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Determining the Cost-Effectiveness of Home Care: A Scoping Review

RESEARCH

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ABSTRACT

Context: The demand for long-term care services provided at home (home care) has increased over time. However, we do not know whether home care is cost-effective with respect to other care options. This restricts the ability of policymakers to allocate the limited resources for long-term care efficiently.

Objectives: The purpose of this scoping review is to understand what is already known about the comparative cost-effectiveness of home care versus other care options, different modes of home care and different intensities of home care.

Methods: We searched six electronic databases in January and February 2023. A total of 1,191 items were identified and reviewed. Fourteen papers were thematically analysed, and the findings were presented under four themes: definition of home care and comparators; measurement of outcomes and costs; treatment of informal care; and methods.

Findings: The existing evaluations of home care lack a standardised framework for measuring outcomes, costs and the impact of informal care and suffer from methodological limitations. Evidence on the comparison between traditional home care options and other models of home-based care, such as directly employed personal assistants or extra care housing schemes, is currently missing.

Limitations: The definition of home care can vary across countries and studies, which may affect our ability to capture relevant literature.

Implications: Future work in the evaluation of home care will need to use new outcome measures, incorporate caregivers' outcomes, and employ newer statistical methods. Relevant authorities also need to prioritise making routinely collected data linkable and accessible.

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BACKGROUND

Adult long-term care supports people, aged 18 and over, with long-term needs related to physical, sensory or learning disabilities, physical or mental long-term health conditions, and dementia. Demand and spending for long-term care have increased over time. From 2004 to 2021, the average long-term care spending as a share of gross domestic product (GDP) rose from 0.9% to 1.8% in the OECD; this is projected to rise to 2.3% by 2040 (Day, De Biase and Dougherty, 2023; OECD, 2023). Population ageing is the main driver of long-term care expenditure growth, but overall long-term care spending is also affected by the composition and organisation of services. Care options across countries typically include care provided in institutional settings (e.g., nursing and residential care homes), care provided at home (often known as home or domiciliary care) and sometimes other models of care that combine specialist housing with dedicated care packages (e.g., extra care housing schemes in England). In most OECD countries, institutional care, which is typically more costly compared to the other modes of care, accounts for the majority of the long-term care spending. In 2021, around half of the long-term care spending occurred in nursing homes and on average, one-fifth of all long-term care spending was used for care provision at home (OECD, 2023).

Over time, however, the composition of long-term care services has been changing. Increasing numbers of people receiving long-term care wish to remain independent in their own homes for longer (Guo *et al.*, 2015; Lehnert *et al.*, 2019; Walbaum *et al.*, 2024), and many governments are shifting the focus towards support at home and away from a reliance on residential and nursing care (De Meijer *et al.*, 2015; Konetzka, 2014). This policy shift aims at accommodating people's preferences and ensuring adequate quality of life and independence in old age but also addressing budget pressures generated by expensive institutional care. Despite the growing policy shift towards home care as a more cost-effective model of care, this position is not yet supported by a robust evidence base, and many countries are seeking evidence to understand what would be a cost-effective configuration of services for the design of their long-term care systems.

This scoping review was undertaken as part of a wider study, which assessed the feasibility of an economic evaluation of home care services in England. England is one of the countries that has set out a vision for long-term care (also known as social care in the UK) that supports people with care needs in their own homes but does not yet have the evidence base to guide care commissioners' decisions about allocating funding between care options (DHSC, 2021). To date, there is relatively little available about the aims of and research approaches that might be used to evaluate home care, especially relative to other alternatives, such as residential care and housing with care. Two recent literature reviews identified only a small number of economic evaluations in long-term care broadly (Bulamu, Kaambwa and Ratcliffe, 2018; Weatherly *et al.*, 2017), but none of these reviews or other studies summarised specifically any existing evidence on the cost-effectiveness of home care relative to other settings.

The aim of the scoping review was thus to assess the existing research and inform subsequent cost-effectiveness research on home care about appropriate methods, concepts and knowledge gaps (Munn *et al.*, 2018). To assess methods and identify methodological gaps, we used, as a guide, the framework of the established economic evaluation methods used in healthcare. Assessing cost-effectiveness typically involves comparing both outcomes and costs of mutually exclusive interventions. In recent years, economic evaluation methods have been developed to assess the cost-effectiveness of healthcare interventions by comparing health outcomes, in the form of quality-adjusted life years (QALYs), of alternative interventions subject to a budget constraint (Drummond *et al.*, 2015). These methods are well-established, and, in some countries, they are incorporated in health economic evaluation guidelines (for example, in England through the National Institute for Health and Care Excellence (NICE)), providing transparency and a standardised framework that decision makers can use to assess value for money across settings (NICE, 2022). However, a similar framework, with a standardised range of methods, outcomes and costs, has not yet been developed for the evaluation of long-term care interventions (Weatherly *et al.*, 2017), despite some attempts to coordinate methods in this area in countries such as England (NICE, 2014). Thus, the methods used in the healthcare evaluation literature served as a benchmark for identifying limitations and gaps in the long-term care evaluation literature that future research would need to address. More specifically, we sought to understand which outcomes, costs and methods to assess cost-effectiveness and address selection issues are used by existing studies, as these are the key elements of an economic evaluation (Drummond *et al.*, 2015). An issue relating to outcomes, costs and methods in long-term care is the treatment of informal carers, who can support cared for persons in addition to formal care services but can also be understood as 'co-beneficiaries' of long-term care, alongside the person they support (Rand, Vadean and Forder, 2020; Wittenberg, James and Prosser, 2019). Therefore, we also explored whether and in what way informal care was accounted for in existing evaluations.

Furthermore, due to the heterogeneity of the home care offerings within and across countries, our study also reviewed the definition of home care used in the literature to assess the comparability of existing evidence and identify gaps in the underpinning of concepts. As captured in existing literature, formal long-term care

received by people living in their own homes varies across many dimensions. These include, among others, the types of services included (e.g., (traditional) home care, community services, day care, meals on wheels, adaptations), the population served (e.g., people over a certain age, people with certain health conditions), the intensity of services, the financing of services (e.g., public support, insurance, out-of-pocket, etc.), the types of providers (e.g., private, public or third sector), care workers ('personal assistants') employed directly by the person or their family or models of home care delivery (e.g., visits vs. live-in care) (Gruber, McGarry and Hanzel, 2023; OECD, 2023). Other relevant aspects also include the organisation of these services and whether they are aligned to healthcare (e.g., community nursing) and/or long-term care systems (i.e., help with (instrumental) activities of daily living [(I)ADLs]). Providing a detailed description of the various long-term care arrangements in each country goes beyond the scope of this paper. However, to provide an overview of existing definitions, our review set out the specific set of services covered by each study on home care and the populations they served. This will help understand the extent of the heterogeneity in the home care definitions and, consequently, the extent of comparability of existing evidence.

