



Co-funded by
the Health Programme
of the European Union



Title:	
WP Leader:	NHS Lanarkshire
Work package:	7
Author(s):	Danika Schepis; Ane Fullaondo; Luz López Samaniego; Eliane Vanhecke; Olaz Albaina Bacaicoa; Anne Hendry; Ana Maria Carriazo; Juan Manuel Espinosa - on behalf of all WP 7 partners
Due submission date:	17th September 2018
Actual submission date:	20th of September 2018
Revised post EP:	Oct 31st 2018
Final version submitted:	Nov 20th 2018

This report is part of Joint Action '724099 / ADVANTAGE' which has received funding from the European Union's Health Programme (2014-2020).

DISCLAIMER: The content of this report represents the views of the author only and is his/her sole responsibility; it cannot be considered to reflect the views of the European Commission and/or the Consumers, Health, Agriculture and Food Executive Agency or any other body of the European Union. The European Commission and the Agency do not accept any responsibility for use that may be made of the information it contains."

TABLE OF CONTENTS

1. Introduction.....	3
2. Objective	3
3. Methods	3
3.1 Search strategy.....	3
3.2 Search output and eligibility criteria	4
3.3 Data collection.....	6
4. Results	6
5. Strengths and limitations of the review	10
6. Discussion.....	11
7. Lessons for Member States.....	13
8. Conclusions	14
9. Annexes.....	16
References.....	25

1. Introduction

The ADVANTAGE “Managing Frailty” Joint Action aims to build a shared understanding among policy makers and stakeholders in order to develop a common European Prevention of Frailty approach. Work Package 7 aims to identify and analyse models of care to prevent or delay progression of frailty and enable people to live well with frailty. During the first year, partners produced a State of the Art Report (SoAR) on the evidence supporting frailty prevention and management activities, both at a personal and population level. This was based on a review of the scientific literature published between 2002 and 2018, and a targeted search of relevant grey literature.

The current evidence supports the case for a more holistic and integrated model of care for frailty, blending a chronic care approach (frailty viewed as a chronic syndrome) with education, enablement and rehabilitation to optimise function, particularly at times of a sudden deterioration in health, or when moving between home, hospital or care home. In all care settings, these approaches should be supported by comprehensive assessment and multidimensional interventions tailored to modifiable physical, psychological, cognitive and social factors and appropriate to the goals and circumstances of the individual.

Although integrated care is generally considered most effective when applied to an older population, there is limited data on outcomes and costs from studies of integrated care to prevent and manage frailty. Therefore we sought to analyse the available evidence of comprehensive integrated care for frailty with respect to the impact on outcomes, resource use and costs.

2. Objective

The purpose of this document is to identify and analyse the impact of integrated models of care to prevent and manage frailty and functional decline. The focus is on health-related outcomes for individuals and the benefits and costs for health and social care systems. The learning from the evidence will inform the Frailty Prevention Approach and help to inform the business case for investing in early interventions to prevent and manage frailty and functional decline. Key messages will be extracted to guide policy makers, funders, commissioners, providers and professionals as they prepare to design, deliver and scale evidence based and cost effective models of care.

3. Methods

3.1 Search strategy

Peer-reviewed medical literature published from 2002 to 2018 was analysed to identify articles assessing the impact of models of integrated care and support to prevent and

manage frailty in primary care and community settings. The search was conducted in Medline via PubMed by combining two key concepts: a frailty approach and models of care. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were used. This search yielded 1065 potential articles of which 157 abstracts were further screened.

Search terms *frailty* or *frail* were applied without prejudice as to the specific definition. As frailty is a complex syndrome that requires a response across a continuum or “whole system” of care, the following search terms were used: *model(s) of care; care model(s); integrated care; health and social care; managed care; coordinated care; and comprehensive care*. As prevention of frailty is particularly influenced by interventions delivered in primary care and community settings, a second query used *primary care, community care, community based care, community dwelling and care, home based care, & home care*.

3.2 Search output and eligibility criteria

Figure 1 illustrates the PRISMA flow chart of articles screened for eligibility. Exclusion criteria included articles focused on a specific disease or intervention without considering service delivery, and lack of data on impact. A final number of 36 papers were scrutinised in detail using *ad hoc* template for cost-effectiveness evaluation.

