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Which interventions are cost effective at decreasing attendances or hospital admissions from long term care facilities? A systematic review of economic evaluations

Eugenie Evelynne Johnson, Ben Searle, Kimberly Lazo Green, Magdalena Walbaum, Robert Barker, Kelly Brotherhood, Gemma Frances Spiers, Dawn Craig, Barbara Hanratty

Final Report

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Report

Eugenie Evelynne Johnson,[1] Ben Searle[1] Kimberly Lazo Green,[2] Magdalena Walbaum,[3] Robert Barker,[1] Kelly Brotherhood,[1] Gemma Frances Spiers,[1] Dawn Craig,[1] Barbara Hanratty[1]

NIHR Older People and Frailty Policy Research Unit

[1] Population Health Sciences Institute, Newcastle University

[2] School of Health Sciences, University of Manchester

[3] Care Policy and Evaluation Centre, London School of Economics

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Main messages

- Most care home residents are older adults. Preventing non-essential admissions to hospital reduces resident harm and limits demands on health services.

- A recent review found high quality evidence from randomised controlled trials (the ‘gold standard’) for a range of interventions to reduce hospital attendances and admissions from care homes.

- This study sought economic evidence for the interventions proven to be effective and found studies on: advanced care planning (ACP); nurse practitioner input; palliative care; and influenza vaccination.

- ACP, palliative care, influenza vaccination and some nurse-led models have the potential to be cost-effective interventions that reduce hospital attendances or admissions from care homes.

- Some caution is needed in direct generalisation to the UK context, given the poor quality of some of the evidence and variation in study interventions and settings.

Executive Summary

Context

Most care home residents are older adults who live with complex health and care needs. Emergency admission to hospital may be needed to address acute or urgent health concerns. However, hospital stays may also be hazardous for older adults, leading to adverse outcomes such as infection, delirium and reduced physical functioning. Preventing non-essential admissions is good for residents and also reduces demands on health services.
A recent review of interventions to reduce hospital attendances and admissions from care homes, found high quality evidence from randomised controlled trials (the 'gold standard') for the following interventions:[1] advanced care planning (ACP); goals of care setting; nurse practitioner input; palliative care intervention; influenza vaccination; and enhancing access to intravenous (IV) therapies. This report looks at the economic evidence for these interventions.

Aim

To summarise the evidence from economic evaluations for effective interventions to reduce hospital attendances and admissions from people living in long-term care facilities.

Methods

We looked for full economic evaluations or cost analyses using established systematic review methods (CRD42023390725)[2] Five databases were searched (MEDLINE, CINAHL, Cochrane CENTRAL, PubMed, Web of Science) from 2010 to January 2023. We confined our study to interventions (listed above) known to work, to reduce hospital admissions, readmissions, or visits to accident and emergency departments for people living in long-term care facilities.[1] Study quality was appraised with the Drummond checklist and amended NIH Critical Appraisal Tools.[3,4]

Findings

Interventions in the six included studies were: ACP in two; nurse practitioner input; influenza vaccination; palliative care; and one nurse led, multicomponent intervention. Five of the studies (two ACPs, palliative care, influenza vaccination, and a nurse practitioner model) reported cost savings, whilst one study (the multicomponent intervention INTERCARE) was inconclusive. The quality of the evidence was modest.

Conclusion

This review suggests that ACP, palliative care, influenza vaccination and some nurse-led models have potential to be cost effective interventions that reduce demand on emergency hospital services from long term care facilities. Caution is needed in direct generalisation to the UK context, given the variation in evidence quality and study settings.

Full Report

Context

One in seven people aged over 85 live in around 11,000 UK care homes.[5,6] As the older population continues to grow faster than any other age group,[7] the number care home residents is predicted to rise. This is important for the NHS, as older residents of care homes / long term care facilities are three times more likely to be admitted to hospital than people of a similar age who live in their own homes.[8]

Hospitals perform a vital service for care home residents when necessary care cannot be provided in the community.[9] However, hospital attendance or admission may also be distressing, harmful, contrary to residents' preferences, and associated with worse functional outcomes.[10,11,12] In hospital, residents are exposed to risk of infection,[10] medication errors[13,14] and are liable to hospital-acquired delirium. A retrospective analysis of unscheduled emergency department presentations from nursing homes in Ireland found that hospital admission did not improve survival rates amongst residents.[15] Overall, one-third of long term care facility residents admitted acutely to hospital die during that stay.[9,12] Despite this, in the UK emergency attendances from care homes in the last year of life are increasing.[16] Estimates suggest that an additional 8000 hospital beds will be needed in the future to meet the demand from care homes.[17] Hospital admissions are most common in the period preceding death, with between one quarter and one half of admissions occurring in the last 12 months of life.[18] Emergency transfers from care homes in the last year of life are also increasing, with costs expected to double by 2041.[17]

A range of interventions have been proposed to reduce hospital transfers from care homes, including shared decision-making, advanced care planning (ACP), involvement of palliative care teams, interdisciplinary teamwork and improved communication and handovers.[19-24] Receipt of palliative care has been associated with a significantly decreased risk of emergency department attendance in the last year of life,[10] and palliative care is particularly effective at reducing end of life hospitalisations for care home residents with dementia.[25] A review of healthcare provision in care homes/long term care facilities reported that specialist nurse input reduced the rates of unplanned hospital transfers, but evidence for specialist doctor interventions was unclear.[26] However, most previous reviews have focussed on single interventions, with hospital utilisation as an outcome. As the number of older people in the population continues to rise, with stable long term care facility bed numbers, policymakers

are likely to need a suite of interventions to address the growing demands on health services.

This review studies the economic evidence for interventions that have been previously found to be effective at reducing unscheduled hospital admissions or attendances from long term care facilities.[1] These interventions include: ACP, influenza immunisation, nurse practitioner/ specialist input, palliative care, and intravenous therapies.[1]

Aim

To synthesise economic evidence on interventions effective at influencing unplanned hospital attendances, admissions or readmissions by residents of long-term care facilities.

In this study, we will use the term **long-term care facilities**, to encompass all relevant international settings, including UK care homes with and without 24-hour nursing (nursing and residential), homes for the aged and skilled nursing facilities.

Methods

We undertook a rapid review of economic evidence. The protocol is available on PROSPERO (CRD42023390725)[2] and methods are detailed below, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)[27].

Search strategy

Search strategies were adapted from a previously published review of clinical effectiveness[1] and used to search five databases (MEDLINE, CINAHL, Cochrane CENTRAL, PubMed, Web of Science) in 2023. Full details of the search strategies are presented in Appendix A.

Eligibility criteria

This review uses the term long-term care facility as an umbrella term for nursing homes, (residents receive nursing as well as personal care), aged care facilities or residential aged care facilities (terms used in Australia and New Zealand for facilities similar to nursing homes), and care homes (a UK term for residential care with and without nursing).[1] Eligible interventions had to have the aim of reducing hospital admissions or unscheduled attendances (e.g. visits to Accident & Emergency or Emergency Departments that do not result in an inpatient stay).

Study eligibility criteria are summarised in Table 1 below. Effective interventions were identified in a previous systematic review.[1] We restricted this review to articles published in English from 2010 onwards to ensure relevance to the current UK context.