Despite this variability, we were able to identify a set of studies of home care interventions that could be meaningfully reviewed. To do so, we took as reference the organisation of long-term care in England, where the most common mode of home care is home care visits provided by private, third-sector or public home care agencies (Skills for Care, 2023). In addition to this more 'traditional' model, home care in England is also provided by staff directly employed by the client or self-employed as personal assistants; an alternative model is that of housing with care, such as extra care housing schemes. As in other countries, the most common alternative care setting is institutional care, which includes residential and nursing care homes. Based on this set up, we specified a set of inclusion and exclusion criteria that defined a minimum set of key characteristics of the interventions under study. Specifically, our definition of traditional home care was any intervention that supported people with personal care and/or (I)ADLs at their place of private residence, irrespective of funding arrangements. In contrast, our definition excluded healthcare interventions (e.g., hospital-at-home, community nursing services), short-term, rehabilitation, and reablement services. As comparators, we considered care models or service delivery interventions for long-term care support with personal care and/or (I)ADLs in a different setting (e.g., institutional care), of a different mode within home care services (e.g., personal assistants or housing with care) and of a different intensity.

In summary, the scoping review was conducted with the following research question: what is known about the comparative cost-effectiveness of home care versus care in other settings (e.g., institutional care), different modes of home care (e.g., visits by care workers, care by personal assistants, housing with care) and different intensities of home care.

METHODS

The research team (KG, HT, SR, FV) discussed the structure and plan of the scoping review following the PRISMA-ScR guidelines. This was then reviewed and discussed with research advisors, including social care professionals, providers, family carers, people receiving home care and policymakers. The research team agreed and drafted the final plan in a written document that was circulated among the project team and advisory group members.

INCLUSION AND EXCLUSION CRITERIA

Studies were included if: (i) they conducted a comparative assessment of the costs and/or effectiveness of two or more interventions as stand-alone studies or alongside a clinical trial or other types of study design; (ii) they focussed on adult long-term care interventions, that is, interventions supporting people with personal care and/or I(ADLs); (iii) one of the comparators in the study was a care model or a service delivery intervention that provided long-term care in people's own homes, irrespective of funding arrangements, and was provided by private, third sector and/or public providers; (iv) the alternative comparator was a care model or service delivery intervention of long-term care in a different setting (e.g., residential or nursing care or a housing with care scheme) or; (v) the alternative comparator was a care model or service delivery intervention of long-term care provided at home but under a different mode (e.g., through the direct employment of a personal assistant) or at different intensity; (vi) the study population were adults aged 18 and over; (vii) they were published in the English language in peer review journals and; (viii) they were published after 2000 to consider more recent and relevant literature.

Studies were excluded if: (i) they examined the costs and/or effectiveness of healthcare services or short-term care services, such as rehabilitation and reablement services delivered at home or informal/unpaid help from family, friends and neighbours; (ii) they had no comparator; (iii) they were burden of disease or cost of illness studies; (iv) they were theory papers, letters, editorials, reviews, research protocols, books, trade journals; (v) they were conference papers, theses, dissertations and studies without a full text available.

SEARCH STRATEGY

We searched six relevant databases selected for coverage and relevance to the topic of study. Scopus was selected to cover literature from a broad range of

disciplines, Web of Science to cover literature published in the sciences and social sciences, PubMed to cover the biomedical literature and life science journals, Social Care Online (from SCIE) to cover research on social care and social work, Social Policy and Practice (OvidSP) to cover literature on evidence-based health and social policy and RePEc/EconPapers to cover the economics literature. We ran pilot searches to refine the relevant search terms. After the pilot searches, we finalised the search terms that best captured the relevant literature on domiciliary care and economic evaluations. Final searches were conducted on 31st January, 6th February and 7th February 2023 (see supplementary appendix).

DATA EXTRACTION AND SYNTHESIS

The initial database search identified 2,223 articles. Of these, 1,032 articles were removed as duplicates. Two researchers (KG, HT) screened 1,191 articles by title and abstract independently. Disagreements were resolved through consensus-based discussion between the two researchers. In some cases, advice was sought from SR and FV. Through this screening, we excluded 1,148 records that were not relevant to the context and topic or/and did not satisfy the inclusion/exclusion criteria. We added five additional articles from the reference lists. We reviewed 48 articles in full text. Following this review, we excluded 34 articles and included 14 studies in the final synthesis chart. Figure 1 presents the flow diagram.

A data-charting format was jointly developed by KG, HT, SR and FV to determine which variables to extract from the identified items. KG conducted the charting for the 14 selected items. All researchers (KG, HT, SR, FV) discussed the results and further updated the data-charting format in an iterative process. We used the background literature on economic evaluations in healthcare (Drummond *et al.*, 2015) as a conceptual framework for our analysis of the themes. Using this framework, we identified the following themes to explore: (i) the definition of home care and comparators; (ii) the measurement of outcomes, (iii) the measurement of costs, (iv) the evaluation methods used, and (v) the treatment of informal care. Specifically, for outcomes, we were interested in understanding which outcomes have been used and to what extent specialised measures, such as the ASCOT-SCT4 (Adult Social Care Outcomes Toolkit for self-completion) (Netten *et al.*, 2012) and ICECAP-O (Investigating Choice Experiments for the Preferences of Older People – CAPability) (Coast *et al.*, 2008), are being used. Regarding costs, we sought to understand what cost perspective existing studies have adopted and how costs were measured. Regarding methods, we sought to understand how studies have measured cost-effectiveness, whether methods used in healthcare evaluation studies, such as cost-utility, cost-effectiveness, cost-benefit or cost-consequence analysis, have been adopted and how studies have accounted for selection issues affecting cost-effectiveness. Relatedly, we sought to understand whether existing research has accounted for informal care as a confounding factor in the statistical analysis and whether informal care has been included in the cost and/or outcomes perspective of existing studies.