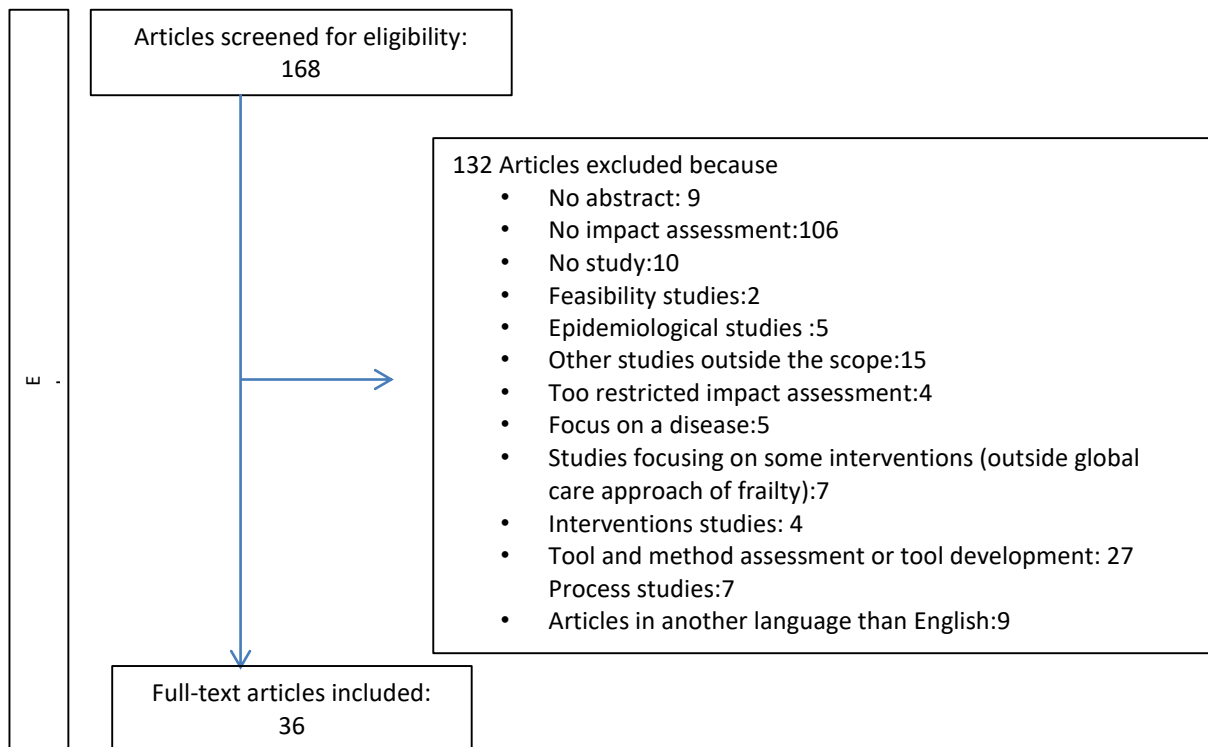


Figure 1 : Flow chart for paper screening

From the 36 studies analysed, six did not meet the eligibility criteria adopted for the economic evaluation: the article had to be about older people; an integrated model or a program of care; include data about impact (effectiveness and / or costs); and potential to be transferred. 6 papers were excluded from the analysis as they met ≤ 2 of the four eligibility criteria. Out of the 30 papers analysed in full, 23 have potential to be transferred to a different setting or region. We excluded 5 of these 23 papers as they did not show positive outcomes for patients' health, healthcare utilisation and/or costs. Only 18 articles showed positive results in terms of costs and/or effectiveness and clear potential to be transferred.

Figure 2 depicts the criteria followed to choose the articles that have been analysed in detail.

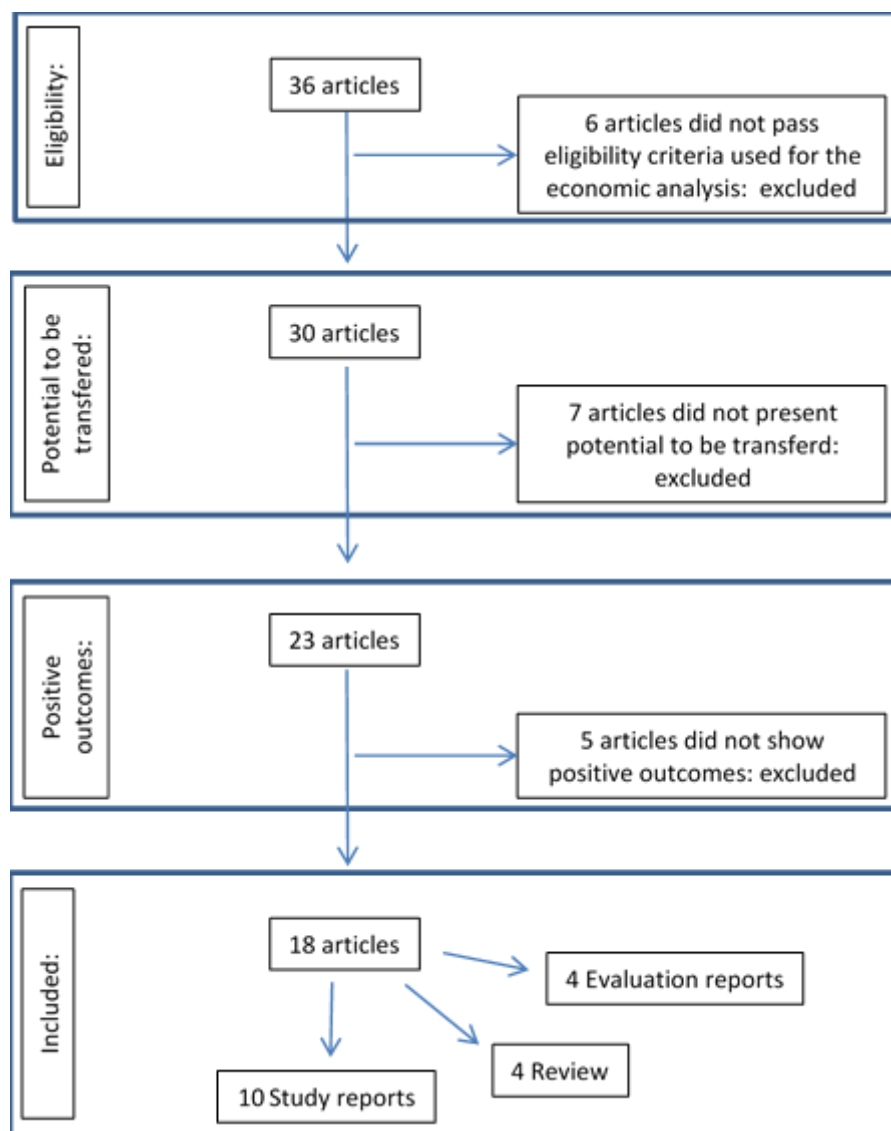


Figure 2: Scheme of final paper selection.

3.3 Data collection

In order to standardise the information gathered, an *ad hoc* template was designed to capture: (i) basic information about the research article, (ii) description of the model of care studied, (iii) details of the evaluation methodology, and (iv) learning and conclusions (Annex 1). The template sections are briefly illustrated in Figure 3 below.

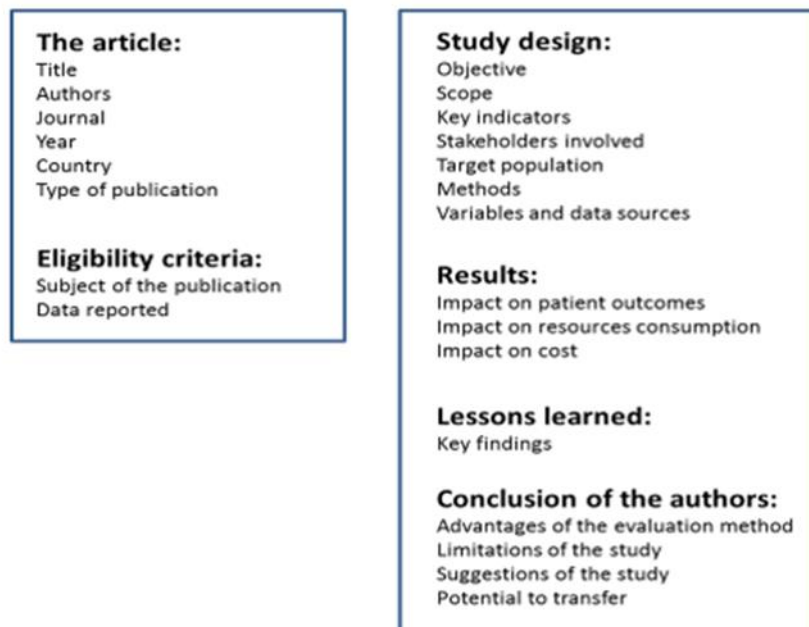


Figure 3. Sections included in the analysis of the impact of integrated care models.

4. Results

The following paragraphs provide a brief overview of the 18 studies that demonstrate positive impact and transferable learning for Advantage JA Member States. The characteristics and outcomes of the 18 studies are summarised in a table in Annex 1.

