL No difference Daily activities: No difference Overall health: No difference ADL (Barthel Index) No difference *Hip replacement*: QoL MD 0.50 (95% 0.13, 0.88), IG improved from baseline Care giver strain index : No difference Deaths: No difference	Hospital admissions: No difference Service use: No data *Costs:* All care groups, Total health care: No difference (COPD patients had high GP costs, p=0.01) *EM care:* High GP costs ((Mann Whitney U test (Median (IQR)):IG 67.84 (45.19-172.83) vs. CG 45.19(15.49-82.95), p<.01) Length of stay IG: reduced differences for all but EM Inpatient hospital more expensive for EM (p<.09). Findings sensitive to length of stay.	*EM Care*: Patients received preferred care: difference 41% (20% to 62%); *Hip replacement*: difference 36% (17% to 55%)	HAH can improve QoL in patients with hip replacement, with no differences in overall costs, except for COPD. Costs were shifted to primary care for EM & COPD care.
Battersby	**CHRONIC CARE**	*Eyre:*	*Qualitative data from patients and professionals*	SA model improved physical function,

2005,2007 Harvey 2001 Kalucy 2000 Australia (-)	South Australia (SA) Health Plus projects (data for non disease specific) (19-27 months from enrolment) Short form survey (SF)-36: *Eyre*: Physical function MD 4.17 (95% CI 0.76, 7.59) (improved) Physical component summary (PCS role) MD 2.14 (95% CI 0.44, 3.84 (improved) *Southern*: PCS MD 2.56 (95% CI 0.49, 4.63) (improved) SF36, WSAS (disability) over time: *Eyre*: , p< 0.05 *Southern* :p<0.05 (WSAS no difference) Deaths: No difference	• Fewer admissions in IG were accounted for by an increase in emergency admissions • >=3 hospital admissions in the previous two years predicted admissions • 33 % likelihood of unplanned admissions per year. • IG increased screening tests. • Domiciliary/community: IG used more services due to improved access. •IG showed net deficit compared to CG (decreased in high risk) •Coordination & extra community services costs •Trial did not achieve cost neutrality.	*(service coordinators (SCs, GPs): (Kalucy 2000)* •40 - 60% achieved sett goals • Structured care plans improved patient's chance of receiving a service *Extent of benefit*: Services were well coordinated, those not accessing care or were at risk of hospital admissions improved most *Effects of care planning:* IG received services according to care plans by GPs, (e.g more screening), adherence depended on timely involvement of GPs, patients, service providers, SCs *Self-management*: Flinders model of support, delivered patient-centred care. Self management capacity incorporated into care planning. Model used to train clinicians across Australia. *Barriers to coordinated care:* Multiple sources of funding, GP focusing on acute care, with *doctors working individually, not in teams (fragmentation),* care should be based on patient's self-management capacity, not just severity *Facilitators:* Patient-centred approach, service coordination in partnership with GPs	access, lowered hospital admissions, but Trial did not achieve cost neutrality. Potential gains in outcomes & costs could be achieved in longer term. Patient centred care and service coordination in partnership with GPs were important
Chew- Graham 2007 UK (-) Burroughs 2006 (Qualitative)	**CHRONIC CARE: Collaborative care model for depression** 16 months Health assessment questionnaire: Disability: No difference		*Qualitative:* • Patients reported difficulty in engaging with the intervention • Dissonance between prior expectations of treatment and their experience; • •Depression not viewed as a legitimate illness to be taken to GP	Collaborative care for older people with depression in primary care, using a facilitated self help intervention is effective and acceptable to patients, but economic evaluation is required.

			• Patients valued contact with empathic and caring person(s) *PCPrs:* Therapeutic nihilism, managing late life depression in their remit, but limitations in own skills, lack of resources for referral.	Therapists' skills for such a model need to be defined.
Pain: No difference *Depression:* SCID >=5 (*Structured Clinical Interview for DSM-IV (Diagnostic Statistical Manual for Mental Disorders)* Adjusted (decreased) OR 0.38 (95% CI 0.15, 0.97), p=0.04 HSCL-20 (Hopkins symptom checklist): No difference Deaths: No difference				
Ollonqvist 2008, 2007, Hinkka 2006, 2007 Finland (++)	**CHRONIC CARE: Network rehabilitation** 12 months Functional independence measure: No difference MMSE decreased IG-0.4, CG-0.9, p=0.05 (borderline) ADL/ IADL: No difference overall Mean increase IADL: IG 0.87 (0.55, 1.99), p<0.0001; CG 0.60 (0.28-0.91), p=0.0003 Subjective health (improved) RR1.94 (95% CI 1.06, 3.55) Deaths: No difference	Institutionalised: No difference Support services: 1.7 fold increase IG compared with CG (p=0.05) (borderline) RR 1.41 (95% CI1.00, 1.96) (due to increase use of transport services) Help from relatives: No difference Municipal services: No difference; IG increased 1.3 fold,(due to transport services) Private home help: No difference CG: Relatives help at follow up declined significantly in oldest (85+) age group. Costs: None	• 93% IG very satisfied / satisfied • Subjective health improved (p=0.04) in IG, decreased in CG (p=0.02 • Half of recommendations implemented within 6 months •Public home help not accessed . *Qualitative data:* (Ollonqvist 2007) *Key workers experience of the model:* • Participated in cooperation in addition to normal work • Networks able to establish stable multisite rehabilitation network-cooperation between 3 agencies •Successful organisational structure was low (small towns) • 'Creators' had experience, enthusiasm, joint working, ability to advance, meet • 'Followers' had difficulties with the process of interagency working	Network rehabilitation improved subjective health, increased use of municipal services, received additional help as ability to manage with daily activities decreased. In Finland, family care aims to complement formal services (health, and social). Longer follow-up required to delay long term admissions