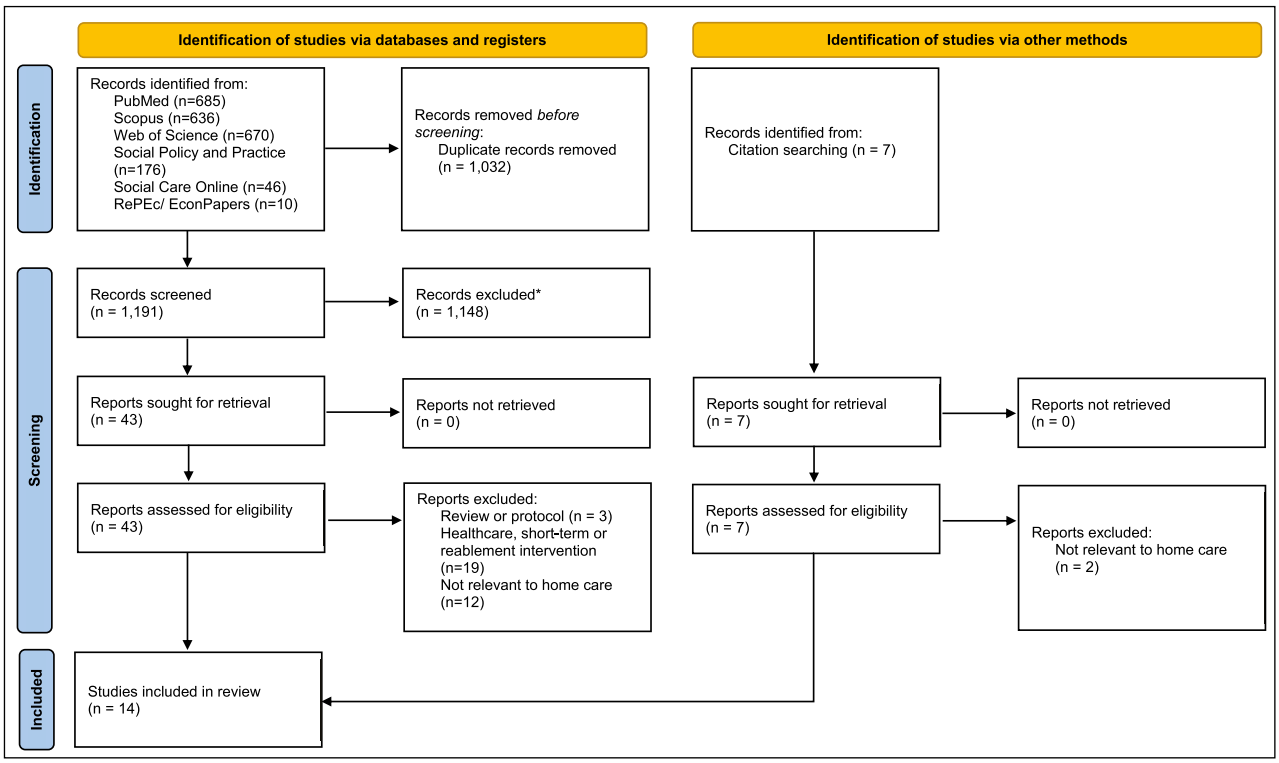

Figure 1 Flow diagram.

* No automation tools were used, so all records were excluded by a human.

PUBLIC PATIENT INVOLVEMENT (PPI)

Research Advisors, which included social care professionals, providers, carers, and people using home care, provided input at different stages of the study. We presented the design and findings of the scoping review at three meetings, in which Research Advisors offered feedback on the development of the research questions, research design and methods, and interpretation of findings. Their feedback helped refine the definition of home care, outcomes and costs and the respective search terms and identify sources of information.

RESULTS

GEOGRAPHIC COVERAGE

All the identified studies (Table 1) were published in peer-reviewed journals, except for one report that was published by a non-profit organisation (Keogh *et al.*, 2018). The studies came from a variety of countries. Of the 14 studies we reviewed, two were from England (Forder *et al.*, 2014; Forder *et al.*, 2018) one based in the Netherlands (Kok, Berden and Sadiraj, 2015), two were from Canada (Chappell *et al.*, 2004; Wilson and Truman, 2005), two were from Taiwan (Chiu, Shyu and Liu, 2001; Kuo *et al.*, 2010), two were from Korea (Kim and Yang, 2005; Park *et al.*, 2021), two were from Serbia (Mihic, Todorovic and Obradovic, 2014; Mihic *et al.*, 2016), one was from Sweden (Condelius, Hallberg and Jakobsson, 2010), one was from the USA (Wysocki *et al.*, 2014) and one from Ireland (Keogh *et al.*, 2018). Some studies had a more regional or local focus. (Wilson and Truman, 2005) focussed on the population in Alberta (Canada), while (Chappell *et al.*, 2004) focussed on two Canadian cities, Victoria and Winnipeg. (Wysocki *et al.*, 2014), a US-based study looked at Arkansas, Florida, Minnesota, New Mexico, Texas, Vermont and Washington, and the Swedish study (Condelius, Hallberg and Jakobsson, 2010) was based on the southern part of Sweden.

HOME CARE AND COMPARATORS

Home care in the studies we reviewed described formal long-term care services provided at home to help people with long-term care needs to live their daily lives. Despite this overarching principle, the definition of home care differed across studies in terms of the exact type of services and tasks included and the people it served. Some studies (n = 4) considered home care together with other community-based services, such as meals, day care, and aids and adaptations (Forder *et al.*, 2018; Keogh *et al.*, 2018; Kim and Yang, 2005; Kok, Berden and Sadiraj, 2015). In other studies (n = 6), home care had a nursing care element to it, particularly if it was serving people with specific conditions, such as dementia or stroke (Chiu, Shyu and Liu, 2001; Kim and Yang, 2005; Kok, Berden and Sadiraj, 2015; Park *et al.*, 2021; Wysocki *et al.*, 2014). One study (Keogh *et al.*, 2018) looked specifically at an intensive home care package provided to people and families with dementia at home rather than a generic home care package. Although the studies we reviewed looked at home care for older people with long-term care needs, there was still some variation in the specific populations they studied. Six studies focussed on older people over 65 (Chappell *et al.*, 2004; Condelius, Hallberg and Jakobsson, 2010; Forder *et al.*, 2014; Park *et al.*, 2021; Wilson and Truman, 2005; Wysocki *et al.*, 2014), two studies on older people in general (Mihic, Todorovic and Obradovic, 2014; Mihic *et al.*, 2016), one study on people over the age of 56 (Kok, Berden and Sadiraj, 2015) and one study on people over 40 (Forder *et al.*, 2018). A few studies focussed on more specific populations, such as older people with a stroke (n = 2) (Chiu, Shyu and Liu, 2001; Kim and Yang, 2005) or older people with dementia (n = 3) (Keogh *et al.*, 2018; Kuo *et al.*, 2010; Park *et al.*, 2021). In all studies (n = 14), formal home care services were provided by private, third-sector or public home care providers or a combination of these. We did not find any studies in which home care was exclusively provided by directly employed personal assistants.

Home care was most commonly compared with care in an institutional setting. As with home care, the definition of institutional care differed across studies. Two studies used the term residential care (Keogh *et al.*, 2018; Kok, Berden and Sadiraj, 2015). Five studies used the term nursing care or nursing homes (Chiu, Shyu and Liu, 2001; Kim and Yang, 2005; Mihic, Todorovic and Obradovic, 2014; Wilson and Truman, 2005; Wysocki *et al.*, 2014). One study used the terms nursing homes and long-term care facilities interchangeably (Chappell *et al.*, 2004), and one study used the term special accommodation, which they described as equivalent to nursing home care (Condelius, Hallberg and Jakobsson, 2010). Two studies used more generic terms, such as institutional care (Kuo *et al.*, 2010; Park *et al.*, 2021). All of these terms were used to describe formal long-term care services provided in an institutional setting by professional staff to help people with a relatively higher level of needs. As with home care, these services were provided by private, third-sector and/or public home care providers and were financed by a combination of public and private contributions.

Another group of studies (n = 3) compared alternative intensities of home care (Forder *et al.*, 2014; Forder *et al.*, 2018; Mihic *et al.*, 2016). We did not find any studies comparing different modes of home care (e.g., between home care agencies and personal assistants) or comparing home care to extra care housing or assisted living facilities services.