Each article provides insights about the entry points, processes and critical components of the interventions that contribute to positive impact. These can be clustered around eight themes that will be key elements of the developing Frailty Prevention Approach.

1. Early intervention, education and enablement

Providing home care and support is one of the most common interventions among all papers analysed. Kono, Kanaya, & Tsumara (2013) described a model that includes preventive home visits by nurses or care managers who undertake structured multidimensional assessments and offer health promoting recommendations every six months over two years. The authors report a reduction in health care costs, due to fewer hospitalisations.

Markle-Reid et al. (2006) reported that home based health promotion nursing, proactively provided to frail older people, enhances quality of life without impact on the overall cost of health care. This paper reports a study evaluating the comparative effects and costs of a proactive nursing health promotion intervention over a six months period in addition to usual home care for older people compared with usual home care services alone. The health professional provided: an initial and ongoing health assessment, identifying and managing risk factors for functional decline and provided health education regarding healthy lifestyles, and management of chronic illnesses. An empowerment approach promoted positive attitudes, knowledge and skills to maintain and enhance health and enhance self-efficacy and participation. Strategies included referral to and coordination of community services, building a trusting, supportive and meaningful relationship with the client and his/her caregiver, and providing caregiver support. Despite the increase in nurse's home visits and contacts, there was no statistically significant difference between the two groups in terms of health and social care cost.

In the study from De Almeida Mello et al. (2016), the population that benefited the most from home care intervention is the one with less advanced signs of frailty. However, the study did not apply a consistent definition and measurement of frailty.

2. Case management

Duke (2005) describes the effects of community-based case management for frail elderly residents of Pitt County and the effect on health care utilisation. The program provided a combination of traditional hands-on care by nurse and social-work case managers, as well as access to remote monitoring and advice through a telehealth unit. There is a clear reduction on hospital cost measured by length of stay, number of hospitalisations and visits to the emergency department.

3. Integrated care out of hours

Di Pollina et al. (2017) report on a three year prospective controlled trial of usual care by a primary care physician and home nursing services, and an intervention group that received an additional home evaluation by a community geriatrics unit with access to round-the-clock geriatric on call service and coordinated follow-up. The number of hospitalizations did not differ between groups however, the intervention led to lower cumulative incidence for the first hospitalisation after the first year of follow-up.

4. Technology enabled interdisciplinary care coordination

A study from USA (De Jonge et al., 2014) achieved reduced Medicare costs by implementing a home-based primary care model (HBPC) for the elderly. Briefly, the physicians perform an initial visit, followed by others every 3 to 4 months, provide 24-hour-a-day, 7-day-a week on-call telephone coverage, and perform hospital attending

duties. The nurses make frequent visits, ranging from every 8 weeks to several times a week, depending on medical necessity. The social workers provide case management for psychosocial and supportive services. Team members occasionally make joint visits to resolve conflicts in care plan, address staff safety concerns, or resolve ethical questions. Weekly team meetings allow discussion of individuals with unstable conditions and direct communication with home health, mental health, and pharmacy colleagues.

The team uses a wireless electronic health record with live access to inpatient and outpatient records and applies home-based diagnostic technology. They report that the intervention lowered total healthcare cost (Medicare) by steering the inpatient and specialty care usage to community-based and generalist care.

Reduced hospital care is the aim of the paper of Meret-Hanke (2011). This study evaluates the effects of the Program of All-Inclusive Care for the Elderly (PACE) on hospital use compared to the classical model of elderly care. It is evident that PACE provides an attractive alternative to nursing home care, and for most people, staying out of nursing homes is a desirable outcome in itself. It is strongly suggested as a potential model for improving transition care. The study lacks an economic evaluation.

An Australian study (Fairhall et al., 2015) compared the costs and cost-effectiveness of a multifactorial interdisciplinary intervention versus usual care for older people who are frail, using data obtained from the Frailty Intervention Trial (FIT). They did not report relevant change in cost when comparing the two groups while frailty values improved. Frailty was identified using the CHS definition of frailty and its variation was used to determine effectiveness outcomes.

5. Collaborative leadership and relationships

Local leadership and partnership working are key influencers of successful implementation as described in the review by Kodner (2006). The importance of team work and collaboration rather than directive top-down decision making cannot be overemphasised. This takes time. The authors noted that studies performed over a three to six months period, in most cases, did not produce any significant impact on patient quality of life and perception of health, nor on resources consumption. Only long term interventions present a full range of data analysis with positive results, both in the area of effectiveness and cost evaluation.

6. Preventing high cost readmissions by transitional care for high risk patients

The frail population is at greater risk of frequent hospitalisation, and especially readmissions. Watkins and colleagues studied the very important point of transition between hospital and home. They focus on preventing re-hospitalisation after discharge in the frail elderly patients. In the model they used the focus was on the psychosocial

aspects of care transitions, trying to identify and act upon the unique personal and medical needs. Care begins in the inpatient rehabilitation facility or acute care hospital and continues at home, in the post-discharge phase. They aimed to empower patients and families to ensure successful transition to home, avoid unnecessary readmission and enable the patient to remain at home. Outcomes are generally positive. They observed a 61% reduction in hospital readmission in this high-risk population. The cost analysis they performed showed that the model costs less than the potential high costs associated with readmission.

7. Sustained system wide change

One very successful example is PRISMA (MacAdam, 2015) an Integrated Service Delivery Network comprised of six main features: coordination among services, single point of entry, case management, individualised care plan, unique assessment tool and information tool. The author shows that long term intervention and horizontal collaboration provide positive results both in patients' health and in resource utilisation. The positive outcomes appeared only after three years of implementation. The author observed a reduction in prevalence and incidence of functional decline, reduction in Emergency Room visits and reduction in hospitalisations, all without any significant increase in cost due to the implementation itself.

Everink et al. (2018) described an economic evaluation performed from a societal perspective alongside a prospective cohort study with two cohorts of patients. The cost of the intervention has been evaluated in the context of healthcare cost within the hospital and outside the hospital: days in hospital; days in nursing home; days in care home; regular contact with GP; contact with GP during out-of-office hours; professional homecare (Nursing/Personal/Domestic care); number of half days per week in day care; contact with medical specialist; contact with allied professional. The care as usual cohort was included before implementation of the pathway and the care pathway cohort after implementation of the pathway. In this report, the implementation of cross-organisational agreements to improve continuity and coordination of care resulted in a generalised reduction of healthcare cost mainly due to reduction in hospital stays, day care center visits and geriatric rehabilitation facility stays. The implementation of the pathway did not affect quality adjusted life years (QALYs).