Table 1: Review eligibility criteria

Study design	Any full economic evaluation Any cost analysis attached to an evaluative study (randomised or non-randomised) Not eligible: descriptions of unit costs alone
Population	Residents in long-term care
Intervention	Advanced care planning (ACP) Goal setting Influenza vaccination Nurse practitioner/specialist input Palliative care Intravenous (IV) therapies
Comparator	Any or none
Outcomes	Any economic outcome (e.g. QALY, ICER) as long as hospital admissions or unscheduled attendances were assessed

Abbreviations: ICER = incremental cost-effectiveness ratio; QALY = quality-adjusted life year

Screening and study selection

Three researchers screened titles and abstracts using the online platform Rayyan. Full texts of selected records were retrieved and assessed by one reviewer using a hierarchy of exclusion criteria (Box 1) and checked by a second. Disagreements were resolved through discussion with a third researcher.

Box 1: Screening hierarchy for full texts

1. Is the study published in the English language? If Yes, go to Q2. If no, exclude on LANGUAGE.
2. Does the study report on an eligible design (i.e. full economic evaluation/cost analysis attached to a randomised or non-randomised study)? If so, go to Q3. If no, exclude on STUDY DESIGN.
3. Does the study evaluate the intervention for residents living in long-term care facilities? If yes, go to Q4. If no, exclude on POPULATION.
4. Does the study report an evaluation of an eligible intervention to reduce hospital admissions, attendance or readmissions? If yes, INCLUDE. If no, exclude on INTERVENTION.

Data extraction and critical appraisal

After piloting the use of our data extraction forms, we obtained standard information on the publication, study design, conduct and outcomes. Incremental cost-effectiveness ratios

(ICERs) and any disaggregated cost data relating to hospital admissions or readmissions were extracted from full economic evaluations. Overall costs of the intervention or cost savings relevant to hospital admissions or readmissions were extracted from cost analyses. Quality assessment was guided by the Drummond and Jefferson 1996[3] checklist for full economic evaluations and an amended NIH Quality Assessment tool[28] relevant to the underlying study design (e.g. cohort, case-control) for costs analyses.[28]

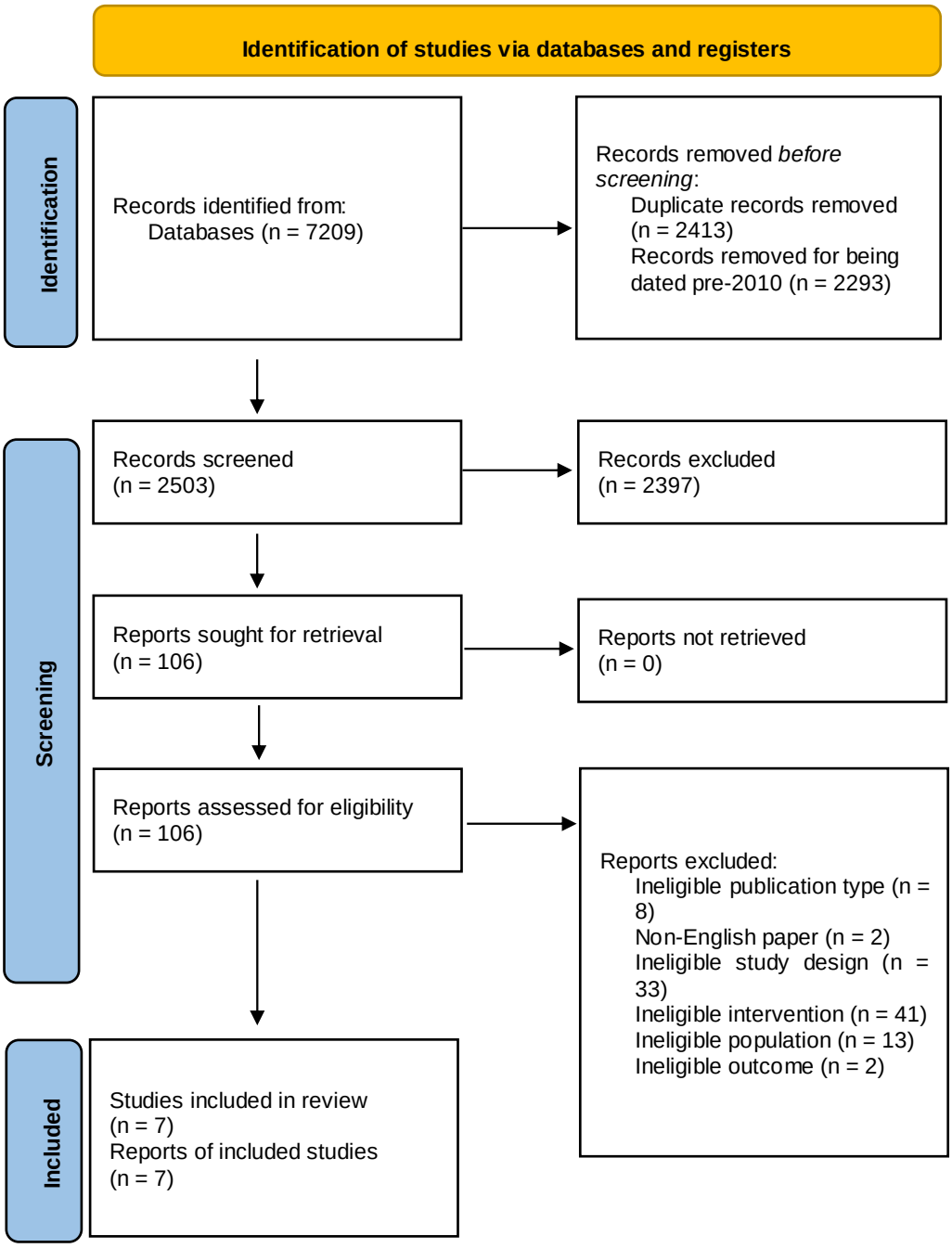
Synthesis

Findings were brought together in a narrative synthesis, divided by type of economic study and intervention type. The impact of these interventions on hospital admissions, the costs savings associated with hospital admissions and delivery of the interventions, and any other additional costs reported, are summarised below.

Findings

Six studies were included (three full economic evaluations[29-31] and three cost analyses[32-35]), following review of 2503 title/abstracts and 106 full-text articles. An additional cost analysis was omitted because it presented insufficient information to allow appraisal.[32]
The process of identifying studies is shown in Figure 1.

Figure 1. PRISMA flowchart



Adapted from Page et al (2020).[27]

Study characteristics

Economic evaluations

A summary of the characteristics of all full economic evaluations included in this review is presented in Table 2.