Overall, we found there was variation in what constitutes home care and institutional care services across studies. The differences we observe can be explained by the fact that long-term care, and especially home care, is a relatively recent development, as many of the reviewed

AUTHOR/ YEAR	TITLE	COUNTRY POPULATION SAMPLE SIZE	STUDY TYPE METHODS	SERVICES COMPARED	OUTCOMES	TYPES OF COSTS MEASURED	CONSIDERATION OF INFORMAL CARE	CALCULATES INCREMENTAL COST-EFFECTIVENESS RATIO?	KEY FINDINGS
Forder *et al.* (2014)	Using cost-effectiveness estimates from survey data to guide commissioning: an application to home care	England 65+ years n = 301	Observational Instrumental variables	Alternative intensities of home care	Social care related quality of life (ASCOT)	Labour costs: home care	Controlled in the statistical analysis	Yes	The optimal intensity of home care was found to be £45 per week at the £30,000 threshold. Incremental cost-effectiveness was found to be over £50,000 at the current level of home care.
Forder *et al.* (2018)	The impact of long-term care on quality of life	England 40+ years N = 622	Observational Instrumental variables	Alternative intensities of community-based care	Social care related quality of life (ASCOT)	Labour costs: home care, day care, social worker Meals on wheels Equipment Home adaptations	Controlled in the statistical analysis	Yes	This study estimated the marginal effect of community-based care intensity (expenditure) on quality of life. It found that there was a positive effect with diminishing returns. Based on these estimates the paper estimated the incremental cost-effectiveness ratio of a marginal change in expenditure on community-based care under two scenarios: (i) increase access (counterfactual of no care – extensive margin) and (ii) increase intensity (counterfactual of lower intensity – intensive margin). The study concludes that, a system aimed to maximise care related quality of life, under unmet needs, would put more emphasis on access (more recipients) than intensity of support.
Kok, Berden and Sadiraj (2015)	Costs and benefits of home care for the elderly versus residential care: a comparison using propensity scores	Netherlands 56+ years n = 1,712	Observational Propensity score matching	Home care vs. residential and nursing care	Happiness (5-point Likert scale question)	Labour costs: formal home care (cleaning, personal care, nursing care, social assistance), general practitioner, medical specialist, physiotherapy, hospital Informal care: disutility method Home adaptations Mobility aids: wheelchair, mobility scooter, public transport, small mobility aids Drugs	Information on informal care was used for matching Measure of costs included informal care	No	Residential care was more expensive for society as a whole than home care. The study highlights that in Netherlands, the taxpayer bears the cost of residential care but other stakeholders (e.g., local authorities, health insurers, informal caregivers) bear the cost of home care. The authors also find some evidence of higher happiness in residential care. They conclude that the incentives in place are towards residential care.

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Mihic, Todorovic and Obradovic (2014)	Economic analysis of social services for the elderly in Serbia: two sides of the same coin	Serbia Elderly population n = 350	Observational Correlation analysis; Economic Net Present Value (ENPV) modelling	Home care vs. nursing care	Health Quality of life Socialization (self-reported questions)	Labour costs: home care Staff training costs Staff commuting costs	Measures benefits from reduced informal care	No	The study found that the economic net present value of both home care and nursing care was positive and thus economically justifiable. The cost of home care per user was though lower than that of nursing care. The study stressed the lack of evaluation studies of social care services.
Chappell *et al.* (2004)	Comparative costs of home care and residential Care	Canada 65+ years n = 491	Observational Mean group comparison (ANOVA)	Home care vs. nursing homes or long-term care facilities	Quality of life (Terrible Delightful Scale (1976)) Life satisfaction (self-reported) Satisfaction with services (self-reported)	Labour costs: home care, residential care, physician, hospital costs Informal care: caregiver time at minimum wage, time at replacement wage Administrative costs: capital costs, food, overhead costs, equipment	Measures informal care costs	No	Quality of life, life satisfaction and satisfaction with services was comparable between community and facility samples. Home care was less costly than residential care.
Kim and Yang (2005) Societal (patient, family, providers, insurer)	Cost–effectiveness of long-term care services in South Korea	Korea Stroke patients with physical/ cognitive impairment n = 99	Observational Mean group comparison (ANCOVA); Regression analysis	Home care services vs. nursing home services	Physical function (four-item ADL score); Cognitive function (cognitive performance scale score (Morris et al. (1994))	Out-of-pocket expenditures by patient, family members, providers, and insurer: hospital and physician services, drugs, home care, nursing home care, home health aides, purchases of special equipment, foods, supplements Informal care: labour cost of caregivers (average wage rate), care-related travel time	Measures informal care costs	No	The study found no statistically significant difference in average total costs between home health-care and nursing home care. The difference in the average cost-effectiveness ratios between the two settings was significant only in terms of physical function but not cognitive function. Regression analysis showed that the most important predictors of cost-effectiveness were baseline ADL scores, the type of long-term care and their interaction. The authors interpret these findings as evidence that home health-care services are more efficient for people with lower levels of need and nursing homes are more efficient for people with higher levels of need.

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Park *et al.* (2021)	Differences in function and healthcare cost of older adults with dementia by long-term care service type: a national dataset analysis	Korea 65+ years with low severity dementia n = 4,414	Observational Mean group comparison; Regression analysis	Home care vs. Institutional care services	Physical function (13-item ADL score); Cognitive function (10-item score); 4-year changes of these indicators	Annual expenditure by beneficiaries: home care, institutional care (physical activities, household chores, nursing needs), medical services	Controlled in the regression analysis	No	Controlling for covariates, the regression analysis in this study found that institutional care was associated with a worsening of outcomes and an increase in costs over time compared to home care. The authors interpret these findings as evidence that home care is a cost-effective way to maintain the function of beneficiaries with low-severity dementia.
Chiu, Shyu and Liu (2001)	Comparisons of the cost-effectiveness among hospital chronic care, nursing home placement, home nursing care and family care for severe stroke patients	Taiwan Stroke patients with severe physical disability n = 313	Observational Mean group comparison; Regression analysis	Home care vs. nursing care	Physical function (6-item ADL score)	Monthly family expenditure on home care/nursing care Informal care: labour cost of caregiving (average wage rate), transportation cost	Measures informal care costs	No	The ADL scores of stroke patients with severe physical functional disabilities were not significantly different among people who used home care or nursing homes. The study also calculated the cost of informal caregiving in terms of wage income lost. This was found to be higher for people receiving care at home. Because of the added informal caregiving cost, the study concludes that it was more effective to care for patients in nursing homes rather than their own homes.
Condelius, Hallberg and Jakobsson (2010)	Medical healthcare utilisation as related to long-term care at home or in special accommodation	Sweden 65+ years n = 1,079	Observational Mean group comparison	Home care vs. special accommodation (equivalent to nursing home)	Number of hospital stays; Number of contacts with outpatient physician	No other cost measurement	Not considered	No	The study found that the mean number of hospital admissions and the mean number of physician contacts in outpatient care were higher for people receiving care at home compared to people receiving care in special accommodation. The authors conclude that granting long-term care at home may lead to increased utilisation of medical healthcare.