Llewellyn-Jones 1999 Australia (-)	**CHRONIC CARE:** Multifaceted shared care for late life depression 9.5 months Depression (GDS): Significantly more movement to less depressed + X^2 6.37, p=0.012 (MH test for trend) Mean change score: (improved): MD -0.96 (95% CI -0.15, 2.06), ns,p=0.09 (Multiple linear regression, p<0.0001, 50% of variance in GDS scores) Regression coefficient CG vs. IG -1.87(-2.97, -0.76); Standardised regression coefficient -0.22, p=0.0011 *Other* : No of depressogenic drugs: No difference Likely to take more anti-depressants: OR 3.1 (95% CI 0.9,10.2, p=0.066			Depression among elderly people in residential care can be improved by multidisciplinary collaboration, enhancing clinical skills of GPs &care staff.
Byles 2004 Australia (-) (Byles 2002 Qualitative)	**PREVENTIVE CARE:** Home based assessment 3 years QoL SF-36 PCS, adjusted MD 0.90 (0.05,1.76), p=0.04 (improved) Mental health component summary (MCS) adjusted MD 1.36 (0.40, 2.32), p<0.05 (improved) MCS: trend in favour of groups which received 6	Hospital admissions in previous year: No difference NH admissions (adverse) RR 2.85 (95% CI 1.26, 6.45); Estimated average cost per visit $116	*Qualitative data: Allied health professionals (HP)* • HPs positive about delivering intervention, role clarity emerged, confidence with their skills. • comfortable reporting to GPs, who were satisfied with HPs' role *Acceptability to clients*: described participants as 'opening up to them'; one SW identified more previously unreported depression.	Home assessment may improve QoL in the final years of intervention, for groups receiving frequent visits. Assessments may increase the probability of NH placements. May not be considered cost

	monthly visits, adjusted MD 2.3, p<0.01

Logistic regression (median scores):

PCS OR 1.38, p=0.0009 (improved)

General Health OR 1.48, p=0.001 (improved)

Mental function OR1.24, p=0.07 (improved)

Deaths: No difference | | *Collaboration with GPs*: Participants' feedback indicated a favourable response towards visits

Benefits: HPs felt patients need to be seen in their homes; Key concerns: home safety, checking vaccination status, dental health, hearing, abbreviated MMSE seen to be unreliable | effective unless targeted to specific groups. |
| Hendriks 2008a, b, 2005 Netherlands (+) | **PREVENTIVE CARE:** Falls prevention

12 months

Primary: Injurious fall: No difference

>1 fall: No difference

Secondary:

Poor perceived health (RAND SF-36 item) adjusted OR 2.14 (0.96,4.78), p=0.06 (borderline), unadjusted ns

Mental health (HAD): No difference

ADL & IADL (Groningen Activity restriction scale) : No difference

QoL (Euroqol): No difference

Deaths: No difference (small numbers) | Costs: No.of people with a fall during follow up. QALYs from EQ-SD (Hendriks 2008b)

•Overall mean total costs higher (IG €4991 CG 4857)

•No significant differences between groups in any cost category

•27% of incremental cost effectiveness ratios suggests that intervention could be more effective at lower cost than control.

• No significant differences on cost effectiveness ratios, costs and effects

•Healthcare utilisation in both groups comparable | • 89% had a referral/ recommendation •72% medical/ OT assessments

•OTs received 456 recommendations

•Only half asked GPs about referrals/recommendations

• 25% did not receive referrals intended

•75% reported adherence to referrals from GPs /OTs

Possible reasons for lack of effect: •Discrepancy between recommendations and implementation

• Lag between fall and intervention

• Extended implementation period of 3.5 months due to GP involvement | Evidence of no significant differences in costs or outcomes. Results do not corroborate other multifunctional falls interventions.

Implementation research assessing feasibility and barriers to adherence is required. |
| Hogan 2001 Canada (++) | **PREVENTIVE CARE:** Falls prevention

12 months

Cumulative no. of falls: No difference | Service use: (secondary)

Hospital admissions: No difference

Fall related ED visits: No difference | • 81.1% adherence to recommendations •mean risk factors per subject 5.71 (2.4) mean recommendations per subject 4.7 (2.4). | Intervention did not have significant effect on falls or health care use. |

	No. >=1 or >3 falls: No difference	Costs: None		
	Mean no. of falls/subject: No difference			
	Time between falls, increased, p<0.001			
	(due to improvement in sub group with > 2 falls at baseline)			
	Deaths: No difference			
Reuben 1999 USA (++) Keeler 1999 (cost effectiveness)	**PREVENTIVE CARE:** Outpatient CGA 15 months Change score: SF-36 Physical function MD 4.69 (95% CI .63, 8.75) p=0.02 (improved) Restricted activity (no of restricted activity days), MD -2.84 (95% CI -0.75, 4.93) p=0.006 (less) Physical heath MD 1.99 (95% CI0.07, 3.91), p=0.04 (improved) Mental health: No difference General health: No difference Deaths: No difference	Bed days: No difference *Estimated Differences in Utilization and Restricted Days From Treatment:* IG-CG: Psychology, Physiotherapy visits p=0.01 • Intervention costs approx $273 • Utilisation: $37 for first 32 weeks; $47 for second 32 weeks; $73 for 5 years (in excess of CG costs). •Intervention reduced decline in physical function by 4.69 units, 64 week cost/unit of improvement are ($273 +184)/4.69 = $97/unit. •*Total cost per QALY: $10, 600(5 years);Over 64 weeks follow-up,* C/QALY = $26, 500. • Costs/effects estimations are imprecise, results sensitive to changes in key variables	• Patient satisfaction: No difference •96% received the CGA & adherence interventions •PCPrs implemented 59% of physician-initiated CGA recommendations within 3 months. •Patient adherence during follow up: 67% of physician-initiated recommendations, 61% of all self-care recommendations	Intervention can prevent functional and health-related QoL decline, with cost effectiveness comparing favourably with other medical interventions.