8. Frailty prevention and reversibility through nutrition and physical activity

Several studies have reported on the importance of working on changing life style in order to prevent and often reverse frailty in older people. Tarazona et al. (2016) described how implementing a multicomponent exercise program was sufficient to: improve functionality; cognitive, emotional, and social networking; as well as biological biomarkers of frailty. Another study, from Ng et al. (2015), focused on physical activity, in combination with a special nutritional program. They observed that frailty among

older individuals is reversible. In particular, physical, nutritional, cognitive, and combination of interventional approaches are effective in reducing frailty (measured based on the CHS¹ criteria for 5 frailty components), they affirm that there is current consensus about physical frailty is potentially reversible with appropriate interventions. In the scoping review by Puts et al. (2017), they analyzed interventions and international policies designed to prevent or reduce the level of frailty in community-dwelling older adults. They concluded there is a significant reduction in the total number of frailty markers when comparing exercise intervention groups vs control. Moreover, they observed that exercise plus nutrition generates a significant reduction in the prevalence of frailty.

5. Strengths and limitations of the review

The methodology for the review was rigorous but pragmatic and proportionate. It refined the focus of the review undertaken for the 2017 SoAR by only considering articles with evidence of impact in an older intervention group and where the model is considered to be transferable. The main limitations and mitigating factors associated with the approach are:

All publications within the scope of the research may not have been identified correctly from reviewing the titles or because of technical issues. However, it is encouraging that the selection of empirical studies and evaluations aligns well with a recently published systematic review by Looman, Huisjsman & Fabbriotti (2018) that selected 46 studies of 29 interventions in 10 countries. Looman reported that most of the studies on preventive, integrated care showed no effects and outcomes for informal caregivers and professionals are rarely considered. Healthcare utilisation was the most reported outcome but the authors found mixed results with limited evidence for cost-effectiveness.

Our use of the search terms frail and frailty aimed to ensure the models of care researched were directly related to the frailty approach. However few studies applied rigorous selection criteria based on a frailty diagnosis.

Studies of how to prevent, detect and manage frailty exclusively in hospitals or in long term care homes were not the focus of this whole system approach.

The impact of studies in primary care may be limited by their inability to influence transitions of care. As observed by Watkins et al, one of the limitations in their study was the lack of a continuum of care between the hospital and the community organisations.

¹ A widely used clinical research definition of the frailty syndrome is the Cardiovascular Health Study (CHS) frailty phenotype, consisting of a combination of weight loss, weakness, slowness, exhaustion, and reduced physical activity

At the same time, other articles show that appropriate interventions by holistic care at home services can improve results without additional system costs. However Everink et al. (2018) demonstrated that inclusion of economic data from a different setting (hospital, geriatric rehabilitation facility and private care) is crucial to understand that implementation of integrated care for frail elderly population is cost-effective when considered across the whole system.

The studies used a wide range of definitions for frailty and the inclusion criteria were not well defined. Indeed Kono et al reported a lack of clarity on the precise medical diagnoses and treatments that were reimbursed by health care insurance programs.

An important factor that can influence the observed impact of a model of care is the selection of outcome measures or indicators used. Fairhall N. et al. (2015) claims that EQ-5D measure may not be sensitive enough or may not include the most appropriate dimensions of quality of life to detect clinically important differences in outcomes for the frail elderly population. It is also important that outcome data is complete, precise and the follow up period offers sufficient time to observe emerging impact.

Of the 30 papers analysed, only one study (Looman et al., 2016) shows increased cost for the intervention group, mainly due to increased GP contacts. The authors reported no difference in health-related quality of life but did not analyse quality of care or consumer satisfaction. It had many limitations: poor description of selection criteria and matching process; lack of precise data on some types of formal and informal care.

As conclusions are based on only 18 studies that specifically address frailty, it must be highlighted that the evidence on the impact of interventions is limited and sometimes inconsistent.

6. Discussion

The limited evidence for cost – effectiveness largely reflects the fact that evaluation methods to capture complex interventions are still in development. Moreover, evaluation is rarely conducted over a long enough period to observe impact. For evidence on cost effectiveness, the perspective must be societal and system, and not just health service impact. Even when evaluation takes place over a longer time scale, the lack of demonstrable impact may be because the implementation has been suboptimal and has not addressed the required changes in service delivery or culture.

The learning from the studies of models of care that have demonstrated cost effectiveness broadly support the State of the Art Report recommendations on the components of effective models of care for frailty:

- a single entry point in the community – generally in Primary Care

- use of simple frailty specific screening tools in all care settings
- comprehensive assessment and individualised care plans – including for caregivers
- tailored interventions by an interdisciplinary team – both in hospitals and community
- case management and coordination of support across the continuum of providers
- effective management of transitions between care teams and settings
- shared electronic information tools and technology enabled care solutions
- clear policies and procedures for service eligibility and care processes.

The effective models of care adopted one or more of three approaches:

- ❖ Home care education and support - this is a relatively low cost and high volume preventative intervention. It was shown to improve health, in terms of quality of life or satisfaction, with no increase in costs. However, if implemented in isolation, it is unlikely to impact on high cost healthcare utilisation in the short term.
- ❖ Improved transition between hospital and home – this is a more intensive but time limited intervention. Transitional care was shown to reduce costs due to a reduction in rates of hospitalisation, emergency room, and institutionalization, particularly for individuals who are at high risk for readmission and associated healthcare costs. Gains can be anticipated in a short to medium time frame.
- ❖ Case management and care coordination by an interdisciplinary team in the community – this is a complex and multidimensional intervention involving a wide range of professionals in different settings. However it takes time to build a mode that provides continuity of care and trusting relationships. There is evidence of cost-effectiveness, but mainly after several years of implementation and particularly where the model is enabled by effective ICT and technology.

Only one study incorporated the use of technology to support remote consultation or monitoring through a telehealth unit (Duke, 2005). The researchers noted that the case-managed population resided in an assisted living facility which offered a supported environment for the intervention to be successful. This paper shows the power of pooled expertise and resources and the amplifying effect from multiple components that add value to an intervention.

Comprehensive integrated models of care may combine all of the above component approaches for maximum impact.

7. Lessons for Member States

It is difficult to make overarching recommendations based on such a small and limited body of evidence. The following enhancing and restricting elements should be explored when building or studying the impact of a recommended model of care for frailty.

Clear definition of the target group

In this report we analysed the impact of care models that had as a target group frail older people or an older population. Authors present different criteria to assess the level of frailty and the associated health outcomes such as prevalence and incidence of functional decline; EQ-5D; QALY or ADL. When the population of the intervention is so heterogeneous, it might be harder to identify and describe a common pattern for cost-effectiveness. It is important to clearly define the target group when introducing an intervention for frailty.