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Wilson *et al.* (2005)	Comparing the health services utilisation of long-term-care residents, home-care recipients, and the well elderly	Canada 65+ years n = 41,866	Observational Mean group comparison (chi square, t test, ANOVA)	Home care vs. nursing home	Health services utilisation (hospital admissions and length of stay, ambulatory procedures, emergency room visits, number of physician procedures)	No other cost measurement	Not considered	No	The study found that people in nursing homes had fewer hospitalizations, shorter stays, less likely to use an emergency room and less likely to receive other ambulatory and outpatient services and received more physician services, compared to people receiving home care. The study concludes based on this evidence, that nursing care is a good way to manage the health and care needs of older people.
Wysocki *et al.* (2014)	Hospitalization of elderly Medicaid long-term care users who transition from nursing homes	USA 65+ years N = 2,338	Observational Retrospective matched cohort design; Cox proportional hazard model	Medicaid home and community-based care services vs. Medicaid nursing homes	Potentially preventable hospitalizations; All hospitalizations	No other cost measurement	Not considered	No	The study found that transitioners from nursing home to community care had a higher likelihood of experiencing a potentially preventable hospitalization, and a higher risk of experiencing any type of hospitalization, over people remaining in the nursing home. The study concludes from these findings that efforts to encourage transitioning to the community might require better planning in terms of the medical needs of people.
Mihic *et al.* (2016)	Can we do better? Economic analysis of human resource investment to improve home care service for the elderly in Serbia	Serbia Elderly population n = 147	Observational Economic net present value modelling; Scenario modelling analysis	Alternative configurations of home care spending	Health; Quality of life; Socialization; (self-reported questions)	Labour costs: home care Staff training costs Staff commuting costs	Measures benefits from reduced informal care	No	This study calculated the economic net present value (ENPV) of investing in additional home care hours and of investing on more beneficiaries for home care services. In both scenarios the ENPV was found positive, and therefore according to the authors both policies are cost-efficient (economically justifiable investments). The optimal configuration of home care services, that gave the highest ENPV, was increasing the number of home care hours from 6 to 8 hours per week and increase the number of the beneficiaries to 33%.

(Contd.)

AUTHOR/ YEAR	TITLE	COUNTRY POPULATION SAMPLE SIZE	STUDY TYPE METHODS	SERVICES COMPARED	OUTCOMES	TYPES OF COSTS MEASURED	CONSIDERATION OF INFORMAL CARE	CALCULATES INCREMENTAL COST-EFFECTIVENESS RATIO?	KEY FINDINGS
Keogh *et al.* (2018)	Supporting older people with complex needs at home: report 1: evaluation of the HSE intensive home care package initiative	Ireland Older people with dementia and disabilities n = 62	Observational Descriptive analysis	Intensive home care package (IHCP) vs. residential care	Quality of life of person with dementia (QOL-AD); Caregiver health-related quality of life (EQ5D3 L); Caregiver stress (ZBI);	Labour costs: home care package Residential care costs: average cost of public long-stay care and average cost of private nursing home care (labour and accommodation costs) Aids and appliances: hoists, beds, wheelchairs	Considered the substitution between informal and formal care	No	This study measured outcomes for people receiving the care home package. They also measured aggregate costs of people receiving care home and people in residential care. The study found that people with dementia and their caregivers were satisfied with the home care package and that their quality of life did not deteriorate. The study also found that the home care package was a viable financial alternative to nursing home care for the majority of people. However, for people needing more intensive care at home, the cost of the IHCP was higher than that of residential care alternatives.
Kuo *et al.* (2010) Direct/ Indirect	Dementia care costs and the patient's quality of life (QoL) in Taiwan: home versus institutional care services	Taiwan Older people with dementia n = 140	Observational Group mean comparison	Home care vs. institutional care	Health-related quality of life (EQ5D)	Labour costs: home care, institutional care Medications Food Equipment Transportation (to dementia care) Informal care: time spent caring and travelling, productivity loss	Measures informal care costs	No	The study compared the quality of life and costs between home care and institutional care overall and by level of dependency (low- vs. high-dependency). The study found that quality of life was higher in home care than institutional care. It also found that the cost was lower for home care compared to institutional care among people with low physical dependence but higher for people with high physical dependence. They conclude from this evidence that home care is better at balancing quality of life and costs, for people with dementia and low physical dependency and institutional care is better for people with high physical dependency.

Table 1 Selected studies (n = 14).

studies also highlighted (Chappell *et al*., 2004; Condelius, Hallberg and Jakobsson, 2010; Kim and Yang, 2005; Mihic, Todorovic and Obradovic, 2014; Wilson and Truman, 2005), that has been shaped under the specific institutional arrangements of each country. Likewise, there is a lack of evidence comparing home care to other models of non-institutional care and limited evidence comparing alternative configurations of home care.

MEASUREMENT OF OUTCOMES AND COSTS

Outcomes

There was a wide range of outcome measures used to compare different care interventions. Some studies focussed on quality of life and wellbeing, such as social care-related quality of life using the ASCOT (Forder *et al*., 2014; Forder *et al*., 2018); health-related quality of life using the EQ-5D (Kuo *et al*., 2010); quality of life using the Terrible Delightful Scale (1976) and self-reported measures of life satisfaction and satisfaction with services (Chappell *et al*., 2004); quality of life for a person with dementia using the Quality of Life in Alzheimer's Disease (QOL-AD) and caregiver health-related quality of life with the EQ-5D and caregiver stress with the Zarit Burden Interview (ZBI) (Keogh *et al*., 2018); self-reported five-point scale of happiness (Kok, Berden and Sadiraj, 2015); and self-reported and subjective measures about quality of life, socialisation and health (Mihic, Todorovic and Obradovic, 2014; Mihic *et al*., 2016). Other studies used instead aspects of functional health as outcome measure (n = 3). These included difficulty with ADLs (with different ADLs, ADL scores and ADL intensity considered) (Chiu, Shyu and Liu, 2001; Kim and Yang, 2005; Park *et al*., 2021); the cognitive performance scale score by Morris *et al*. (1994) (Kim and Yang 2005); and a 10-item self-reported score on cognitive function (Park *et al*., 2021). For a third group of studies (n = 3), the main outcomes of interest were indirectly associated with costs, that is, healthcare utilisation, rather than people's quality of life outcomes. These outcomes included the number of hospital stays and number of contacts with outpatient physicians (Condelius, Hallberg and Jakobsson, 2010); the number of hospital admissions, length of stay, ambulatory procedures, emergency room visits and number of physician procedures (Wilson and Truman, 2005); and preventable hospitalisations and hospitalisations (Wysocki *et al*., 2014).

Costs

There was heterogeneity across studies in the types of costs considered and how these were measured. Three studies stated the perspective from which costs were evaluated. Forder *et al*. (2014) and Forder *et al*. (2018) were based on the perspective of a commissioner of publicly funded long-term care and, accordingly, considered only the costs of long-term care services. Kim and Yang (2005) took a societal perspective and thus considered costs to the patient, family, service providers and national insurance system. Kim and Yang (2005) classified direct costs to the care recipient and family as those arising from out-of-pocket spending on long-term care and medical services, prescription drugs, equipment, and food. Indirect costs to the care recipient included forgone earnings, and those to the family included the labour cost of providing informal care and travel time.