Table 2: Summary of characteristics of full economic evaluations

Study ID	Type of EE/ Clinical study design	Country and settings	Intervention	Comparison	Currency and cost year	Currency conversion methods	Perspective	Time horizon	Discount rate
Bartakova et al. 2022[29]	CEA – non-randomised stepped-wedge design	Switzerland: 11 nursing homes (six single nursing homes and one cluster of five homes)	INTERCARE: nurse-led care model focusing on strengthening interprofessional collaboration, using expanded role of nurses, comprehensive geriatric assessment, advanced-care planning, data-driven quality improvement	Usual care	Swiss Francs (CHF); cost year not reported	No currency conversion	Participating nursing homes	Not explicit	0%
Lacny et al. 2016[30]	CEA – Controlled before and after design	Canada: two nursing homes	Nurse Practitioner-Family Physician (NP-FP) model of care: a collaborative practice agreement between NP working with three house physicians	Internal control (FP-only model): with residents in the same nursing home as the intervention group External control (FP-only model): with residents in a nearby,	CAD; Medication costs 2006-2008	Not reported	Healthcare system	Not explicit	Not reported

				similar nursing home					
Wichmann et al. 2020[31]	CEA – Cluster RCT	Belgium, Finland, Italy, Netherlands, Poland, England, Switzerland; 73 long-term care facilities	PACE Steps to Success: aims to integrate general palliative care into daily routines in long-term care facilities through training	Usual care - allowed to use all supportive services without restriction	Euros; 2017	Not reported	Health care	1 month	Not reported

Abbreviations: CAD = Canadian dollars; CEA = cost-effectiveness analysis; EE = economic evaluation; FP = family physician; RCT = randomised controlled trial

Three cost-effectiveness analyses (CEAs) were included,[29-31] which were set in long-term care facilities in Switzerland[29], Canada[30], and multiple countries across the EU (Belgium, Finland, Italy, Netherlands, Poland, England, Switzerland)[31]. The number of participating long-term care facilities ranged from two to 73, and the number of residents ranged from 121 to 983. The underlying study designs were: non-randomised stepped wedge,[29] before-and-after,[30] and cluster-randomised trial.[31] Two studies took the perspective of the healthcare system,[30,31] while one adopted a care home perspective.[29]

Each study assessed a different type of intervention. Bartakova 2022 evaluated a multicomponent intervention, INTERCARE,[29] which consisted of a specialist nurse conducting geriatric assessment and ACP. Lacny 2016 assessed a new Nurse Practitioner-Family Physician (NP-FP) model of care,[30] which involved a nurse practitioner providing day to day primary health care services, such as ordering tests, diagnosing and treating illness and prescribing medications, in collaboration with primary care doctors. The intervention in Wichmann 2020 was a one-year programme to integrate general palliative care into day-to-day routines through a train-the-trainer approach (Palliative Care for Older People (PACE) Steps to Success).[31]

All three economic evaluations measured the number of hospitalisations[29,31] or emergency transfers.[30] One measured health-related quality-of-life (HRQoL) using the 5-level EQ-5D (EQ-5D-5L) and the Quality of Dying in Long-Term Care (QOD-LTC) scales.[31] The comparator groups differed. Bartakova and Wichmann used the pre-intervention state[29] and usual care,[31] respectively. Lacny compared to a similar nursing home without nurse practitioner input.[30] Incremental cost effectiveness ratios (ICER) were calculated in two studies (change in costs divided by the change in hospitalisation or emergency transfer rate throughout the intervention period).[29,30] The third study assessed Quality Adjusted Life Years (QALYs) based on the EQ-5D-5L and costs per quality increase given by the QOD-LTC.[31] Most of the disaggregated costs were associated with hospitalisations and emergency transfers via ambulance, costs of hospital visit and stays, and costs of intervention implementation (including time and resources, staff salaries, specialist consultations or visits, medications, and direct medical costs).

Cost analyses

A summary of the characteristics of all cost analyses included in this review is presented in Table 3.

Table 3: Summary of characteristics of cost analyses

Study ID	Clinical study design	Country and settings	Intervention	Comparison	Currency and cost year	Currency conversion methods	Perspective	Time horizon	Discount rate
O'Sullivan et al. 2016[33]	Before and after feasibility study	Ireland: three LTCs: two private, one publicly funded nursing homes	Let Me Decide (LMD): Advance care planning programme	None	Euros; cost year not reported	Average per diem cost was estimated to account for the variation in average length of stay (LOS) associated with the inpatient case mix cost and the LOS reported in this study.	Long-term care facilities	Pre (baseline: January 2010 to June 2012, 30 months) and post (July 2013 to June 2015, 24 months) implementation	Not reported
Teo et al. 2014[35]	Case-control historical cohort	Singapore: seven nursing homes	Project Care at the End-of-Life for Residents in homes for the Elderly (CARE) programme: to provide advance care planning and palliative care for residents identified to be at risk of dying within one year. It involves training staff in nursing	A historical cohort of NH residents who have resided in the NH for at least 3 months was used as control group	SGD; 2011	Inflated to 2011 SGD using the Consumer Price Index (CPI)	Health care system	Less than three months and one month prior to death	Not reported

			homes to provide palliative care for residents with complex symptoms						
Shireman et al. 2019[34]	Cluster-RCT	USA: 823 nursing homes	High dose of influenza vaccine	Low dose of influenza vaccine	USD; cost year not reported	Not reported	Payer (Medicare)	1 November 2013 to 31 May 2014	Not reported

Abbreviations: CPI = Consumer Price Index; LMD = Let Me Decide; LOS = length of stay; LTC = long-term care; NH = nursing home; NP-FP: nurse practitioner-family physician; PACE = Palliative Care for Older People; RCT = randomized controlled trial; SGD = Singapore dollars; USA = United States of America; USD = US Dollars

Three cost analyses[33-35] were included, set in long-term care facilities in Ireland,[33] Singapore,[35] and the USA.[34] The number of participating long-term care facilities ranged from three to 823 and the number of residents from 245 to 37,262. Two studies were concerned with ACP[33,35] and one with influenza vaccination.[34] The clinical studies underpinning the cost-analyses were a before and after feasibility study,[33] a case-control study,[35] and a cluster-randomised trial.[34] One cost analysis described itself as a cost-benefit analysis (CBA) but the design of the study and methods were not compatible with that label.[34]

One study considered an established ACP programme called Let Me Decide (LMD).[33] This was a palliative care education intervention with seminars for nurses and healthcare assistants on the palliative care approach, communication at end-of-life and issues relating to grief and bereavement. Nurse training included symptom assessment and management to deliver holistic, patient-centred care. The other ACP intervention aimed to train staff to provide ACP and palliative care for residents with complex symptoms who were expected to die within one year (Project Care at the End-of-Life for Residents in homes for the Elderly (CARE) programme).[35] The remaining cost analysis looked at the impact of a high-dose influenza vaccine on hospitalisation, mortality and functional decline amongst long-stay nursing home residents.[34]

All three cost analyses measured the number of hospital admissions,[34] number of emergency transfers and doctor visits,[35] and length of hospital stay.[33] Costs were measured using gross costs of hospital resources,[33] and costs per length of stay and emergency transfer.[34,35] Other costs included intervention delivery costs, such as vaccine costs per dose[33] and fixed costs,[35] and direct medical costs such as acute inpatient services[34] and emergency department observation.[33] Only two cost analyses had comparator groups. The case-control study used a historical cohort of nursing home residents not in any end-of-life care programme as the matched control group.[35] In the cluster-randomised study, the control group was given a low dose of influenza vaccine.[34]

Critical appraisal

Full details of all critical appraisal can be found in Appendix B.

Economic outcomes of the studies

An overview of the economic outcomes relating to hospital admissions from the included full economic evaluations and cost analyses are presented in Appendix C.