Identify specific improvement areas

Early intervention before loss of independence is important to reduce demand. Remaining independent and living at home have a high value for older people. Low cost and high volume educational interventions enhance quality of life without increasing overall cost of health care.

Targeted and time limited services to improve transition from hospital to home is a low volume intervention that has high impact in the short term, particularly if linked with rehabilitation and pharmaceutical care interventions.

Select the right outcomes and indicators

It is essential to understand what outcomes are able to be influenced by a specific intervention for frail older people, or for their informal caregiver. It is important to balance cost-effectiveness evaluation with cross-sectoral data on health and wellbeing, and health and social care quality outcomes as well as data on the impact on the informal caregiver.

Cross-sectoral coordination and collaboration

The majority of the studies reported that integration of services is one of the key factors for success. In each study, cross-sectoral collaboration is noted as an essential component of an integrated model of care for frail elderly people. Successful implementation requires time and support to develop positive and trusting professional relationships and skills in effective team working.

Engage and empower stakeholders

Often the fear to change towards new model of care, at macro, meso and micro levels, can be an obstacle to successful implementation. Empowering collaborative leadership and partnership working, rather than top-down direction, will promote adoption of change and sustain implementation. Stakeholders will participate more if they feel involved from the beginning and if their needs and opinions are taken into account.

Plan and fund for the long haul

Another very important aspect reported is the uncertainty created by lack of financial stability. Positive impact from the successful PRISMA model was detected only during the third year of implementation. This means that when investing in an integrated model of care for frailty, robust financial and spread plans have to be in place.

When considering which models of care to implement, and in which order, it is important to consider the complexity of the implementation challenge and allow a realistic timescale for realising the anticipated gains.

8. Conclusions

There is a lack of studies about cost-effectiveness on frailty; therefore the message of this report should be to underline that more studies are needed. There has been insufficient agreement on a common definition of frailty, and suboptimal use of common measurement instruments and outcomes in the research undertaken to date. Future programmes and models of care for frailty should address these gaps and generate evidence of impact on health and cost-effectiveness. Health and social care interventions during all frailty stages - including the asymptomatic stage where health promotion is the main intervention - should be measured in terms of direct and indirect cost and benefit for patients, caregivers and for providers in primary care, home care, hospital-based, and transitional care services.

Although not used in the research studies reviewed, this report introduces MAFEIP as possible applicable cost-effectiveness tool, briefly described below.

MAFEIP - Monitoring and Assessment Framework for the European Innovation Partnership on Active and Healthy Ageing

The MAFEIP monitoring framework comprises a web-based tool which rests on the principles of Decision Analytic Modelling (DAM). More specifically, it is based on a traditional Markov model, an approach that is commonly used in health economic evaluations to assess the impact of healthcare innovations in terms of health outcomes and resource use.

MAFEIP measures the likelihood that the assessed interventions will achieve their expected impacts in terms of both increased efficiency and improved health and quality of life of the beneficiaries. It also allows to simulate changes in the interventions in order

to detect the key determinants of their effectiveness and usefulness and guide further design, development or evaluation.

The framework and the tool were initially developed to provide a common model and a shared language in response to the EIP on AHA members' specific monitoring needs. Today the tool has achieved a high level of maturity and has gone through a collaborative improvement and refinement process which makes it usable and flexible to adapt to different kinds of users far beyond the EIP on AHA context.

To get more information about the tool, you can access the official webpage through this link:

<https://www.mafeip.eu/the-tool>

9. Annexes

1: Ad hoc template for “Analysis and lessons learned from models of care “

Name of partner, who analyses this paper

insert here:

1. Information about the article

Information about the article
Title
Authors
Journal
Country
Year
Reference

1.1 Identify the publication type/content type of the paper

Publication type
review
systematic review
study report
evaluation report
other

1.2 Eligibility criteria

Inclusion criteria				
The publication is about				
Elderly	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
A model or a program of care	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
The publication includes data or reports about				
Effectiveness assessment	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Cost assessment	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
First step conclusion				
The publication fulfils the whole inclusion criteria	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>

Stop here in case of “non eligibility”

2 Information about study

2.1 Study design

Study description
Objective(s)
Expected benefits
Key indicators of the study
Main outcomes
Implementation level (national, regional,...)
Stakeholders involved
Target group inclusion criteria
Target group exclusion criteria
Brief description of the intervention
Intervention group
Sample size
Follow-up length
Control group
Sample size
Follow-up length
Method
Evaluation method
Economic evaluation (cost-utility, budget impact analysis,...)
Variables and data sources
Variables (contacts with GP and nurses, contacts with secondary care, contacts with accident & emergency services, hospitalization days,...)
Economic measure (unit cost, cost per hour,...)
Data sources (electronic health record, accounting system, national statistics institute...)

2.2 Results

Results
Impact on patient identification
Impact on patient outcomes (quality of life, death rate,...)
Impact on resources consumption (healthcare resources, social resources,...)
Impact on costs

2.3 Lessons learned about the intervention of the model of care

Lessons learned
Key findings (barriers/facilitators) about the effectiveness of the intervention
Key findings (barriers/facilitators) about the implementation of the intervention

2.4 Conclusion of the authors

Conclusions
Key findings of the study
Advantages of the evaluation method
Limitations of the study
Suggestions of the study
Potential to transfer and/or to scale-up
Any other conclusion
Your comments
Insert here :