Data for longest follow up;IG Intervention Group, CG Control Group, RR Relative risk; OR Odds Ratio; CI Confidence Interval; MD Mean difference (SMD Standardised MD); ns Not significant, p<0.05 significant; ADL Activities of daily living,IADL: Instrumental ADL, CM Case management, CGA Comprehensive Geriatric assessment;GP General Practitioner; ED Emergency department; OP Outpatient, NH Nursing home, MMSE Mini mental score examination;Qol Quality of life, PCPr Primary care professionals; GDS Geriatric depression scale; HAD Hospital anxiety & depression

Table 6 Integrated Team Model: Outcomes according to type of care (acute, chronic, palliative, preventive)

Study ID/Country (Quality - low, + medium ++ good)	Effectiveness on health, function & quality of life outcomes	Effectiveness on resource use	Processes of care	Evidence summary
Cunliffe 2004 UK (+)	**ACUTE CARE:** Early Discharge & Rehabilitation Service (EDRS) 12 months ADL (Barthel Index BI): No difference 3 months (improved) MD 1.2, (95% CI 0.4-1.9) Nottingham Extended ADL : No difference EADL domestic (improved), MD1.4 (95% CI 0.4,2.4) QoL: Euroqol: No difference GHQ patient (improved) MD -1.9 (95% CI -3.50, -0.40), 3 months MD -2.4 95% CI -4.1, -0.7) GHQ carer: No difference (3 months improved MD -2.0 95% CI -3.8,-0.1) Deaths: No difference	Residential status, institution/hospital: No difference Hospital readmissions: No difference NH/residential care readmissions: No difference Length of stay (LOS), median difference: 4 (95% CI 3-7) (decrease IG) Hospital bed days (median difference) 4 (95% CI 1-9) (decrease IG) No. attending geriatric day hospital (decreased) RR = 0.47 (95% CI 0.23-0.56) No. receiving social services : No difference Costs: None	*Qualitative data* • 76% EDRS received services; high satisfaction in both groups • *EDRS* felt to be patient centred, clear goals, team working *EDRS vs. hospital/community services*: • Lonely at home but glad not in institution, • Process of care appreciated. • *EDRS patients* reported caring staff, positive communication, frequent visits, recognised staff expertise, attention to detail, timely provision of care needed *Staff:* reported good EDRS organisation and operation, 'whole person' approach	Older people can be discharged sooner with better health outcomes, using a well-staffed and organised patient centred service. Shorter LOS is not offset by more/longer readmissions to hospital or NH. EDRS is less likely to have OP or day hospital rehabilitation
Harris 2005 New Zealand (+)	**ACUTE CARE:** Hospital at home (HAH) 90 days ADL/IADL(Functional Improvement measure): No difference	Hospital readmissions: Reduction in first 10 days: IG 12.6%; CG 6.4% No difference at final follow up. Average total cost/ patient (NZ$) IG 6524 CG 3525, p<0.0001	*Satisfaction:* Acceptability Good/excellent IG 83% CG 72.5%, X^2 p=0.05 (borderline) RR 1.86 (95% CI 0.98, 3.50)	HAH was more acceptable and as effective as inpatient care. It was significantly more costly than standard inpatient care, largely due to the

	Cognitive Function (MMSE):No difference Health status (SF-36): No difference Mental component summary (MCS): No difference Proportion of falls: No difference Carer Strain (decreased) MD -1.6, p=0.02 Deaths: No difference	Hospital days, pre-discharge & readmissions (IG 11.4, CG 6.6 (explains cost difference) Community care/personal expenditure: No difference Cost/ patient HAH almost $NZ 3000>CG HAH was new service, but operating at full capacity would reduce difference	Feeling under pressure during receipt of service or recommending service to others; No difference	hospital at home programme not operating at full capacity
Hughes 2000 USA (-) Multi centre	**ACUTE & PALLIATIVE CARE:** Discharge & home base primary care (Veterans affairs) 12 months: Terminal (TG), Non terminal (NTG) groups, Treatment effect coefficients (TEC, SE) BI: No difference QoL(SF-36) : Physical function: No difference Mental health: Improved TG, TEC 3.0(2.7), p=0.008, NTG: No difference General health: Improved, TG, TEC 0.9 (2.8), p=0.03 NTG: No difference PCS & MCS: No difference *Bodily pain : improved(TG , NTG: Favoured CG* *Care giver:* Caregiver burden: (objective) Improved NTG, TEC	Hospital readmissions: No difference Number of readmissionsn1-6 months: IG 11% reduction, MD -0.1 (95% CI -0.21, 0.01), P=0.06 (borderline), due to improvement in NTG 12 months: ns NTG severely disabled: (reduction) MD -0.2 (95% CI -0.30, -0.10), p=0.03 12 months: ns *Service use:* LOS (Home care) IG 5.6m CG: 5.9% used hospice care, with a mean LOS 48.5 days; 49% used private home care but did not report same benefit as IG *Costs:* IG: 12.8x >CG MD $+3334, p=0.02; NH: MD$ +416, p=0.02 Difference of $3000 approximately equal to intervention cost , plus $282 (approx)/patient/month Total VA costs: IG18.1% > CG, p<0.001;	Patient satisfaction: TG: No difference NTG : Improved: Access TEC 5.3 (1.1), p<0.001 Communication TEC 8.5 (1.4), p=0.005 Technical quality p<0.001 Interpersonal p=0.001 Outcomes p=0.02 Personal satisfaction: No difference Care giver satisfaction: Improved on all domains in TG and NTG 58% IG discharged within 6 months	Intervention improved st QoL in terminally ill patients, satisfaction among non–terminally ill, improved caregiver QoL, satisfaction with care & caregiver burden. It reduced hospital readmissions but did not substitute for other forms of care. Higher costs should be weighed against the benefits