Amongst studies which did not explicitly state a study perspective, three considered costs beyond those associated with long-term care and healthcare services, such as the cost of informal care. Of the three, Kuo *et al*. (2010) distinguished between direct and indirect costs. They classified direct costs as those arising from long-term care services, medical care, food, equipment, and transportation. Indirect costs were those incurred by informal carers and included time spent caring, travelling time and productivity loss associated with providing care.

Beyond differences in whether the cost of informal care was considered, there was also variation in how these costs were measured. Chiu, Shyu and Liu (2001) and Kim and Yang (2005) measured the labour cost to caregivers (as foregone average wage) and the care-related travel time. Chappell *et al*. (2004) measured the labour cost of caregiving time at minimum wage and at replacement wage, and Kok, Berden and Sadiraj (2015) measured informal care costs as the disutility of informal caregiving with the wellbeing method.

Similarly, there was variation in the definition and measurement of formal long-term care costs. This is driven in part by the diversity in definitions of home care across studies. The activities performed by home care were not always explicitly described in the studies, so the tasks could be different between home care packages. In Kok, Berden and Sadiraj (2015), formal long-term care covered cleaning, personal care, nursing care and social assistance, and in Park *et al*. (2021), home care included support with physical activities, household chores and nursing needs. Some studies also considered other services such as meals on wheels, equipment, mobility aids and home adaptations as part of the home care package (Forder *et al*., 2018; Kim and Yang, 2005; Keogh *et al*., 2018; Kok, Berden and Sadiraj, 2015; Kuo *et al*., 2010).

All studies considered the labour cost of long-term care services. In Forder *et al*. (2014), Chappell *et al*. (2004), Kuo *et al*. (2010), and Keogh *et al*. (2018), this comprised the labour cost of home care services. In Forder *et al*. (2018), costs comprised home care, day care and social care worker costs. In Mihic, Todorovic and Obradovic (2014) and Mihic *et al*. (2016), labour costs included staff training costs and staff commuting costs. One study included capital and overhead costs (Chappel *et al*., 2004), and two studies included healthcare costs such as physician and hospital utilisation and medication (Kok, Berden and Sadiraj, 2015; Park *et al*., 2021).

Three studies whose main outcome was healthcare utilisation (Condelius, Hallberg and Jakobsson, 2010; Wilson and Truman 2005; Wysocki *et al.*, 2014) did not consider any additional costs to this analysis. The way costs were calculated and reported also varied across studies. Three studies (Forder *et al.*, 2014; Forder *et al.*, 2018; Kok, Berden and Sadiraj, 2015) reported unit costs and aggregated the different elements of care, while the remaining studies used aggregate figures on aggregate costs or expenditure and, therefore, a very detailed breakdown of costs was not provided.

Heterogeneity

Overall, we found little consistency in the measurement of outcomes. Although some of the reviewed studies focussed on quality of life and wellbeing there was still limited use of the new outcome tools developed for use in long-term care (e.g., ASCOT, ICECAP). These measures have been specifically designed to capture the experiences and perspectives of the service users (e.g., ASCOT-SCT4, ICECAP-O) and their caregivers (e.g., ASCOT-Carer), as well as the objectives of the decision makers and would therefore be preferable to other physical, wellbeing or quality of life measures that do not fully capture the impact of long-term care (Makai *et al.*, 2014). There was similarly little consistency in which costs were considered and how these were measured across studies. This is partly due to the variation in the definition of formal home care (i.e., what services are regarded as home care) across countries and contexts and also the lack of available data (breakdown of costs versus aggregate figures).

More broadly, the heterogeneity in the types and measurement of outcomes and costs could be explained by the lack of a standardised framework for evaluating long-term care interventions. For example, there is still no commonly accepted outcome measure for long-term care interventions equivalent to the healthcare QALY. Similarly, there is as yet no consensus on the appropriate perspective for economic evaluations and, in turn, the types of costs which should be accounted for when evaluating long-term care interventions (Weatherly *et al.*, 2017).

INFORMAL CARE

There is still no single standardised way of accounting for informal carers in the context of an economic evaluation of long-term care interventions. There is a long-standing literature that evaluates the impact of health interventions on family members' and informal carers' outcomes (Basu and Meltzer, 2005; Hoefman, Van Exel and Brouwer, 2013; Wittenberg, James and Prosser, 2019) and an emerging literature that considers the impact of long-term care services on informal carers' quality of life in their own right (Rand, Vadean and Forder, 2020). Informal care can also be captured on the cost side of an economic evaluation if caregivers' out-of-pocket expenditures and/or time input are taken into account (Hoefman, Van Exel and Brouwer, 2013). Furthermore, informal care can substitute for or complement formal care services (Bolin, Lindgren and Lundborg, 2008; Bonsang, 2009), suggesting that it can also impact care recipients' outcomes and, therefore, needs to be accounted for when measuring the impact of formal services on outcomes, as a confounding factor.

Most of the reviewed studies considered informal care in their analysis of home care, but not in a consistent and systematic way. Four studies controlled for the availability of informal care in the statistical analysis as a confounding factor (Forder *et al.*, 2014; Forder *et al.*, 2018; Kok, Berden and Sadiraj, 2015; Park *et al.*, 2021). Five studies considered the cost of informal care and measured it in terms of opportunity costs or productivity losses of carers (Chappell *et al.*, 2004; Chiu, Shyu and Liu, 2001; Kim and Yang, 2005; Kok, Berden and Sadiraj, 2015; Kuo *et al.*, 2010). None of the reviewed studies considered caregiver outcomes in their own right and as part of the outcomes perspective of the study.

METHODS

A range of economic evaluation methods have developed in recent years to compare the benefits and costs of health care interventions. These include cost-utility, cost-effectiveness, cost-consequence, cost-benefit, and cost-minimisation analyses, all of which entail a comparison of the relative costs and benefits of alternative interventions but differ in the outcomes they use and the way this information is presented (Drummond *et al.*, 2015). Another important methodological issue with economic evaluation studies is that of selection, whereby the result of a choice between alternatives (e.g., care settings) is often affected by baseline circumstances (e.g., functional capacity, health, multimorbidity, availability of informal care, and other demographic and socioeconomic characteristics). Randomised control trials (RCTs) are recognised as the gold standard study design as they can address the issue of selection more convincingly, but they are often practically and ethically difficult to run. In the absence of experimental data, observational data techniques can be used, which address the selection issue in different ways depending on the specific data and design (e.g., quasi-experimental designs, instrumental variables methods, matching methods, regression analysis). Overall, the comparability and robustness of the results of a study will depend on the methods used. Evidence from studies that measure cost-effectiveness with one of the established economic evaluation methods will be easier to compare, and studies that control for baseline characteristics will be less susceptible to biases. Figure 2 illustrates how different data and methods combined can affect the comparability and bias of the results.