Summary table 1: Eligible papers

N.	Authors	Year	Country	Publication type	Mach eligibility criteria
1	Béland F, Bergman H, Lebel P, et al	2006	Canada	Only Abstract availbale	No
2	Béland F, Bergman H, et al	2006	Canada	Only Abstract availbale	No
3	Leutz W, Ford T, Leung M, et al	2003	USA	Only Abstract availbale	No
4	Linda Shaw	2004	USA	Other	No
5	Christopher Frank, C. Ruth Wilson	2015	Canada	Review	No
6	EMIEL O. HOOGENDIJK	2016	The Netherlands	Review	No
7	Ruikes FGH, Zuidema SU, et al	2016	The Netherlands	Study report	Yes
8	Metzelthin S, van Rossum E, et al	2015	The Netherlands	Study report	Yes
9	de Almeida Mello J, Declercq A, et al	2016	Belgium	Evaluation report	Yes
10	Frances M.Weaver, Elaine C. Hickey, et al	2007	USA	Evaluation report	Yes
11	Karen M. van Leeuwen, Judith E. Bosmans, et al	2015	The Netherlands	Evaluation report	Yes
12	Louise A. Meret-Hanke	2011	USA	Evaluation report	Yes
13	Wilhelmina M Looman, Robbert Huijsman, et al	2016	The Netherlands	Evaluation report	Yes
14	Dennis L. Kodner	2006	NA	Review	Yes
15	Ayumi Kono, Yukiko Kanaya , et al	2013	Japan	Study report	Yes
16	Cheryl Duke	2005	USA	Study report	Yes
17	Irma H. J. Everink, Jolanda C. M. van Haastregt, et al	2018	The Netherlands	Study report	Yes
18	K. Eric De Jonge, Namirah Jamshed, et al	2014	USA	Study report	Yes
19	Lynn Watkins, Carol Hall and Daria Kring	2012	USA	Study report	Yes
20	Maureen Markle-Reid, Robin Weir, et al	2005	Canada	Study report	Yes
21	Nicola Fairhall, Catherine Sherrington, et al	2015	Australia	Study report	Yes
22	Barth Oeseburg , Klaske Wynia , et al	2009	NA	Systematic review	Yes
23	Francois Béland, Marcus J. Hollander	2011	NA	Systematic review	Yes
24	Petra Hopman, Simone R. de Bruin,et al	2016	NA	Systematic review	Yes
25	Looman WM, Fabbricotti IN, Huijsman R	2014	The Netherlands	Evaluation report	Yes
26	Laura Di Pollina, Idris Guessous, et al	2017	Switzerland	Evaluation report	Yes
27	Margaret MacAdam	2015	Canada	Evaluation report	Yes
28	De Labra C, Guimaraes-Pinheiro C, et al	2015	NA	Systematic review	Yes
29	Tarazona-Santabalbina FJ, Gomez-Cabrera MC,et al	2016	Spain	Study report	Yes
30	Cesari M, Vellas B, Hsu FC, et al	2015	USA	Study report	Yes
31	De Coninck, L, Bekkering GE, et al	2017	NA	Systematic review	Yes
32	Ng TP, Feng L, Nyunt MS, et al	2015	Singapore	Study report	Yes
33	Hoogendijk EO.	2016	The Netherlands	Review	Yes
34	Hopman P, de Bruin SR, Forjaz MJ, et al	2016	NA	Systematic review	Yes
35	Dedeyne L, Deschodt M, et al	2017	NA	Systematic review	Yes
36	Puts MET, Toubasi S, et al	2017	NA	Systematic review	Yes

Summary table 2 : Included papers

N.	Authors	Specific effectiveness and/ or cost evaluation	Outcomes: health and or healthcare utilization	Potencial to be transferred
1	L Di Pollina, I Guessous, et al	Both	health outcomes: no difference; healthcare utilization: positive outcomes	Yes
2	J de Almeida Mello , A Declercq, et al	only effectiveness	health outcomes: positive outcomes; health utilization: positive outcomes	Yes
3	Margaret MacAdam	Both	health outcomes: positive outcomes; health utilization: positive outcomes	Yes
4	Louise A. Meret-Hanke	only effectiveness	health outcomes: positive outcomes; health utilization: positive outcomes	Yes
5	Dennis L. Kodner	Both	health outcomes: positive outcomes; health utilization: positive outcomes	Yes
6	L Watkins, C Hall and D Kring	Both	health outcomes: positive outcomes; health utilization: positive outcomes	Yes
7	Cheryl Duke	Both	health outcomes: positive outcomes; health utilization: positive outcomes	Yes
8	M Markle-Reid, R Weir, et al	Both	health outcomes: positive outcomes; health utilization: positive outcomes	Yes
9	K. Eric De Jonge, N Jamshed, et al	only cost	health outcomes: no differences; health utilization: positive outcomes	Yes
10	A Kono, Y Kanaya , et al	only cost	health outcomes: not reported; health utilization: positive outcomes	Yes
11	N Fairhall, C Sherrington, et al	Both	health outcomes :positive outcomes; health utilization: positive outcomes	Yes
12	IH. J. Everink, J C. M. van Haastregt, et al	Both	health outcomes: no difference; health utilization: positive outcomes	Yes
13	C De Labra , C Guimaraes-Pinheiro , et al	only effectiveness	health outcomes: positive outcomes; health utilization: not reported	Yes
14	FJ Tarazona-Santabalbina, MC Gomez-Cabrera, et al	only effectiveness	health outcomes: positive outcomes; health utilization: not reported	Yes
15	M Cesari , B Vellas , et al	only effectiveness	health outcomes: positive outcomes ;health utilization: not reported	Yes
16	TP Ng , L Feng ,et al	only effectiveness	health outcomes: positive outcomes; health utilization: not reported in details	Yes
17	L Dedeyne , M Deschodt, et al	only effectiveness	health outcomes: positive outcomes; health utilization: not reported	Yes
18	MET Puts , S Toubasi , et al	only effectiveness	health outcomes: positive outcomes; health utilization: not reported	Yes

Summary table 3: objective and outcomes 1

Authors	Objective	Health care Outcomes	Health care utilizations	Cost
L. Di Pollina, I. Guessous, et al	To test the efficacy of providing integrated care at home to reduce unnecessary hospitalizations, emergency room visits, institutionalization, and mortality in community dwelling frail and dependent older adults.	NA	Hospitalizations: unnecessary hospitalizations for social reasons were significantly less frequent in the intervention. Length of hospital stay was lower, but not significantly, in the intervention than in the control group; Emergency room visits: The HR over the entire follow-up period for emergency room visits was 0.43	NA
J de Almeida Mello, A Declercq , et al	To examine the effects of home care interventions for frail older people in delaying permanent institutionalization during 6 months of follow-up.	No type of intervention showed a significant effect on risk of death. These interventions delayed institutionalization of older people with moderate to severe impairment, whereas frail older people receiving night support at home with full supervision had a higher risk of institutionalization than people in the comparison group.	Somehow there is a reduction in hospitalization.	NA
Margaret MacAdam	To evaluate the implementation of an Integrated Service Delivery Network (ISD French acronym) to improve the health, empowerment and satisfaction of frail older people and to change health and social service utilization without increasing caregiver burden.	The differences in health between the experimental and control groups were small. In both groups, the health experience scores were low. The changes in health over three months were small.	The use of care did not change significantly over three months for either the experimental group or the control group.	There was also no statistically significant change in costs.
Louise A. Meret-Hanke	This study evaluates the effects of the Program of All-Inclusive Care for the Elderly (PACE) on hospital use.	Not specified	PACE effectively controls hospital use among community-dwelling frail elderly persons.	The hospitalization reduction are large enough to make cost savings possible, but the study did not analyse this in depth.