	-0.7(0.3), p=0.008; TG : No difference QoL: Physical function, mental health improved in TG & NTG PCS & MCS: improved NTG Deaths: No difference	Non VA/private costs: IG 9% lower than CG Sensitivity analyses did not alter findings. *Costs of professionals' visits & physicians 24.3 hours per month not known*		
Melin 1993 (-) Sweden	**ACUTE CARE:** Discharge planning & care 6 months Personal ADL (Katz): No difference IADL (improved) MD: IG 4.90, CG 3.20, p=0.04 MMSE ; No difference	Hospital readmissions: No difference Increased CG patients in hospital, p=0.03 Mean days in- patient, long term care (decreased) MD -33, 95% CI -49.2, -16.8, p< 0.001 Total service use (visits) adjusted means IG 336.4, CG 193.6, p=0.001 (increased) Social care (hours) home aides IG 179.2 CG 131, P=0.01 (increased) OP visits, day care, informal care givers: No difference *Costs:* Comparative (no cost effectiveness ratios) Total costs/patient (000 swedish crown, 1989 price level) Long term IG 2521/23 CG IG 5130/70, p<0.001 (reduced) OP IG 3884/35 CG 1685/23 (reduced), p=0.001 Other (medication,transport, informal care) IG 443/4 CG 242/3 (increased) p=0.01	No. medical diagnoses (improved) IG -0.50 CG 0.40, p<0.001 No. of drugs (reduced) IG 0.00, CG 0.40, p=0.05 Perception of functions/care: No difference	Improved IADL, medical diagnosis, used less inpatient care and more OP care, with no overall cost differences. Intervention team & community care costs higher, but offset by lower long term care costs No cost-effectiveness analysis reported

		Total overall costs: No difference		
Nikolaus 1995, 1999, 2003 (-) Germany	**ACUTE & PREVENTIVE CARE:** Post discharge & falls prevention at home 12 months ADL: No difference IADL (improved) MD 1.3 (data not given) Dependency ADL : No difference Dependent on IADL: No difference (IG vs. CG) IG vs.assessment only, (improved) RR 0.5 (95% CI 0.3, 0.9) p <0.05 Falls (decreased) IG 163 CG 204; IRR 0.69 (95% CI 0.51-0.97) Frequent fallers: No difference Fall related injuries: No difference Fallers with >=2 falls (decreased) IRR 0.63 (95% CI 0.43, 0.94) Self perceived health (improved) MD 0.7 p<0.05 Life satisfaction (improved) MD 0.7, p<0.05 Deaths: No difference	NH admissions (new): No difference Hospital readmissions: No difference LOS (less), Mean & range IG 33.5 (30.4-36.5); CG 42.7 (39.8-45.6), p<0.05 Community services: IG>CG Long term care admissions(new); No difference Discharge destination Long term care (less) RR 0.02 (95% CI 0.01, 0.04); Private home: >90% all groups, ns Community (home) (increased) RR 1.29 (95% CI 1.01, 1.64), p<0.05 *Costs*: Average net saving DM 7000 (US$ 4000)/ subject. Staff/ community services costs offset by fewer days in hospital & NH *Survivors* LOS hospital (Mean & range) (less) IG 22.2 (18.0-26.4), CG 35.7 (31.1-40.4), p<0.05 Hospital re-admissions: No difference No. of days(less) IG 1652 ,CG 2566, p<0.05 (Long term care (less) IG 2458, CG 5065 p<0.05 Physician visits: No difference	Home team recommended 222 home modifications to 137 homes Compliance > 60%	CGA plus home intervention improves function, lowered LOS with no effect on hospital or NH admissions It increased use of community services. It can delay permanent NH placement, may reduce direct costs of hospital and NH patients resulting in net savings Good compliance to recommendations may prevent falls.