Economic evaluations

Two of the studies reported reductions in hospital utilisation.[29,31] The multi-component intervention INTERCARE described a fall in hospitalisation rate from 1.27 ± 1.07 per 1000 nursing days before the intervention period to 1.14 ± 0.93 per 1000 nursing days during the intervention period.[29] PACE, the palliative care programme reported a reduction in hospital stay of almost three nights.[31] However, the Nurse Practitioner-Family Physician model of care was not associated with any significant change in emergency transfers when compared with the control groups.[30]

INTERCARE

The cost effectiveness of the multicomponent INTERCARE intervention was uncertain. INTERCARE was judged to be effective but was more costly than usual care.[29] The base-case ICER per avoided hospitalisation was 22,595 CHF and mean additional nursing home costs during the intervention period was 2937 CHF ± 630 CHF per 1000 nursing days. Sensitivity analysis suggested the ICER could range up to 31,300 CHF per avoided hospitalisation, and average daily loss of nursing home revenue per resident was 160 CHF (range 120-201 CHF).[29]

Nurse Practitioner-Family Physician Model (NP-FP)

The NP-FP model appeared to be associated with clinical and economic benefits, but uncertainty around costs and effects, and the size of the study, limit the conclusions that can be drawn on cost-effectiveness.[30] A smaller increase in costs (CAD 354) was reported in the intervention compared with each control group (internal control: CAD 457; external control: CAD 373; combined control: CAD 397).[30] The increase in emergency transfers was slightly larger in the intervention group (0.0247 more transfers per person-month for the intervention group compared with internal and combined control groups (0.0634 and 0.0452 respectively).

PACE

Evaluation of the PACE intervention suggested that timely palliative care in long-term care settings could lead to significant cost savings and prevent lengthy hospitalisations while also retaining quality-of-life.[31] Post-intervention, costs increased by €600.75 for dying residents in the control group but decreased by €257.52 in the intervention group. After controlling for age, gender, disease severity and country of residence, there was a statistically significantly lower mean difference (MD) in post intervention costs of -€983.23 (95% CI − €1,762.22 to −€321.46, P = 0.02). This reduction was mainly associated with the lower hospital

admissions costs (-€919.51). A significant improvement in quality of life was also noted in the intervention group.

Cost analyses

Three cost analyses examined the impact of different interventions on hospitalisations. All reported cost savings resulted from reduced hospital admissions and/or emergency transfers. However, it is important to note that study quality was modest, often limited by study size and reporting, while none were set in the UK. This limits the confidence with which findings may be generalised to the UK context.

Let Me Decide Advanced Care Planning (LMD ACP)

A study of the LMD ACP programme[33] in three nursing homes in Ireland reported a decrease in hospitalisation rate and inpatient days (hospitalisation incidents decreased from 27.8 to 14.6%, $z = 3.96$, $P < 0.001$; inpatient days from 0.54 to 0.36%, $z = 8.85$, $P < 0.001$). National cost reduction per annum was estimated at €10 to €17.8, associated with hospitalisation, and €0.4 million from ambulance transfers. Scenario analyses, varying unit costs and length of stay produced estimates of cost savings from reduced hospitalisations between €17.7 to €42.4 million.

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CARE ACP

The ACP CARE intervention[35] was introduced in seven Singaporean nursing homes for 48 people/cases with 197 controls. Project CARE cases reported adjusted cost savings per resident of SGD 7129 (95% CI SGD 4544 to SGD 9714) over the last three months of life and SGD 3703 (95% CI SGD 1848 to SGD 5557) over the last month of life.

Influenza vaccination

A study in the US reported a reduction in hospital admissions, lower costs and Medicare expenditure associated with use of higher dose influenza vaccination for Medicare beneficiaries in nursing homes.[34] The adjusted mean differences in per participant medical costs were $262 (95% CI -0.06 to 524) for acute inpatients, $85 (95% CI 2 to 168) for other inpatients and $6 (95% CI -7 to 18) for emergency department and observation costs. The direct medical costs per nursing home resident were reported to be $406 higher for those receiving a standard vaccine dosage, of which $212 was attributable to lower inpatient hospital costs.

Discussion

Summary of findings

This rapid review synthesised economic evidence on effective interventions to reduce hospital attendances and admissions from long-term care facilities. Three full economic evaluations and three cost analyses were included in this review and cost savings were reported in five of these six studies. Whilst study quality and relevance to the UK are not strong, our findings suggest that ACP, particularly in a palliative care setting, and influenza vaccination have the potential to be cost-effective interventions in long-term care. The evidence for nurse-led models of care was not strong, which may reflect the challenges of measurement in this setting.

Implications for policy

ACP in UK care homes accelerated during the COVID-19 pandemic and should now be routine practice. It affords an opportunity for residents and families to be involved in plans for future care and support, whilst they have the capacity and time to do so. ACP was included in several different interventions reviewed in this work. In some cases, training in ACP was provided for staff, or the ACP was conducted by palliative care or nurse practitioners. Whilst the quality of the studies is mixed, it suggests ACP is likely to reduce or contain costs. In generalising to UK health and care settings, it is important to note that time, training, and expertise in ACP were provided in the research context, and these may be critical for success. Two of the interventions also set the ACP within a palliative care intervention or approach, which is not universally the case.

Training staff in care homes to integrate **timely palliative care** into everyday practice was effective in the PACE intervention study. This could be relevant to future workforce development in social care, particularly strategies to enhance staff recruitment and retention.

Influenza vaccination is already part of usual care in the UK and the economic evidence supports that practice. However, it is important to note the US study included in this review compared different doses of vaccine, which is not standard in the UK.

Nurse practitioners have taken on routine primary care work in many UK care homes. The study included in this review produced scant economic evidence to support this approach, or more complex, **multi-component interventions**. Conclusions were limited by the small size and modest quality of the studies. As this is a model that has already been implemented,

future robust research would be useful to generate definitive evidence regarding cost-effectiveness.

Strengths and limitations

We used robust methods for this review. A comprehensive search strategy was adapted from a previously-published systematic review and applied to numerous clinical databases.[1] Standard procedures to enhance review quality were adopted, including piloting and duplicating study assessments.[36] Our focus on interventions supported by RCT evidence prioritises the highest quality evidence but will have excluded some potentially effective approaches.

Most of limitations of this work lie in the quality of the available evidence. Research in long term care has grown in recent years but there are many reasons why it is a challenging setting for experimental studies. Collection of economic data alongside an RCT is ideal but is limited by the paucity of trials in this field.[37] This places greater reliance on cost-effectiveness evidence from quasi-experimental or observational studies, which can overestimate the benefits of interventions.[38] In addition, study design and reporting across the six studies can be criticised for a number of other reasons, including small size and short time scales.[30,34]

Conclusion

This work suggests that ACP, palliative care and influenza vaccination have potential to be cost-effective interventions to reduce emergency hospital attendances and admissions from long term care facilities. Overall, there is a dearth of experimental studies and economic evaluations from long term care facilities, while the quality of evidence reviewed was modest. Further research is needed to draw definitive conclusions, particularly on nurse practitioner and multicomponent nurse interventions.

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Appendix A: Search strategies

All searches were conducted on 20 September 2022 and updated on 10 January 2023.