Summary table 3: objective and outcomes 2

Authors	Objective	Health care Outcomes	Health care utilizations	Cost
Dennis L. Kodner	Compare 3 successful integrated care models.	The evidence generally points to a promising pattern of outcomes in terms of access, clinical coordination and continuity, functional decline, service utilisation, institutionalisation, quality of life, carer burden and client satisfaction.	PACE : large decrease in hospital use (both admissions and days), reduced institutionalisation (both admissions and days), and substantial increases in the utilisation of outpatient medical care and therapies, as well as home- and community-based services. SIPA : while positive patterns were discerned in overall hospital and nursing home use, no significant differences in emergency department, hospital or nursing home stays or costs were found. PRISMA : the intervention failed to alter the use of services	Cost effectiveness hasn't been analysed in depth. Overall financial consideration: umbrella organisational structures guide integration and financial incentives promote prevention, rehabilitation and the downward substitution of services, as well as enable service integration and efficiency.
L Watkins, C Hall and D Kring	This study describes a social-worker navigator transitional care model for at-risk seniors being discharged from hospital to home. The model is designed to prevent rehospitalisation in order improve quality of life and patient outcomes.	Improvement in quality-of-life scores for both physical and mental health.	Hospital readmissions were decreased by 61% for this high-risk population.	Cost savings by preventing readmissions correlated cost.
Cheryl Duke	To investigate the effects of community-based case management for frail elderly residents of Pitt County and what is the effect that this would have on health care utilization among this population group.	Progressive deterioration of mental functioning, but the Modified Geriatric Depression Scale (MGDS) scores demonstrated an improved perception on quality of life.	Reduced emergency department visits. Reduced hospital admissions. Reduced total number of hospital days.	Reduced emergency department costs. Reduced hospital admission costs
M Markle-Reid, R Weir, et al	Study evaluating the comparative effects and costs of a proactive nursing health promotion intervention in addition to usual home care for older people compared with usual home care services alone.	Increased quality of life and reduces mental illness.	Increased nurse's home visit and contact.	There was no statistically significant difference between the two groups in the mean cost of all types of health and social services, and the total annual per person direct costs of health services at 6-months. The intervention group presented a lower cost of prescription medications.

Summary table 3: objective and outcomes 3

Authors	Objective	Health care Outcomes	Health care utilizations	Cost
K. E. De Jonge, N. Jamshed, et al	To determine the effect of home-based primary care (HBPC) on Medicare costs and mortality in frail elders.	There was no difference in survival over time between cases and controls that died during the study.	The cases had lower costs for hospital care, physician fees, and skilled nursing facility (SNF) care and higher costs for skilled home health and hospice services	Total Medicare costs during the 2-year mean follow-up were lower for cases than controls
A Kono, Y Kanaya, et al	To analyse the cost effects of preventive home visits for frail elders compare to normal care	NA	Decreased hospitalization.	Reduced monthly health care costs, particularly avoiding costly hospitalizations.
N. Fairhall, C. Sherrington, et al	To compare the costs and cost-effectiveness of a multifactorial interdisciplinary intervention versus usual care for frail older people, using data obtained from the Frailty Intervention Trial (FIT).	The prevalence of frailty was lower in the intervention group compared with the control group at 12 months	There were no significant between-group differences in cost for any service except meal delivery, where the mean cost was greater in the intervention group.	The multifactorial intervention is good value for money in terms of improving transition from frailty in all frail participants, but particularly in the very frail
I H. J. Everink, J C. M. van Haastregt, et al	Economic evaluation performed from a societal perspective alongside a prospective cohort study with two cohorts of patients. The care as usual cohort was included before implementation of the pathway and the care pathway cohort after implementation of the pathway.	Implementation of the pathway did not affect quality adjusted life years (QALYs)	After implementation: shorter hospital stays; shorter geriatric rehabilitation facility stays; increased GP contacts; decreased day care centre visits.	Lower healthcare costs after implementation.
C De Labra ,C Guimaraes-Pinheiro, et al	To retrieve recent evidence examining the potential role of physical exercise interventions in frail older adults. The aim is to provide evidence that physical exercise has positive effects on most of the outcome measurements.	In the selected studies examined, the primary outcome measured was the effects of the intervention on the domains of frailty and/or physical capacity and/or functional capacity of the sample. They detected positive outcomes.	NA	NA
FJ Tarazona-Santabalbina , MC Gomez-Cabrera , et al	To ascertain if a supervised-facility multicomponent exercise program (MEP) when performed by frail older persons can reverse frailty and improve functionality; cognitive, emotional, and social networking; as well as biological biomarkers of frailty, when compared with a controlled population that received no training.	There is a reduction in the prevalence of frailty at the end of a physical activity program.	NA	NA

Summary table 3: objective and outcomes 4

Authors	Objective	Health care Outcomes	Health care utilizations	Cost
M Cesari, B Vellas, et al	To assess the effectiveness of occupational therapy to improve performance in daily living activities in community-dwelling physically frail older people.	The most effective outcomes were related to the International Classification of Functioning, Disability and Health (ICF) components "activity and participation." Increased social participation and increased ADL are also clinically relevant.	NA	NA
TP Ng, L Feng, et al	To establish whether frailty among older individuals is reversible with nutritional, physical, or cognitive interventions, singly or in combination.	Physical, nutritional, cognitive, and combination interventional approaches are effective in reducing frailty, measured based on the CHS criteria for 5 frailty components operationally.	No major differences between groups with respect to secondary outcomes (IADL-ADL dependency, hospitalization, and falls).	NA
L Dedeyne, M Deschodt, et al	This systematic review aimed to determine the effect of multi-domain compared to mono-domain interventions on frailty status and score, cognition, muscle mass, strength and power, functional and social outcomes in (pre)frail elderly (≥65 years).	Multidomain interventions show a greater beneficial impact compared to mono-domain interventions (eg, nutritional intervention alone) or usual care for frailty characteristics, physical functioning, and muscle mass and strength. To be more specific, physical exercise seems to play an essential role in the multi-domain intervention. Results were inconclusive for cognitive, functional, and social outcomes.	NA	NA
MET Puts, S Toubasi, et al	A scoping review of interventions and international policies designed to prevent or reduce the level of frailty in community-dwelling older adults.	The studies that compared exercise to control conditions showed a significant reduction in the total number of frailty markers. Exercise plus nutrition compared with control identified a significant reduction in the prevalence of frailty.	NA	NA