Richards UK 1998 (++) Coast 1998 (cost minimisation)	**ACUTE CARE:** HAH 3 months Functional ability (BI): No difference Daily activities (COOP WONCA) (improved) MD -0.04(95% CI -0.47,0.38), p=0.05 (borderline) Overall health (COOP WONCA): No difference QoL (Euroqol EQ-5D): No difference Deaths; No difference	LOS (increased) CG 62% of HAH, (95% CI 51% to 75%, p < 0.0001), IG 16.8, CG 12.2, p<0.0001 *Costs:* Mean cost/patient: Initial inpatient costs: IG £1960.7 CG 535.1 Re-admissions IG 805.5 CG 860.8 HAH, other NHS, social services IG £3292.0 CG £2515.7 Patient costs IG £77.0 CG 59.6 HAH costs lower than continued hospital care for NHS & social service, patient perspectives. Informal care costs not included	Patient satisfaction 1/11 measures (Likert scale) (improved) Discussions with staff (increased) IG 47.4% CG 27.7%, % difference 19.7 (95% CI 5.9 to 33.5), p=0.024 Content with care, quality of care, received needed help, involved in decision making , informal support; No difference	Early discharge hospital at home did not improve physical function, quality of life or overall patient satisfaction. It was associated with longer LOS, but is less costly than acute care. Increased LOS must be interpreted with caution because of different organisational characteristics of the services
Weinberger 1996 USA (-) Multicentre	**ACUTE CARE:** Discharge planning & post discharge care (VA) QoL SF-36: No difference	No of readmissions (increased), p=0.005 Days of hospitalisation (increased), p=0.041 Distribution of data non-normal (Wilcoxon rank used)	Patient satisfaction high, p<0.001 •Greatest difference for patients' perceptions of the continuity of their care (33%) •Nonfinancial barriers to access medical care (16%). •Overall compliance to intervention 89.0%	The intervention increased rather than decreased rate of rehospitalisation but patients in intervention group were more satisfied with their care
Banerjee 1996 UK (++)	**CHRONIC CARE:** Psychogeriatric home care 6 months Improved depression (AGECAT) RR 1.73 (95% CI 1.18, 2.54)	One extra doctor as key worker for each member of IG; no cost data	IG : *Treatment, % proposed by team vs. % completed:* •Started 79 vs. 78 • Physical review 76 vs. 91	Psychogeriatric home care is more effective for depression than GP alone, in disabled, socially isolated elderly people living at home

	Recovered from depression RR 2.30 (95% CI 1.22, 4.35), adjusted OR depression 9.0 (95% CI 2.0,41.5) Mean depression (MADRS) (improved) MD in score -7 (95% CI -10,-3) Deaths: No difference		• Social measures 69 vs. 75 • Counselling/psychotherapy 59 vs. 88 •Family work 34 vs. 80 •Outreach referral 24 vs. 43 • ADL assessment 21 vs. 100	
Bernabei 1998 Italy (-)	**CHRONIC CARE:** Integrated care & CM 12 months Function: (significantly less deterioration in IG +5.1%CG. -13.0% ADL (improved), MD -0.6 (95% CI -0.88, -0.32), p<0.001 (adjusted) IADL (improved) MD -0.3 (95% CI -0.58,-0.02), p<0.05 Mental status (short portable) (improved) IG -3.8% CG. -9.4% MD -0.6 (-1.16,-0.05), p<0.05 Depression (GDS) (improved) IG -4.0% CG. -11.8%, MD -1.9 (95% CI -3.29, -0.51), p<0.05 No of medications +(reduced), MD -0.7 (95% CI -0.77, -0.63) Deaths: No difference	NH admissions: No difference Hospital admissions (decreased) RR 0.74 (95% CI 0.56 to 0.97), p<0.05 NH or hospital (decreased) RR 0.69 (95% CI 0.53 to 0.91), p<0.01 ER+ (decreased) RR 0.64 (95% CI0.48 to 0.85), p<0.025 *Service use*: IG: No increased use of health services in IG (less than CG) GP home visits (less) MD -2.9 (95% CI -3.2, -2.6), p=0.04 *Costs:* •19% decrease in community health service costs • 48% decrease in NH costs •34% decrease in hospital expenses Total per capita health care costs 23% lower in IG Overall savings= £1125 /person/year due to reduced service		Integrated care and CM may provide a cost effective approach to reduce admissions to institutions and functional decline in older people living in the community without increases in use of health services and with overall savings attributed to decreases in hospital and NH expenses

		costs (excluded informal care costs)		
Montgomery 2003 Canada (-)	**CHRONIC CARE:** Home CM with access 3 months MMSE (improved) from baseline to follow up mean scores 1.3, t 3.75,p=0.0001 ADL & EADL: No difference (data only for IG) *Other:* Mean no. of prescriptions (IG 4.3, CG 2.6) & OTC medication (IG 2.3 CG 0.7) p<0.0001 (increase) Care giver burden: No difference Deaths: No difference	NH admissions (designated) (decreased) RR 0.39, (95% CI 0.17, 0.89) Geriatric day hospital attendance (increased) RR 2.64 (95% CI 1.60, 4.45) Waiting time(days) less, IG 9 CG 38, p = .006. ER/hospital services: No difference . Days in hospital (less) IG 388 CG 927 <30 days (shorter) IG 4/18 CG 9/18, p=0.03 Total hours home care service IG 8.5 CG 6.1, p=0.02 (increase) *Costs:* None	Care givers Family satisfaction (increased) • Promptness of service; MD 0.6 (IG 4.21,CG 3.63, t=2.11, p=0.02) • Assessment & deployment of services (faster); Mean days: IG 2.2 CG 12.1, p<.0001	Patients in the integrated programme received *significantly* faster assessment & deployment of home services, greater access to day hospital, prompt attention to referrals and had reduced need for long term care and reduced LOS
Sommers 2000 USA (-) Cluster randomised	**CHRONIC CARE:** Senior care connection (SCC) 24 months (between year 1 and 3) *Effect of nurse & social worker contacts* Mean change score, *ADL/IADL* (low score =improved) trend (low, medium, high contacts) No contacts 0.09, low <21 0.10, medium 22-38 0.01, high >38 -0.03, p=0.005 (trend, ANCOVA) SF 36 self rated health: No difference Trend for improved health in second year Depression (GDS): No difference	Hospital admissions rate/year (12-24 months) IG 0.38-0.36 , CG increased 0.34-0.52, p=0.03, 24 months (decreased) RR 0.73 (95% CI 0.58, 0.92); (12 months , ns) *Effect of nurse & social worker contacts* Hospital admissions (decreased) No contacts 0.17, low <21 0.07, medium 22-38 0.05, high >38 -0.18, p=0.02 (trend, ANCOVA) *Physicians visits (decreased)* ,No contacts 0.88, low <21 -0.86, medium 22-38 -1.05, high >38 -2.8, p=0.003 (trend, ANCOVA) Service use: Year 1: No difference; Year 2: IG less hospital	Interviews & patient satisfaction questionnaire: • Initial 12 months spent in developing trusting relationship with team. • Usefulness of SCC mean score 4/5 Other: • Nurse/social worker at least 1 contact with 85% of IG • average 14 months of the SCC/patient • Patients averaged 34 nurse or social worker contacts .	Team-patient relationship showed potential for less utilisation whilst improving health, with overall net savings. Dose response between health service utilisation, patient health status and number of contacts It is not clear whether those at 'higher risk' for admissions had more contacts, thereby having fewer admissions