MEDLINE	
#	Searches
1	nursing homes/ or intermediate care facilities/ or skilled nursing facilities/
2	Homes for the Aged/
3	(nursing adj (home* or facilit*)).tw.
4	(home? for the aged or home? for the elderly).tw.
5	((intermediate or long-term or longterm) adj care facilit*).tw.
6	or/1-5
7	hospitalization/ or "length of stay"/ or patient admission/ or patient readmission/ or patient transfer/
8	(hospital adj3 (treat* or stay or days or care)).tw.
9	(stay adj2 length).tw.
10	(hospitaliz* or hospitalis* or rehospitalis* or rehospitaliz*).tw.
11	((hospital? or patient?) adj3 (admit* or admis* or readmit* or readmis* or transfer)).tw.
12	emergency service, hospital/ or trauma centers/
13	Emergency medical services/
14	((acute or immediate or emergency or critical) adj (care or service)).tw.
15	use of emergency department?.tw.
16	emergency department? use.tw.
17	trauma cent?r*.tw.
18	or/7-17
19	6 and 18
20	economics/
21	exp “costs and cost analysis”/
22	economics, dental/
23	exp “economics, hospital”/
24	economics, medical/
25	economics, nursing/
26	economics, pharmaceutical/
27	(economic$ or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic$).ti,ab.
28	(expenditure$ not energy).ti,ab.

29	value for money.ti,ab.
30	budget$.ti,ab.
31	or/20–30
32	((energy or oxygen) adj cost).ti,ab.
33	(metabolic adj cost).ti,ab.
34	((energy or oxygen) adj expenditure).ti,ab.
35	or/31–34
36	31 not 35
37	letter.pt.
38	editorial.pt.
39	historical article.pt.
40	or/37–39
41	36 not 40
42	Animals/
43	Humans/
44	42 not (42 and 43)
45	41 not 44
46	19 and 45

Cochrane CENTRAL	
#	Searches
1	MeSH descriptor: [Nursing Homes] explode all trees
2	MeSH descriptor: [Homes for the Aged] this term only
3	(nursing NEXT (home* or facilit*)):ti,ab,kw
4	("home? for the aged" OR "home? for the elderly"):ti,ab,kw
5	((intermediate or long-term or longterm) NEXT care facilit*):ti,ab,kw
6	(#1 OR #2 OR #3 OR #4 OR #5)
7	MeSH descriptor: [Hospitalization] explode all trees
8	(hospital NEAR/3 (treat* or stay or days or care)):ti,ab,kw
9	(stay NEAR/2 length):ti,ab,kw
10	(hospitaliz* or hospitalis* or rehospitalis* or rehospitaliz*):ti,ab,kw
11	((hospital? or patient?) NEAR/3 (admit* or admis* or readmit* or readmis* or transfer)):ti,ab,kw

12	MeSH descriptor: [Emergency Service, Hospital] explode all trees
13	MeSH descriptor: [Emergency Medical Services] this term only
14	((acute or immediate or emergency or critical) NEXT (care or service)):ti,ab,kw
15	use of emergency department?:ti,ab,kw
16	emergency department? use:ti,ab,kw
17	(trauma center*):ti,ab,kw or (trauma centr*):ti,ab,kw
18	(#7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17)
19	(#6 AND #18)

Embase	
#	Searches
1	nursing home/
2	nursing home patient/
3	home for the aged/
4	(nursing adj (home* or facilit*)).tw.
5	(home? for the aged or home? for the elderly).tw.
6	((intermediate or long-term or longterm) adj care facilit*).tw.
7	or/1-6
8	hospitalization/
9	"length of stay"/
10	hospital admission/
11	hospital readmission/
12	patient transport/
13	(hospital adj3 (treat* or stay or days or care)).tw.
14	(stay adj2 length).tw.
15	(hospitaliz* or hospitalis* or rehospitalis* or rehospitaliz*).tw.
16	((hospital? or patient?) adj3 (admit* or admis* or readmit* or readmis* or transfer)).tw.
17	emergency health service/
18	((acute or immediate or emergency or critical) adj (care or service)).tw.
19	"use of emergency department?".tw.
20	"emergency department? use".tw.
21	trauma cent?r*.tw.
22	or/8-21

23	7 and 22
24	Health Economics/
25	exp Economic Evaluation/
26	exp Health Care Cost/
27	pharmacoeconomics/
28	24 or 25 or 26 or 27
29	(econom$ or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic$).ti,ab.
30	(expenditure$ not energy).ti,ab.
31	(value adj2 money).ti,ab.
32	budget$.ti,ab.
33	29 or 30 or 31 or 32
34	28 or 33
35	letter.pt.
36	editorial.pt.
37	note.pt.
38	35 or 36 or 37
39	34 not 38
40	(metabolic adj cost).ti,ab.
41	((energy or oxygen) adj cost).ti,ab.
42	((energy or oxygen) adj expenditure).ti,ab.
43	40 or 41 or 42
44	39 not 43
45	animal/
46	exp animal experiment/
47	nonhuman/
48	(rat or rats or mouse or mice or hamster or hamsters or animal or animals or dog or dogs or cat or cats or bovine or sheep).ti,ab,sh.
49	45 or 46 or 47 or 48
50	exp human/
51	human experiment/
52	50 or 51
53	49 not (49 or 52)
54	44 not 53

55	0959-8146.is.
56	(1469-493X or 1366-5278).is.
57	1756-1833.en.
58	55 or 56 or 57
59	54 not 58
60	conference abstract.pt.
61	59 not 60
62	23 and 61

ISI Web of Science	
#	Searches
18	#17 AND #16
17	TS=(“cost benefit analysis” OR “cost of illness” OR “economic evaluation” OR “economic outcome” OR “cost effectiveness”)
16	#15 AND #4
15	#14 OR #13 OR #12 OR #11 OR #10 OR #9 OR #8 OR #7 OR #6 OR #5
14	TS=("emergency department$ use")
13	TS=("use of emergency department$")
12	TS=(((acute or immediate or emergency or critical) NEAR (care or service)))
11	TS=((("Trauma center*" or "trauma centr*")))
10	TS=("Emergency medical services")
9	TS=(("hospital emergency service"))
8	TS=((((hospital? or patient?) NEAR/3 (admit* or admis* or readmit* or readmis* or transfer))))
7	TS=(((hospitaliz* or hospitalis* or rehospitalis* or rehospitaliz*)))
6	TS=(((stay NEAR/2 length)))
5	TS=(((hospital NEAR/3 (treat* or stay or days or care))))
4	#3 or #2 or #1
3	TS=((((intermediate* or long-term or longterm) NEAR "care facilit*")))
2	TS=(("home$ for the aged" or "home$ for the elderly"))
1	TS=((nursing NEAR (home* or facilit*)))

PubMed	
#	Searches

#44	#17 and #43
#43	#39 not #42
#42	#40 not (#40 and #41)
#41	humans[mesh]
#40	animals[mesh:noexp]
#39	#34 not #38
#38	#35 or #36 or #37
#37	historical article[Publication Type]
#36	editorial[Publication Type]
#35	letter[Publication Type]
#34	#29 not #33
#33	#30 or #31 or #32
#32	energy expenditure[Title/Abstract] OR oxygen expenditure[Title/Abstract]
#31	metabolic cost[Title/Abstract]
#30	energy cost[Title/Abstract] OR oxygen cost[Title/Abstract]
#29	#18 or #19 or #20 or #21 or #22 or #23 or #24 or #25 or #26 or #27 or #28
#28	budget*[Title/Abstract]
#27	value for money[Title/Abstract]
#26	expenditure*[Title/Abstract] not energy[Title/Abstract]
#25	economic*[Title/Abstract] or cost[Title/Abstract] or costs[Title/Abstract] or costly[Title/Abstract] or costing[Title/Abstract] or price[Title/Abstract] or prices[Title/Abstract] or pricing[Title/Abstract] or pharmacoeconomic*[Title/Abstract]
#24	“Economics, Pharmaceutical”[Mesh]
#23	“Economics, Nursing”[Mesh]
#22	“Economics, Medical”[Mesh:NoExp]
#21	“Economics, Hospital”[Mesh]
#20	“Economics, Dental”[Mesh:NoExp]
#19	“Costs and Cost Analysis”[Mesh]
#18	“Economics”[Mesh:NoExp]
#17	Search (#6 AND #16)
#16	Search (#7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15)
#15	Search ("emergency departments" OR "emergency department")
#14	Search ("acute care" OR "immediate care" OR "emergency care" OR "critical care" OR "acute service" OR "immediate service" OR "emergency service" OR "critical service")