9. References

- Cesari M, Vellas B, Hsu FC, Newman AB, Doss H, King AC, et al. A physical activity intervention to treat the frailty syndrome in older persons-results from the LIFE-P study. *J Gerontol A Biol Sci Med Sci*. 2015 Feb;70(2):216-2
- De Almeida Mello, J., Declercq, A., Cès, S., Van Durme, T., Van Audenhove, C., & Macq, J. (2016). Exploring Home Care Interventions for Frail Older People in Belgium: A Comparative Effectiveness Study. *Journal of the American Geriatrics Society*, 64(11), 2251–2256. <https://doi.org/10.1111/jgs.14410>
- De Coninck, L, Bekkering GE, Bouckaert L, Declercq A, Graff MJL, Aertgeerts B. Home- and Community-Based Occupational Therapy Improves Functioning in Frail Older People: A Systematic Review. *J Am Geriatr Soc*. 2017; 65:1863–1869.
- Dedeyne L, Deschodt M, Verschueren S, Tournoy J, Gielen E. Effects of multi-domain interventions in (pre)frail elderly on frailty, functional, and cognitive status: a systematic review. *Clin Interv Aging*. 2017;12:873-896
- De Labra C, Guimaraes-Pinheiro C, Maseda A, Lorenzo T, Millán-Calenti JC. Effects of physical exercise interventions in frail older adults: a systematic review of randomized controlled trials. *BMC Geriatrics* 2015;15:154
- Di Pollina, L., Guessous, I., Petoud, V., Combescure, C., Buchs, B., Schaller, P., ... Gaspoz, J.-M. (2017). Integrated care at home reduces unnecessary hospitalizations of community-dwelling frail older adults: a prospective controlled trial. *BMC Geriatrics*, 17(1). <https://doi.org/10.1186/s12877-017-0449-9>
- Duke, C. (2005). The frail elderly community– based case management project. *Geriatric Nursing*, 26(2), 122–127. <https://doi.org/10.1016/j.gerinurse.2005.03.003>
- Eric De Jonge, K., Jamshed, N., Gilden, D., Kubisiak, J., Bruce, S. R., & Taler, G. (2014). Effects of Home-Based Primary Care on Medicare Costs in High-Risk Elders. *Journal of the American Geriatrics Society*, 62(10), 1825–1831. <https://doi.org/10.1111/jgs.12974>
- Everink, I. H. J., van Haastregt, J. C. M., Evers, S. M. A. A., Kempen, G. I. J. M., & Schols, J. M. G. A. (2018). An economic evaluation of an integrated care pathway in geriatric rehabilitation for older patients with complex health problems. *PLOS ONE*, 13(2), e0191851. <https://doi.org/10.1371/journal.pone.0191851>
- Fairhall, N., Sherrington, C., Kurrle, S. E., Lord, S. R., Lockwood, K., Howard, K., ...

- Cameron, I. D. (2015). Economic Evaluation of a Multifactorial, Interdisciplinary Intervention Versus Usual Care to Reduce Frailty in Frail Older People. *Journal of the American Medical Directors Association*, 16(1), 41–48. <https://doi.org/10.1016/j.jamda.2014.07.006>
- Kodner, D. L. (2006). Whole-system approaches to health and social care partnerships for the frail elderly: an exploration of North American models and lessons. *Health and Social Care in the Community*, 14(5), 384–390. <https://doi.org/10.1111/j.1365-2524.2006.00655.x>
- Kono, A., Kanaya, Y., Tsumura, C., & Rubenstein, L. Z. (2013). Effects of preventive home visits on health care costs for ambulatory frail elders: a randomized controlled trial. *Aging Clinical and Experimental Research*, 25(5), 575–581. <https://doi.org/10.1007/s40520-013-0128-4>
- Looman, Wilhelmina M, Huijsman, R., Bouwmans-Frijters, C. A. M., Stolk, E. A., & Fabbriotti, I. N. (2016). Cost-effectiveness of the ‘Walcheren Integrated Care Model’ intervention for community-dwelling frail elderly. *Family Practice*, 33(2), 154–160. <https://doi.org/10.1093/fampra/cmz106>
- Looman, Wilhelmina Mijntje, Fabbriotti, I. N., & Huijsman, R. (2014). The short-term effects of an integrated care model for the frail elderly on health, quality of life, health care use and satisfaction with care. *International Journal of Integrated Care*, 14(4). <https://doi.org/10.5334/ijic.1010>
- Looman WM, Huijsman R, Fabbriotti IN (2018). The (cost-)effectiveness of preventive, integrated care for community-dwelling frail older people: A systematic review. *Health Soc Care Community*. 2018;00:1–30. <https://doi.org/10.1111/hsc.12571>
- MacAdam, M. (2015). PRISMA: Program of Research to Integrate the Services for the Maintenance of Autonomy. A system-level integration model in Quebec. *International Journal of Integrated Care*, 15(6). <https://doi.org/10.5334/ijic.2246>
- Markle-Reid, M., Weir, R., Browne, G., Roberts, J., Gafni, A., & Henderson, S. (2006). Health promotion for frail older home care clients. *Journal of Advanced Nursing*, 54(3), 381–395. <https://doi.org/10.1111/j.1365-2648.2006.03817.x>
- Meret-Hanke, L. A. (2011). Effects of the Program of All-Inclusive Care for the Elderly on Hospital Use. *The Gerontologist*, 51(6), 774–785. <https://doi.org/10.1093/geront/gnr040>
- Metzelthin S, van Rossum E, Hendriks M, De Witte L, Hobma S, Sipers W, et al. Reducing disability in community-dwelling frail older people: cost-effectiveness study

- alongside a cluster randomised controlled trial. *Age & Ageing* 2015. 44(3):390-396.
- Ng TP, Feng L, Nyunt MS, Feng L, Niti M, Tan BY, Chan G, Khoo SA, Chan SM, et al. Nutritional, Physical, Cognitive, and Combination Interventions and Frailty Reversal Among Older Adults: A Randomized Controlled Trial. *Am J Med*. 2015;128(11):1225
- Puts MET, Toubasi S, Andrew MK, Ashe MC, Ploeg J, Atkinson E, et al. Interventions to prevent or reduce the level of frailty in community-dwelling older adults: a scoping review of the literature and international policies. *Age and Ageing* 2017;46:383–392
- Ruikes FGH, Zuidema SU, Akkermans RP, Assendelft WJJ, Schers HJ, Henk J, et al. Multicomponent Program to Reduce Functional Decline in Frail Elderly People: A Cluster Controlled Trial. *Journal of the American Board of Family Medicine*. 2016; 29(2):209-217
- Watkins, L., Hall, C., & Kring, D. (2012). Hospital to Home: A Transition Program for Frail Older Adults. *Professional Case Management*, 17(3), 117–123. <https://doi.org/10.1097/NCM.0b013e318243d6a7>
- Weaver, F. M., Hickey, E. C., Hughes, S. L., Parker, V., Fortunato, D., Rose, J., ... Baskins, J. (2008). Providing All-Inclusive Care for Frail Elderly Veterans: Evaluation of Three Models of Care: ALL-INCLUSIVE CARE FOR ELDERLY VETERANS. *Journal of the American Geriatrics Society*, 56(2), 345–353. <https://doi.org/10.1111/j.1532-5415.2007.01538.x>