We found that few studies used an established economic evaluation approach, and not many studies

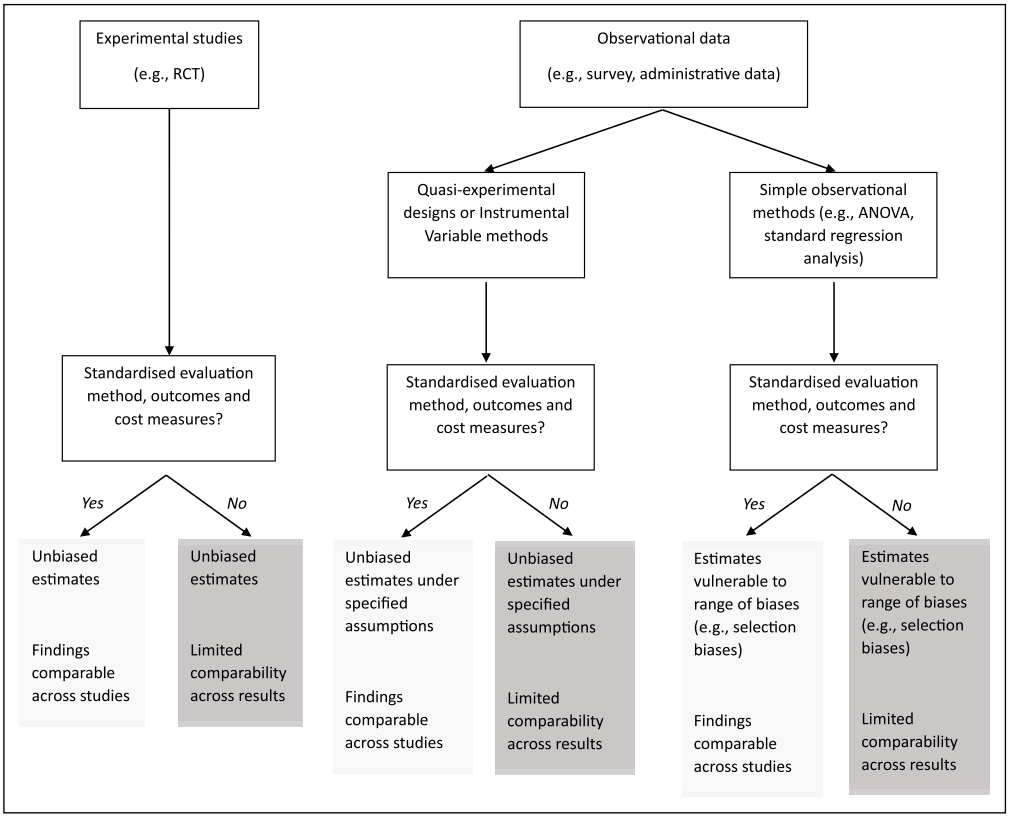

Figure 2 Comparability and bias of economic evaluation studies by study design.

compared simultaneously the costs and benefits between the alternatives. Only two studies conducted a cost-effectiveness analysis and calculated the incremental cost-effectiveness ratio (ICER) between different intensities of home care (Forder *et al.*, 2014; Forder *et al.*, 2018). Kim and Yang (2005) analysed cost-effectiveness by comparing the ratio of cost over outcomes between home care and nursing care but did not derive an ICER. Chappell *et al.* 2004 used a cost minimisation analysis after finding that outcomes were comparable across the alternatives. The remaining studies did not adopt an economic evaluation approach. Amongst these, five studies compared the costs and outcomes of care alternatives separately (Chiu, Shyu and Liu, 2001; Keogh *et al.*, 2018; Kok, Berden and Sadiraj, 2015; Kuo *et al.*, 2010; Park *et al.*, 2021) and three studies (Condelius, Hallberg and Jakobsson, 2010; Wilson and Truman, 2005; Wysocki *et al.*, 2014) compared only the outcomes of home care against alternatives. Finally, the two studies by Mihic, Todorovic and Obradovic (2014) and Mihic *et al.* (2016) used economic net present value modelling to compare the difference between the discounted total benefits and costs across alternatives.

In terms of study design, we found no RCTs. This is possible to be the case due to the practical and ethical challenges of conducting RCTs in the context of care interventions, especially where these services are part of statutory care. All studies relied on observational data, with selection issues addressed to different degrees. Six studies used group mean comparisons (Chappell *et al.*, 2004; Chiu, Shyu and Liu, 2001; Condelius, Hallberg and Jakobsson, 2010; Keogh *et al.*, 2018; Kuo *et al.*, 2010; Wilson and Truman, 2005) without accounting for possible differences in group characteristics. Two studies used regression analysis to control for individual-level characteristics (Chappell *et al.*, 2004; Chiu, Shyu and Liu, 2001; Condelius, Hallberg and Jakobsson, 2010; Keogh *et al.*, 2018; Kim and Yang, 2005; Kuo *et al.*, 2010; Park *et al.*, 2021; Wilson and Truman, 2005). Wysocki *et al.* (2014) used a Cox proportional hazard model to compare the risk of hospitalisation between groups controlling for several characteristics. Mihic, Todorovic and Obradovic (2014) and Mihic *et al.* (2016) modelled the economic net present value of spending on home care compared to nursing care and on alternative home care configurations but without adjusting for other characteristics. While regression-based approaches can account for observable confounders, they are nonetheless susceptible to selection based on unobservable factors. Therefore, estimates from these studies are likely to be biased.

Only three studies of the 14 studies in our sample attempted to account for selection due to unobserved confounders. Kok, Berden and Sadiraj (2015) used a propensity score matching approach to address the possibility that people may systematically choose different care alternatives based on unobservable factors. Their analysis matched individuals receiving home care with those receiving residential care based on their predicted probability of using each type of care. In a similar vein, (Forder *et al.*, 2014; Forder *et al.*, 2018)

used an instrumental variables approach to account for the possibility that the intensity of care (e.g., number of contact hours) is driven by unobserved factors. Their analysis used the type of local authority and the average care use in the local area as instrumental variables for individuals' care intensity and controlled for other observable characteristics through regression. These more sophisticated methods improve on previous research by addressing the issue of selection and unobserved confounding more thoroughly. Nonetheless, as with any observational studies, they are sensitive to the empirical specification and rely on possibly unverifiable assumptions about the underlying data.

DISCUSSION

With this scoping review, we set out to understand the landscape of research on economic evaluations of home care interventions compared to long-term care interventions offered in other settings, modes or intensities. We found a paucity of high-quality evidence around the cost-effectiveness of home care. Firstly, we did not find any evidence on the comparative cost-effectiveness between the more traditional model of home care offered by home care agencies to other modes of home-based care, such as directly employed personal assistants or housing with care schemes. These alternative models, however, account for a non-negligible proportion of the home care sector in some countries such as England (Skills for Care, 2023) and can be of interest in terms of organising the long-term care sector to other countries too. It is thus important to get this evidence, and future research needs to fill this evidence gap.

Secondly, existing studies comparing home care to institutional care and comparing different intensities of home care suffered from methodological limitations, meaning that any existing evidence on the cost-effectiveness of home care is still not robust and difficult to use for policy. The first methodological limitation was the lack of consistency in the measures of outcomes and costs used. Many of the reviewed studies used outcomes that align with the concept of homecare outcomes, such as care-related quality of life and functioning as defined in (Thomé, Dykes and Hallberg, 2003). However, these outcomes are not yet standardized. Likewise, existing studies did not adopt a consistent cost perspective. Some studies focussed only on costs relating to formal long-term care services, but other studies also considered healthcare costs as well as the costs of informal caregiving. Furthermore, the measurement of costs was not consistent. Many studies focussed only on the labour costs of long-term care services, but there was less consistency in terms of considering housing or household costs.