#13	Search ("trauma center" OR "trauma centers" OR "trauma centre" OR "trauma centres")
#12	Search ("emergency medical services" OR "emergency medical service")
#11	Search ("hospital emergency service" OR "hospital emergency services")
#10	Search ((hospital OR hospitals OR patient OR patients) AND (admit* or admis* or readmit* or readmis* or transfer))
#9	Search (hospitaliz* OR hospitalis* OR rehospitalis* OR rehospitaliz*)
#8	Search ("stay length" OR "length of stay" OR "stay lengths" OR "lengths of stay")
#7	Search ((hospital AND (treat* OR stay OR days OR care)))
#6	Search (#1 OR #2 OR #3 OR #4 OR #5)
#5	Search ("long-term care facility" OR "long-term care facilities")
#4	Search ("longterm care facility" or "longterm care facilities")
#3	Search ("intermediate care facility" OR "intermediate care facilities")
#2	Search ("home for the aged" OR "homes for the aged" OR "home for the elderly" OR "homes for the elderly")
#1	Search ("nursing home" OR "nursing homes" OR "nursing facility" OR "nursing facilities")

CINAHL	
#	Searches
S45	S23 AND S44
S44	S41 NOT (S42 OR S43)
S43	(ZT "doctoral dissertation") or (ZT "masters thesis")
S42	MH "Animal Studies"
S41	S36 NOT S40
S40	S37 or S38 or S39
S39	PT commentary
S38	PT letter
S37	PT editorial
S36	S34 or S35
S35	TI (cost or costs or economic* or pharmacoeconomic* or price* or pricing*) OR AB (cost or costs or economic* or pharmacoeconomic* or price* or pricing*)
S34	S30 or S33
S33	S31 or S32
S32	MH "Health Resource Utilization"
S31	MH "Health Resource Allocation"

S30	S24 NOT S29
S29	S25 OR S26 or S27 OR S28
S28	MH "Business+"
S27	MH "Financing, Organized+"
S26	MH "Financial Support+"
S25	MH "Financial Management+"
S24	MH "Economics+"
S23	S7 AND S22
S22	S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21
S21	trauma cent#r*
S20	emergency department? use
S19	use of emergency department*
S18	((acute or immediate or emergency or critical) N1 (care or service))
S17	(MH "Emergency Medical Services")
S16	(MH "Trauma Centers")
S15	(MH "Emergency Service")
S14	((hospital* or patient*) N3 (admit* or admis* or readmit* or readmis* or transfer))
S13	(hospitaliz* or hospitalis* or rehospitalis* or rehospitaliz*)
S12	(stay N2 length)
S11	(hospital N3 (treat* or stay or days or care))
S10	(MH "Patient Admission")
S9	(MH "Length of Stay")
S8	(MH "Hospitalization")
S7	S1 OR S2 OR S3 OR S4 OR S5 OR S6
S6	((intermediate or long-term or longterm) N1 care facilit*)
S5	(home* for the aged or home* for the elderly)
S4	(nursing N1 (home* or facilit*))
S3	(MH "Nursing Home Patients")
S2	(MH "Skilled Nursing Facilities")
S1	(MH "Nursing Homes")

Appendix B: Critical appraisal

Economic Evaluations

The Drummond-Jefferson checklist was used across the three areas of study design, data collection, and analysis and interpretation of results. All three economic evaluations showed clear indication of research questions and study design being stated.[29-31] However, Bartakova 2022 and Wichmann 2020 did not present any information on why the choice of economic evaluation (i.e. CEA) was the most appropriate method to use.[29,31] Effectiveness estimates were also not reported in the same two economic evaluations,[29,31] where only references of the full trial published in a different paper were mentioned. There was some transparency in the reporting of unit costs data, currency and price year, and details of adjustment for inflation or currency conversion. Only one study[29] reported quantities of resources separately from the unit cost, and one study[30] did not report any details on price year or inflation conversion. All three economic evaluations stated the methods used to value health states and other benefits. None of the three economic evaluations studies used any decision models.[29-31] The time horizon for all included economic evaluations were either short or not explicit, which explains why no discount rates were reported except for in one study.[29] All three economic evaluations reported their approach to sensitivity analysis. Wichmann 2020 did not include an incremental analysis[31] or disaggregated costs.[29] Conclusions following from the data were presented well across all studies, with appropriate discussion of limitations and answers to the study question.

Cost Analyses

In the cost analysis based on a cluster-randomised study,[34] no clear judgement could be made on the different domains of bias (e.g. patient selection, performance, attrition, and detection), as no information was described in the paper. Similarly, O'Sullivan 2016[33] and Teo 2014[35] did not explicitly mention blinding or adjusting of potential confounders. This makes it difficult to assess the validity of the outcome measures and analyses. Selection criteria, sample size, and drop-out rates of the participants were sufficiently reported in two cost analyses,[33,34] while an intention-to-treat analysis was conducted in the randomised study.[34]

For the economics-related questions, only one cost analysis[34] reported the costing approach used, while two studies[34,35] identified the data collection process used for the economic evidence. Components of all resources were reported in monetary terms and time horizons were stated in all three cost analyses.[33-35] However, information on discount rates were not found.

Critical appraisal of full economic evaluations (Drummond & Jefferson 1996)[3]			
Items	**Bartakova 2022**	**Lacny 2016**	**Wichmann 2020**
1. Was the research question stated?	Yes	Yes	Yes
2. Was the economic importance of the research question stated?	Yes	Yes	Yes
3. Was/were the viewpoint(s) of the analysis clearly stated and justified?	Yes	Yes	Yes
4. Was a rationale reported for the choice of the alternative programmes or interventions compared?	Yes	Yes	Yes
5. Were the alternatives being compared clearly described?	No	Yes	Yes
6. Was the form of economic evaluation stated?	Yes	Yes	Yes
7. Was the choice of form of economic evaluation justified in relation to the questions addressed?	No	Yes	No
8. Was/were the source(s) of effectiveness estimates used stated?	Yes	Yes	Yes
9. Were details of the design and results of the effectiveness study given (if based on a single study)?	No	Yes	No
10. Were details of the methods of synthesis or meta-analysis of estimates given (if based on an overview of a number of effectiveness studies)?	NA	NA	NA
11. Were the primary outcome measure(s) for the economic evaluation clearly stated?	Yes	Yes	Yes
12. Were the methods used to value health states and other benefits stated?	Yes	Yes	Yes
13. Were the details of the subjects from whom valuations were obtained given?	No	Yes	Yes
14. Were productivity changes (if included) reported separately?	NA	NA	NA
15. Was the relevance of productivity changes to the study question discussed?	NA	NA	NA
16. Were quantities of resources reported separately from their unit cost?	Yes	No	No
17. Were the methods for the estimation of quantities and unit costs described?	Yes	No	No
18. Were currency and price data recorded?	Yes	No	Yes
19. Were details of price adjustments for inflation or currency conversion given?	No	No	Yes
20. Were details of any model used given?	NA	NA	NA
21. Was there a justification for the choice of model used and the key parameters on which it was based?	NA	NA	NA
22. Was the time horizon of cost and benefits stated?	No	Yes	Yes
23. Was the discount rate stated?	Yes	No	No
24. Was the choice of rate justified?	No	No	No