	Other: Medication: No difference Symptom scale: No difference Deaths: No difference	admissions, readmissions, office visits. Hospital admissions (/patient/ yr) (decreased) MD IG -0.02, CG 0.18, p=0.03 Re-admissions (decreased) MD -2.0, CG 5.4, p=0.03 *Visits:*Office (decreased), MD -1.5, CG 0.5, p=0.003; Physician (decreased) MD IG -0.5, CG 0.4, p=0.003 *Costs* Year 2: Total savings £ 258, 934 (no difference in hospital LOS, but CG had more admissions). *Net per patient savings $ 90,* (excludes savings from fewer physician visits		
Brumley 2007, 2003) USA (+ +)	**PALLIATIVE CARE** (Kaiser Permanente): Home based Deaths (no comparison data, overall 75%);	90 days *Reduced:* Hospital days by 4.36, p<0.001 ER visits by 0.35, p=0.02 Physician visits, MD -5.8, p=0.001 Hospital visits, MD -7.0, p<0.001 ED visits -1.37, p<0.001 Skilled nursing visits , -3.7, p=0.005 Total home health visits (increased) MD 21.8, p<0.001 *Costs:* IG was 33 % less than CG, p =.03 Mean cost patients $12670 +/- $12523, CG $20,222 +/- $30,	Satisfaction (Reid Gundlach) (improved) OR 3.37 (95% CI 0.65, 4.96), p=0.03, RR 1.15 (95% CI 1.05, 0.26) Number of days in the study: IG 196 days, CG 242 days, p<0.05 **Site of death** (home) (increased) Adjusted OR 2.20 (95% CI 1.3, 3.7), p<0.001; RR 1.38 (95% CI 1.15,1.67)	In-home palliative care significantly increased patient satisfaction while reducing use of medical services and costs of medical care at the end of life. Intervention patients were more likely to die at home, and less likely to visit the ED or be admitted to hospital.

		026 (less) Average cost/patient/day IG $95.30 CG $ 212.80,p=.02 Medical costs reduced by 45% (Brumley 2003)		
Hughes 2000 USA (-) *Multi centre*	*Delivered acute & palliative care - See acute care above*	*Delivered acute & palliative care - See acute care above*	*Delivered acute & palliative care - See acute care above*	*See acute care above*
Counsell 2007 USA (+)	**PREVENTIVE CARE:** Home based Geriatric Resource Assessment & Care for elders (GRACE) 24 months ADL/IADL (AHEAD: No difference QoL (SF36) Physical function: No difference General health (improved) MD 2.5 (95% CI 0.06, 4.90) p=0.045 (borderline) Mental health (improved) MD 3.9 (95% CI 1.57, 6.23), Cohen's d 0.21, p=0.001 MCS (Improved), MD 2.4 (95% CI 1.06, 3.74), p<0.001 PCS: No difference Death: No difference	Hospital admissions/readmissions/stays: No difference ED visits (decreased), IG 1445, CG 1748, p=0.03, *High risk of hospitalisation (baselines)* Year 2: Hospital admissions (decreased) IG 396 , G 705; p = .03, Hospital days (No difference) ED visits (decreased) IG 848, CG 1314, p=0.03 Costs: None	*Quality of medical care 12 months* Geriatric conditions New diagnosis of difficulty walking or falls(improved) RR 4.08 (95% CI 1.88, 8.90), p<0.001 Urinary incontinence (improved) RR 3.13 (95% CI 2.26, 4.34), p<0.001 Depression (improved) (PHQ-9 score>=10) , RR 3.75 (95% CI 2.15, 6.55), p<0.001 New antidepressants prescribed (improved) RR 3.23 (95% CI 1.52, 6.87), p<0.001 General health care Preventive care (improved) RR 1.23 (95% CI 1.11, 1.35), p<0.01 Continuity of care (improved), RR 1.44 (95% CI 1.23, 1.68), p<0.001 Medication use (improved) RR 1.52 (95% CI 1.27, 1.82), p<0.001 End of life care (improved) RR 2.60 (95% CI 2.01. 3.37), p<0.001	GRACE improved quality of care, and reduced acute care utilization among a high-risk group. Improvements in health-related QoL were mixed, with reduced ER visits. No conclusions on whether reductions in acute care utilization will offset program costs