Overall, standardising the outcomes and cost perspective in future home care evaluations would facilitate the comparison of evidence across settings and help guide policy. There is an emerging consensus for the use of social care-related quality of life outcome measures, such as the ASCOT and the ICECAP in long-term care evaluations (Bulamu, Kaambwa and Ratcliffe, 2015; Makai *et al.*, 2014). Some recent efforts to coordinate methods in long-term care evaluations in countries such as England (NICE, 2014) suggest the use of these outcome tools and the consideration of public sector resources in the cost perspective of a study, as well as the value of unpaid care where appropriate as a sensitivity analysis. The adoption of a unified framework is needed in future evaluations of home care to standardise methods in this field and provide transparency. As the decisions about cost and outcome perspectives are still likely to differ between countries due to institutional and financing differences (Sharma *et al.*, 2021), future evaluation studies would benefit from explaining clearly the decisions made about the measurement of effectiveness and costs. Greater consistency in the measurement of outcomes and costs would also be facilitated through the better collection of relevant measures and the better linkage of existing data. In England, for example, routinely collected data for people's care outcomes (e.g., Adult Social Care Survey (ASCS)) and unpaid carer outcomes (e.g., Survey of Adult Carers in England (SACE)) cannot be linked to new routinely collected data on care inputs (e.g., Adult Social Care Client Level Data (ASC CLD)) and any evaluation studies of long-term care services have to rely on primary data collections. Thus, relevant authorities need to prioritise making routinely collected data linkable and accessible so that future evaluations can benefit from that.

The second methodological limitation of the existing evidence base is related to the methods used to address selection issues and present the evidence. We did not find any experimental studies, and of the observational studies in this review, only very few tried to control for observable and unobservable factors that could be different between people receiving home care and those receiving care in other settings, including the level of needs, demographic characteristics, socioeconomic factors as well as the availability of informal care. As experimental data is possible to be difficult to obtain within long-term care, future research will need to employ newer and more advanced statistical methods that address selection issues more convincingly with observational data, such as instrumental variables, matching and quasi-experimental methods. Furthermore, future research should also adopt established economic evaluation approaches to present and compare benefits and costs, such as cost-utility, cost-benefit, cost-consequence, and cost-minimisation methods. These approaches, as demonstrated in evaluations of healthcare interventions, generate more comparable and readily applicable evidence that can help inform policy and commissioning decisions. One example is the use of cost-effective analysis leading to

the estimation of the ICERs, which allows consistent and transparent comparison of various care alternatives.

The scoping review has highlighted, additionally, the lack of consistency in the treatment of informal care in existing studies. Some studies considered the availability of informal care in the statistical analysis as a confounding factor and others measured informal care costs. However, we did not find any studies that measured the impact of home care and comparators on the outcomes of informal carers. This is in contrast to the more developed part of the healthcare evaluation literature that has evaluated the impact of healthcare interventions on family members' and informal carers' outcomes and has assessed the implications of these effects for cost-effectiveness evaluations (Al-Janabi *et al*., 2016; Goodrich, Kaambwa and Al-Janabi, 2012). Understanding the impact of long-term care services on carers' outcomes is more important with regard to long-term care evaluations, as informal carers are often seen as co-clients/co-beneficiaries (in England under the Care Act 2014). The amount/intensity of formal care received directly affects the amount and/or nature of care provided by informal carers, which can then affect care recipients' outcomes as well as carers' outcomes, through the alleviation of subjective burden or enabling self-care, access to support and reappraisal of role/priorities (Rand, Vadean and Forder, 2020). Future research will thus need to fill this evidence gap and produce evidence on the impact of home care and its comparators on informal carers' outcomes. This will improve understanding of the extent of this impact and, consequently, the implications for economic evaluations in long-term care.

The scoping review also found heterogeneity in the definition of home care across countries and studies in terms of the types of help and types of services provided and populations served. This variability further complicates the comparability of existing findings and can lead to inconclusive results in terms of the cost-effectiveness of home care. The wide heterogeneity in long-term care offerings and the challenges this is posing for cross-country comparisons are well recognised in policy and academic research (Gruber, McGarry and Hanzel, 2023) and can be explained by the fact that long-term care policy is relatively new and has evolved differently across countries depending on the specific institutional background of each country. It is thus important that future research also develops to standardise the formal home care package services.

This study has also highlighted the limited geographic spread of the existing evidence, which came from very few European countries, North America, Taiwan and Korea. We can hypothesise several reasons for this geographic concentration. First, formal home care is still in a nascent state for countries such as those in East and Southeast Asia and Latin America. For some of these countries, relatively younger populations and other, more pressing policy challenges may put long-term care low on the policy agenda (Bloeck, Galiani and Ibarrarán, 2019). In others, families and social ties may still play a significant role in providing social safety nets, especially with regard to the provision of care and support for older people (Yeung and Thang, 2018). Beyond the state of development of the formal long-term care sector, institutional factors could also be important in explaining the paucity of evidence in more developed long-term care systems, such as those of Germany and Japan, for which we found no studies. For example, Germany and Japan, which have well-established national long-term care insurance programmes, spend the largest fraction of their total long-term care spending on home care as opposed to institutional care (Gruber, McGarry and Hanzel, 2023). In such contexts, there may be less perceived impetus for comparisons of home care to institutional settings. Finally, to the extent that certain publications are in languages other than English, these studies would not have been picked up by our selection criteria. Overall, despite the increasing policy interest, engagement with academic research may still be limited around the world.

Some limitations of this study are worth noting. As mentioned earlier, the definition of home care is not homogeneous, and the terminology used to describe it can vary significantly in the literature. We sought to address this by our broad search terms and considering a wide terminology, but we acknowledge that this diversity may still affect our ability to capture all relevant literature. Furthermore, we restricted the search to studies written in English, so studies published in other languages without an English language version would not have been included. Finally, our evidence came from publicly available academic and policy research. It is possible that in insurance systems, for example, there is internal provider-level analysis, which is not shared in the public domain and consequently not included in our review. On the other hand, the strength of this scoping review is that it provided evidence from a wide range of databases that covered different disciplines and used broad inclusion criteria to allow the review of studies from different countries over many years.

In summary, this review has identified that the evidence is scarce on the value for money of home care. With limited public resources to support an increasing number of people with long-term care needs, an increased focus on the economic evaluation of long-term care services is required, especially in contexts where a variety of models or options co-exist. The review has identified a number of methodological issues in the existing evidence base, including the selection of appropriate outcome and cost measures, methods to account for selection bias, the definition of home care and the consideration of informal carers. Future research will need to fill these gaps to help standardise methods around long-term care evaluations.

ADDITIONAL FILE

The additional file for this article can be found as follows:

- **Supplementary Appendix.** Search terms and searches by database. DOI: https://doi.org/10.31389/jltc.314.s1

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COMPETING INTERESTS

The authors have no competing interests to declare.

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