25. Was an explanation given if cost or benefits were not discounted?	Yes	No	No
26. Were the details of statistical test(s) and confidence intervals given for stochastic data?	No	No	NA
27. Was the approach to sensitivity analysis described?	Yes	Yes	Yes
28. Was the choice of variables for sensitivity analysis justified?	No	No	Yes
29. Were the ranges over which the parameters were varied stated?	NA	No	No
30. Were relevant alternatives compared?	Yes	Yes	Yes
31. Was an incremental analysis reported?	Yes	Yes	No
32. Were major outcomes presented in a disaggregated as well as aggregated form?	Yes	No	No
33. Was the answer to the study question given?	Yes	Yes	Yes
34. Did conclusions follow from the data reported?	Yes	Yes	Yes
35. Were conclusions accompanied by the appropriate caveats?	Yes	Yes	Yes
36. Were generalisability issues addressed?	Yes	Yes	Yes

Key: Green = yes; Red = no; White = not applicable (NA)

Critical appraisal of cost analyses: pre-post study	
Item from NIH pre-post tool	**O'Sullivan 2016**
Was the study question or objective clearly stated?	Yes
Were eligibility/selection criteria for the study population prespecified and clearly described?	Yes
Were the participants in the study representative of those who would be eligible for the test/service/intervention in the general or clinical population of interest?	Yes
Were all eligible participants that met the prespecified entry criteria enrolled?	Yes
Was the sample size sufficiently large to provide confidence in the findings?	Yes
Was the test/service/intervention clearly described and delivered consistently across the study population?	Yes
Were the outcome measures prespecified, clearly defined, valid, reliable, and assessed consistently across all study participants?	Yes
Were the people assessing the outcomes blinded to the participants' exposures/interventions?	No
Was the loss to follow-up after baseline 20% or less? Were those lost to follow-up accounted for in the analysis?	Yes
Did the statistical methods examine changes in outcome measures from before to after the intervention? Were statistical tests done that provided P values for the pre-to-post changes?	Yes
Were outcome measures of interest taken multiple times before the intervention and multiple times after the intervention (i.e. did they use an interrupted time-series design)?	No
If the intervention was conducted at a group level (e.g. a whole hospital, a community, etc.) did the statistical analysis take into account the use of individual-level data to determine effects at the group level?	Not applicable
Items 5-11 from cost analysis tool	
Is the costing approach reported (e.g., top-down, bottom-up)?	Unclear
Is the data collection process reported (e.g. prospective, retrospective)?	No
Are all components of resource use identified that are relevant to the condition/disease, population, intervention, study objectives, and study perspective?	Yes
If not, is a justification provided for excluding relevant components for resource use?	Not applicable
Are all identified and included components of resource use measured?	Yes
If not, is a justification provided for not measuring certain components of resource use?	Not applicable
Are all included components of resource use valued in monetary terms?	Yes
If not, is a justification provided for not valuing certain components of resource use?	Not applicable
Is the chosen time horizon specified?	Yes

If so, is the chosen time horizon justified?	Yes
Are future costs discounted?	No
If so, is a justification provided for the discount rate?	Not applicable

Key: Green = yes; Red = no; White = not applicable; Grey = Unclear

Critical appraisal of cost analyses: controlled, randomised study	
Item from NIH controlled randomised tool	**Shireman 2016**
Was the study described as randomized, a randomized trial, or an RCT?	Yes
Was the method of randomization adequate (i.e. use of randomly generated assignment?)	NR
Was the treatment allocation concealed (so that assignments could not be predicted)?	NR
Were study participants and providers blinded to treatment group assignment?	Cannot determine
Were the people assessing the outcomes blinded to the participants' group assignments?	NR
Were the groups similar at baseline on important characteristics that could affect outcomes (e.g. demographics, risk factors, co-morbid conditions)?	Yes
Was the overall drop-out rate from the study at endpoint 20% or lower of the number allocated to treatment?	Yes
Was the differential drop-out rate (between treatment groups) at endpoint 15 percentage points or lower?	Yes
Was there high adherence to the intervention protocols for each treatment group?	Cannot determine
Were other interventions avoided or similar in the groups (e.g. similar background treatments)?	NR
Were outcomes assessed using valid and reliable measures, implemented consistently across all study participants?	NR
Did the authors report that the sample size was sufficiently large to be able to detect a difference in the main outcome between groups with at least 80% power?	Yes
Were outcomes reported or subgroups analysed prespecified (i.e. identified before analyses were conducted)?	NR
Were all randomised participants analysed in the group to which they were originally assigned, i.e., did they use an intention-to-treat analysis?	Yes
Items 5-11 from cost analysis tool	
Is the costing approach reported (e.g., top-down, bottom-up)?	Yes
Is the data collection process reported (e.g. prospective, retrospective)?	Yes
Are all components of resource use identified that are relevant to the condition/disease, population, intervention, study objectives, and study perspective?	Yes
If not, is a justification provided for excluding relevant components for resource use?	Not applicable

Are all identified and included components of resource use measured?	Yes
If not, is a justification provided for not measuring certain components of resource use?	Not applicable
Are all included components of resource use valued in monetary terms?	Yes
If not, is a justification provided for not valuing certain components of resource use?	Not applicable
Is the chosen time horizon specified?	Yes
If so, is the chosen time horizon justified?	Yes
Are future costs discounted?	No
If so, is a justification provided for the discount rate?	NR

Key: Green = yes; Red = no; White = not applicable; Grey = not reported or cannot determine
Abbreviations: NR = not reported

Critical appraisal of cost analyses: case control study	
Item from NIH case-control tool	**Teo 2014**
Was the research question or objective in this paper clearly stated and appropriate?	Yes
Was the study population clearly specified and defined?	Yes
Did the authors include a sample size justification?	No
Were controls selected or recruited from the same or similar population that gave rise to the cases (including the same timeframe)?	Yes
Were the definitions, inclusion and exclusion criteria, algorithms or processes used to identify or select cases and controls valid, reliable and implemented consistently across all study participants?	Yes
Were the cases clearly defined and differentiated from the controls?	Yes
If less than 100 percent of eligible cases and/or controls were selected for the study, were the cases and/or controls randomly selected from those eligible?	No
Was there use of concurrent controls?	No
Were the investigators able to confirm that the exposure/risk occurred prior to the development of the condition or event that defined a participant as a case?	Yes
Were the measures of exposure/risk clearly defined, valid, reliable, and implemented consistently (including the same time period) across all study participants?	Yes
Were the assessors of exposure/risk blinded to the case or control status of participants?	No
Were key potential confounding variables measured and adjusted statistically in the analyses? If matching was used, did the investigators account for matching during study analysis?	No
Items 5-11 from cost analysis tool	
Is the costing approach reported (e.g., top-down, bottom-up)?	No
Is the data collection process reported (e.g. prospective, retrospective)?	Yes