Nikolaus 1995, 1999, 2003 (-) Germany	**Delivered acute care & preventive care by a home intervention team** *See acute care above*	*See acute care above*	*See acute care above*	*See acute care above*
Boult 2001 (-) 1998,1994 Morishita 1998) USA	**PREVENTIVE CARE:** GEM Outpatient 18 months Functional ability Physical functioning dimension (PFD) (improved) MD -3.2 (95% CI-6.11,-0.29) Bed disability days (decline in functional ability) (less) MD -0.90 (95% CI -1.59,-0.21) Restricted activity days (decline in functional ability): No difference Patients lost functional ability (less) RR 0.76 (95% CI 0.63, 0.91) Patients with increased restricted activity days (less) RR 0.61 (95% CI 0.43,0.87)Patients with increased bed disability days: No difference Depression GDS (improved) RR 0.48, (95% CI 0.31.0.76), *Adjusted OR 0.43, 95% CI 0.20-0.94*Deaths: No difference	Self reported use of home health care (less) (adjusted OR 0.60, 95% CI 0.37-.0.98). GEM used less. IG: lower ER visits, NH use. Total Costs: Mean IG $11354, CG 11786 Medicare spent more on GEM in first 6 months, more CG months 7-18; £1350/person. No significant differences in Medicare payments for health service. Reliance on Medicare data means health services provided by other payers not covered, Total costs £1350/person	*Process: 6 months* • Patient satisfaction with overall care high (PSQ-18,) , RR 2.11 (95% CI 1.58, 2.84), p<0.001 • IG independent and significant predictor of satisfaction). • High ratings - technical quality, interpersonal manner, communication, financial aspects, accessibility, time spent with physicians • GEM patients reported to have better understanding of health, made to feel better, making it easier to take medications. • Physicians rating high, would refer their patients to GEM if available. *Contacts:* Nurses 23.5/week Total staff time/week 216 mins *Referral* services used most frequently were physician consultations 44.9% for GEM	GEM is significantly less likely to lose functional ability, experience health related restrictions in their daily activities, possible depression, or use home healthcare services.

Burns 2000, 1995 USA (-)	**PREVENTIVE CARE:** GEM Outpatient 2 years Function (Katz): ADL/IADL: No difference IADL (over time) IG fewer impairments over time, IG 0, CG +1.4, p<0.017 Quality of life: General well being (RAND GWB) (improved) MD 4.7 (95% CI 0.03, 9.37), IG +12.0, CG +8.4, p<0.001 (over time) Cognition MMS E: No difference IG +1.5, C 0.0, P<0.001 (improved over time) Health perception (GHP) (improved), MD 1.0 (95% CI 0.22, 1.78) Life satisfaction (perceived global) (improved over time) IG + 1 CG -0.1, p= 0.037 Depression (CES-D); No difference at follow up At all time points (improved) (over time), IG -6.4; CG -5.5, p<0.001 Deaths: No difference	Mean hospitalisations; No difference Service use: Year 1: No difference Year 2 CG 40% higher, p = .019; MD -5.0 (95% CI -9.46, -0.54 Costs: None		Primary care combining CGA and long term GEM may improve outcomes for targeted older adults. whilst reducing clinic visits, with no effect on hospitalisations
Cohen 2002 USA (+) Schmader 2004	**PREVENTIVE CARE:** GEM Outpatient, 11 VA Medical centres	Long term care, mean days: No difference Clinic visits; No difference	Schmader 2004, Retrospective data from Cohen 2002	GEM outpatient care had no significant effects on survival, improvements in mental health with no

	12 months Mean score change, QoL SF 36 Physical function: No difference Mental health (improved), IG 6.30, CG 0.80, p=0.001 General health (improved) IG -4.40, CG -8.20, p=0.01 *Secondary functional measures* ADL/IADL (Katz): No difference Deaths: No difference	Total costs (including VA: No difference	All adverse drug reactions: No difference Serious (35% reduction) RR 0.65 (95% CI 0.45, 0.93) (adjusted) *Suboptimal prescribing* Medication: No difference Appropriateness: No difference No of conditions with omitted drugs (less) adjusted MD -0.3 (95% CI -0.5, -0.2), p=0.0004	increase in costs. It reduces serious adverse drug reactions & suboptimal prescribing.
Englehardt 1996 USA (-) (Toseland 1996, 1997)	**PREVENTIVE CARE:** GEM Outpatient 24 months (8, 16 months where indicated) SF20 or FIM; No difference (no data); Psychological well being: Reported no difference (no data) Deaths: No difference Deaths in those reporting no pain, p=0.051 (borderline decrease)	16 months: Acute admissions: No differences (borderline significance) Days of care (increased)MD 3.4 (95% CI 3.2, 3.6), p=0.00 NH admissions: No difference ER visits (increased) MD 0.8 (95% CI 0.53, 1.07) Acute days of care decreased, ns Costs: Outpatient (MD -$918), p=0.05 (borderline) OP use (16-24 months): No difference Clinic use during study period increased GEM, p<0.05; ER lower, p<0.05; hospital care increased for CG Cost savings over 24 months: None (GEM higher costs by 34.8% to month 16, lower than CG by 37.8% months 16-24)	*Quality of health & social care* • Quality assurance review (QAR) improved (over time) (F=4.12, p=0.004), attributed to assessment, care planning & drug use review • Continuity of care improved (F 5.76, p=0..019), other quality of care measures improved (F 2.06, p=0.01) • QAR assessment & planning – (adverse increase in CG), (MD 0.06, p<0.05), (attributed to less consistent reporting of vital signs in the GEM group • Drug use review improved (MD 0.15, p<0.05) Patient satisfaction PSQ high (8 months). F=4.44; p=0.013 (over time) • Positive changes in Pressing problem Index	GEM had no overall impact on health or function, health care utilisation or costs of care but significant reductions were found during 16-24 month period. GEM provided more coordinated health care, and improved quality of care but CG was better on assessment and care planning. GEM patients seen more frequently by providers than CG resulting in higher OP costs