Are all components of resource use identified that are relevant to the condition/disease, population, intervention, study objectives, and study perspective?	Yes
If not, is a justification provided for excluding relevant components for resource use?	Not applicable
Are all identified and included components of resource use measured?	Yes
If not, is a justification provided for not measuring certain components of resource use?	Not applicable
Are all included components of resource use valued in monetary terms?	Yes
If not, is a justification provided for not valuing certain components of resource use?	Not applicable
Is the chosen time horizon specified?	Yes
If so, is the chosen time horizon justified?	No
Are future costs discounted?	No
If so, is a justification provided for the discount rate?	Not applicable

Key: Green = yes; Red = no; White = not applicable

Table 3: Overview of economic outcomes from the economic evaluations and cost analyses as reported by study authors

Economic evaluations			
Study	**Impact on hospital admissions**	**Costs/savings relating to hospital admissions**	**Other costs data reported**
Bartakova et al. 2022[29]	Average hospitalisation rate Before intervention: 1.27 ± 1.07 per 1000 nursing days During intervention: 1.14 ± 0.93 per 1000 nursing days	Base-case ICER: 22,595 CHF per avoided hospitalisation Sensitivity analysis if the salary rate was in upper limit of range: ICER = 31,300 CHF per avoided hospitalisation Average daily loss of revenue per resident due to a hospitalisation 2017-2020 (range): 160 CHF (120-201 CHF) Mean additional nursing home cost during the intervention period: 2937 CHF ± 630 CHF per 1000 nursing day	Cost of implementation Average total implementation cost (range) 685 CHF (110 to 1591 CHF) Average total implementation time per bed 9.35 hours (2.05 to 17.16 hours) Most cost and time intensive personnel resources: administration and internal coordination; internal training and information events Intervention costs Yearly intervention costs, i.e., nurse salary (range): 939 CHF (259 to 1513 CHF) NH losses and savings due to hospitalisation Average daily loss of revenue per resident due to a hospitalisation 2017 to 2020 (range): 160 CHF (120 to 201 CHF) Each absence amounts to 100% loss on NH nursing service revenues 11% average of hotel services 52% average loss on all associated revenues No savings for NHs

Lacny et al. 2016[30]	Emergency department transfer rates intervention group (NP-FP): Before: 0.0202 After: 0.0446 ED transfer rate, person-month: 0.0247	Probabilistic ICER Cost, CAD/ED transfer rate, person-month Intervention: CAD 354 Emergency department transfer healthcare costs: Before: CAD 944 After: CAD 1299	No additional costs reported
Wichmann et al. 2020[31]	Hospitalisations Difference between the intervention and control group before and after intervention: 2.9 nights Quality of end of life (care) in the last month of life (QOD-LTC): 3.19 (1.72 to 4.65) P = 0.00	Cost difference per hospital admissions: €919.51 (€1.725.97 to €299.56; P = 0.018) Overall cost savings in the intervention group: −€983.28 (−€1,762.22 to −€321.46; P = 0.020)	Post-intervention mean costs resource use (unadjusted MD): Control (n = 558): €1962.64 Intervention (n = 425): €1410.35

Abbreviations: CAD = Canadian dollars; CHF = Swiss Francs; ED = emergency department; ICER = incremental cost-effectiveness ratio; NP-FP = nurse practitioner-family physician; QOD-LTC = quality of life long-term care

Cost analyses			
Study	**Impact on hospital admissions**	**Costs/savings relating to hospital admissions**	**Other costs data reported**
O'Sullivan et al. 2016[33]	Hospitalisations per year Before: 80 After: 44	Episode of care €4081/Episode Before: €37,487,265 After: €19,686,419	Sensitivity analysis (average € millions, 95% CI) Length of stay, reference hospital data €491/day Before: €44.69 (25.84 to 70.51) After: €20.30 (13.75 to 28.31) Difference: €24.39 (6.05 to 48.55)

	Hospitalisation rate (based on hospitalisation incidents) Before: 27.9% After: 14.6%, z = 3.96, P < 0.001 Average LOS per stay Before: 7.02 After: 9.07 Average LOS for same period in reference hospital site amongst those transferred from nursing homes Before: 9.89 After: 8.58 Hospital bed days (per month) Before: 1403 (46.8) After: 798 (33.3) Hospitalisation rate (based on hospital days) Before: 0.54% After: 0.36%, z = 8.85, P < 0.001	Length of stay €491/day diagnosis related group (DRG) Before: €31,630,876 After: €21,472,704 Difference: €17,800,847 (cost savings) Ambulance transfers €97/transfer Before: €891,761 After: €468,308	Length of stay, LMD-ACD Data €857/day Before: €56.71 (34.61 to 87.58) After: €38.11 (22.48 to 60.20) Difference: €18.60 (−10.87 to 52.14) Length of stay, reference hospital data €857/day Before: €77.98 (47.24 to 118.78) After: € 35.43 (25.59 to 47.01) Difference: €42.55 (10.72 to 83.16) Probabilistic scenario analysis Baseline: €4081/episode of hospitalisation Before: €37.82 (2.65 to 119.34) After: €19.87 (1.37 to 64.10) Difference: €17.95 (1.15 to 58.90) Baseline: LMD-ACP Length of stay and €491/day Before: €32.49 (18.96 to 52.34) After: €21.83 (12.46 to 35.40) Difference: €10.67 (−6.10 to 30.69) Ambulance transfers Before: 0.89 (0.55 to 1.34) After: 0.47 (0.27 to 0.73) Difference: 0.42 (0.19–0.73)
Shireman et al. 2019[34]	No explicit data reported	Emergency department/observation	Per-participant direct medical costs - mean Acute inpatient

		High-dose: $133 (95% CI 248 to 427) Standard dose: $135 (95% CI 123 to 148)	High-dose: $3043 (95% CI 2773 to 3313) Standard dose: $3255 (95% CI 2998 to 3512) Other inpatient High-dose: $338 (95% CI 248 to 427) Standard dose: $419 (95% CI 324 to 513) Adjusted differences (MD) in per participant direct medical costs Acute inpatient: $262 (95% CI -0.06 to 524) Other inpatient: $85 (95% CI 2 to 168) Emergency department/observation: $6 (95% CI -7 to 18)
Teo et al. 2014[35]	Doctor visits Last 3 months in life Mean utilisation (SD): 2.8 (6.4) Final month in life Mean utilisation (SD): 1.5 (3.5) Transport Last 3 months in life Mean utilisation (SD) 3.7 (8.8) Final month in life Mean utilisation (SD): 2.0 (4.9)	Doctor visits Last 3 months in life Median cost per resident (10-90th PR) SGD 0 (0 to 520) Final month in life Median cost per resident (10-90th PR) SGD 0 (0 to 325) Transport Last 3 months in life Median cost per resident (10-90th PR) SGD 0 (0 to 58) Final month in life Median cost per resident (10-90th PR) SGD 0 (0 to 35)	Fixed cost Median cost per resident Last 3 months in life SGD 583 Final month in life: SGD 583 Overall median cost per resident (10-90th PR) Last 3 months in life: SGD 583 (583 to 1323) Final month in life: SGD 0 (583 to 1088)

Abbreviations: CI = confidence interval; LOS = length of stay; PR = per resident; SD = standard deviation; SGD = Singapore dollars

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Email: pru-manager@manchester.ac.uk

Telephone: 0161 306 7797

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