		stress (maintained at 16 months)		
Epstein 1990 USA (-)	**PREVENTIVE CARE:** GEM Outpatient Health Maintenance Organisation (HMO) 12 months (3 months where indicated) Cognitive function; No difference Improved at 3 months Deaths: No difference	No significant differences among groups in patients hospitalised, admitted to nursing home, hospital days, diagnostic tests, doctor visits or costs	*Process* Geriatric assessment teams: • Had significantly more new diagnosis than internists, $p<=0.05$ • Provided psychosocial evaluations more frequently, $p<=0.001$ • Suggested changes in medication regimes more often, $p<=0.001$ • Provided home ($p<=0.05$) & community services more often $p<=0.001$ Satisfaction: non significant increase at 3, 12 months; low functional status associated with more satisfaction, $p< 0.05$	Consultative GEM improved processes of care with no effect on outcomes for older ambulatory patients in an HMO. New teams provided comprehensive and continuity of care which require additional targeting.
Fordyce 1997 USA (-)	**PREVENTIVE CARE:** GEM Outpatient 3 years Improved health, function, healthy behaviours; 20% increase in robust elderly and decrease in frailty (No comparison data given)	Mean change from baseline to follow-up OP visits IG + 1.4, CG -0.3 Hospital admissions IG + 0.15, CG -0.07; hospital stays IG +0.62, IG -0.03 •Fewer hospitalisations • Shorter length of stay. • STAR less likely to be hospitalised (baseline pre intervention period) RR 0.49 (95% CI 0.32, 0.74), $p<0.001$ • Increased short term use by STAR because intervention identified problems & provided treatment	No comparison data given •Satisfaction - self report; 93% satisfied/very satisfied Life changes-self report: • 52%increased safety • 56%completion of power of attorney for health care • 59% increased medication understanding • 69% perceived ability to participate more effectively in their own health care	Improved health and behaviours and increased satisfaction reported , with increased short term utilisation of medical services , but fewer hospitalisations and shorter length of stay

		Costs: None		
Phelan 2007 USA (-)	**PREVENTIVE CARE:** GEM Outpatient Senior resource team (SRT) 24 months (12 months where indicated) Primary: Physical subscale (AIMS 2 arthritis): No difference Affect subscale (ill health): No difference Secondary: ADL (12 months) (improved) RR 0.67, 95% CI 0.45, 0.99 (less disability) Psychological well being (mental health index) (improved), Mean IG 77.6 CG 75.5, p=0.03 Self rated health (good); No difference	Deaths (adverse) RR 1.55 (95%CI 1.00, 2.39) p=0.045 unadjusted Adjusted IG 11.4% CG 7.1%, p=0.03 Hospitalisations (%): No difference (Rate in years 1 and 2 higher in IG) Costs: none	•PCPrs satisfaction with SRT high (>70%) •PCP satisfaction with systems support low IG 17% CG 25%, 12 m; high 24 m, IG 39% CG 29%, ns •Provider self efficacy high in both groups *Other process of care of PCPs:* Blood Pressure control: No difference Prescription of high risk medication; No difference *Prop screened for geriatric syndrome: (adjusted p values)* Depression (12 m increased) RR 2.39 (95% CI 1.92, 2.98), p<0.001 Cognitive impairment (12 m increased) RR 2.36 (95% CI 1.88, 2.96), p<0.001 Falls (12 m increased) RR 2.68 (95% CI 2.08, 3.47), p<0.001	Intervention providers screened significantly more for geriatric syndromes and improved AD disability at 12 months, but not at 24 months. Adverse effect on mortality was of concern. PCPs viewed the addition of interdisciplinary team favourably.
Silverman 1995 USA (-)	**PREVENTIVE CARE:** GEM Outpatient 12 months Functional health (Barthel IndexI): No difference Cognitive health MMSE: No difference Dementia (Clinical dementia rating scale): No difference Depression (Diagnostic Interview schedule): No difference	Service use: No significant differences: NH home placement Physician & other health provider visits ER visits Length of hospital stay.	*Diagnoses: Proportion of patients* Cognitive impairment (improved) RR 2.81 (95% CI 1.84, 4.30) Depression (improved) RR 2.01 (95% CI 1.36, 2.96) Incontinence (improved)	Consultative outpatient GEM significantly improved diagnosis of common health problems, psychological benefits to patients and reduced caregiver stress, with no effect on health status, or service use. GEM patients were satisfied with personal qualities of

	Anxiety: No difference	Costs: none	RR 3.13 (95% CI1.87, 5.26)	physician.
	Care giver outcomes (adjusted)		Patient satisfaction: Both groups highly satisfied (no data)	
	Family strain scale (decreased)			
	MD -4.5, p=0.002		Personal qualities of physician (GAU sub-scale) rated high, p=0.038	
	Global burden scale (decreased)			
	MD -0.11, P=0.013			
	Deaths: No difference			

Data for longest follow up; IG Intervention Group, CG Control Group, RR Relative risk; OR Odds Ratio; CI Confidence Interval; MD Mean difference (SMD Standardised MD); ns Not significant, p<0.05 significant; ADL Activities of daily living,IADL: Instrumental ADL, EADL Extended ADL; CM Case management, CGA Comprehensive Geriatric assessment, GEM Geraitric evaluation & management;GP General Practitioner; ED/R Emergency department/room; OP Outpatient, NH Nursing home, MMSE Mini mental score examination; Qol Quality of life, PCP Primary care providers; GDS Geriatric depression scale; HAD Hospital anxiety & depression