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ORIGINAL RESEARCH ARTICLE

Funding Health Promotion Activities to Reduce Avoidable Hospital Admissions in Frail Older Adults (HomeHealth): Further Challenges to the "Cost-Effective but Unaffordable" Paradox

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Abstract

Introduction Health promotion initiatives are often promoted as being worth the investment given future cash-savings. This paper uses the findings of HomeHealth, a health promotion service for older adults with mild frailty, to examine how economic evaluation relates to local decision making in England.

Methods The HomeHealth trial randomised 388 participants aged 65+ years with mild frailty to receive HomeHealth (195 participants) or treatment as usual (193 participants). Health and social care resource use and carer time were self-completed at baseline, 6 months and 12 months. Primary and secondary healthcare resource use and medications were collected from patient files at 12 months post recruitment, covering the past 18 months. Stakeholders including commissioners were consulted on the results of the trial and budget impact.

Results Participants allocated to HomeHealth had a significant reduction in emergency hospital admissions at 12 months (incident rate ratio (IRR) 0.65; 95% confidence interval (CI) 0.45–0.92) and unpaid carer hours at 6 months (− 16 h (95% CI − 18 to − 14 h) or − £360 (95% CI − 369 to − 351) per patient). Although the intervention is cost saving overall due to fewer emergency admissions, at a cost of £457 per patient commissioners do not have the budget to fund it.

Discussion This case study illustrates the problem with using standard economic evaluation methods to argue for implementation of health promotion initiatives in publicly financed healthcare systems. Although HomeHealth resulted in reduced emergency admissions and may be cost saving to the system as a whole, it is not locally cash releasing. Health promotion initiatives are unlikely to be funded from local budgets without significant system-wide changes.

Key Points for Decision Makers

Health promotion interventions can potentially play a role in preventing avoidable emergency admissions.

The HomeHealth intervention provides a case study as to why financially this presents problems for the English NHS.

Even though the intervention results in a significant reduction in hospital admissions and is potentially cost saving, it does not release the finances from local budgets to pay for the service.

Extended author information available on the last page of the article

1 Introduction

The National Health Service (NHS) in England is currently under significant financial strain. This is due to a combination of long-standing and recent issues, including legacy issues related to the COVID-19 pandemic, higher than expected inflation, and a backlog of work related to the NHS estate [1]. This is in addition to the expectation since 2010 that the NHS make £20 billion in efficiency savings [2]. As a result, there is a keen interest in identifying areas where publicly financed health and social care costs can be reduced.

One area where potential improvements in costs and performance could occur is in avoidable emergency admissions. In England in the first half of 2024 emergency admissions via accident and emergency (A&E) were 20%

higher than they were in 2011, with approximately 18,000 emergency admissions to hospital each day [3]. Although many of these admissions are necessary, approximately 20–35% of all emergency admissions are potentially avoidable through better management in primary care [4]. As part of the NHS Long Term Plan, NHS England has made reducing emergency admissions a key priority [5].

Health prevention and promotion activities that address individual health needs in patients at high risk of emergency hospital admissions are one way of reducing emergency admissions [4]. To be successful, these interventions benefit from a co-ordinated system-wide approach [6, 7]. Clinicians are also more likely to implement and adhere to these practices if financial incentives are provided that align with shared outcomes [8, 9]. This is partly because of the fragmented nature of patient care in many healthcare systems, where clinicians in primary care are responsible for identifying and managing patients at risk of hospital admission, but the financial benefits fall to secondary care. Instead of focusing on preventative measures, many clinicians also focus on the management of already acute presentations as they present more of an immediate risk [6]. This is exacerbated by increased clinician workloads and hence a reduced capacity for more preventative healthcare.

In the NHS in England minimal funding is earmarked for health prevention and promotion activities. Although some funding was identified for smoking cessation and obesity services as part of the NHS Long Term Plan [5], most of the funding for health prevention and promotion comes from local authorities as part of their remit of providing public health services [10]. Within the ring-fenced budget allocated to public health there are seven mandatory services which local authorities must provide, including sexual health and substance misuse services. Health promotion and prevention services are not mandatory and so are commissioned from the remaining budget. GPs can receive financial incentives for some health promotion and prevention activities as part of the quality outcomes framework, but for 2024/2025 this is only for patients with a diagnosis of type II diabetes, dementia or serious mental illness [11].

As a result, non-public health prevention and promotion activities for avoiding hospital admissions, such as integrated care and provision of community-based alternatives to hospital care, such as hospital at-home services or virtual wards [5], are more commonly commissioned given that they can fall within the larger healthcare commissioning budget. The evidence for the effectiveness and cost effectiveness of these services is, however, limited [12].

1.1 The Role of the National Institute for Health and Care Excellence (NICE) in Recommending Treatments

In the English and Welsh NHS, NICE is responsible for reviewing the clinical and cost effectiveness of new healthcare technologies, including health promotion activities. NICE can then make recommendations regarding whether the new technology should be made available in the NHS. Patients then have a legal right to access the new health technology if prescribed by their treating physician [13].

The NICE Technology Appraisal Guidance sets out the methods that are required for an economic evaluation, sometimes called the NICE reference case [14]. The purpose of the NICE reference case is to ensure a consistent and equitable approach when evaluating cost effectiveness across different diseases and programmes of work. In particular, the NICE reference case defines the specific methods for calculating the incremental cost per quality-adjusted life-year (QALY) gained of the new technology compared to current best practice, or the incremental cost-effectiveness ratio (ICER). Clinically effective new technologies with an ICER of less than £20,000 per QALY gained are likely to be recommended by NICE. The rationale for this decision-making process is that it provides an assessment of best value for taxpayers' money by taking account of the opportunity cost, where within a finite budget resources can only be used once, and the idea is to maximise the potential health gain of utilising these resources [15].

The current threshold of £20,000–£30,000 per QALY gained has been criticised elsewhere for potentially not representing the true opportunity cost of producing a QALY [16]. This means that new expensive pharmaceuticals and other healthcare technologies are potentially displacing treatments with a higher QALY gain to the detriment of population health [17]. NICE has recently started to take into account the budget impact when making recommendations for new treatments, although that does not guarantee that the treatments are affordable [18].

The aim of this article is to illustrate how reporting results in line with the NICE reference case relates to the realities of local decision making based on funding. We do this by focusing on a health promotion intervention that potentially reduces avoidable hospital admissions. The HomeHealth intervention has been used as a motivating case study. We firstly run a full economic evaluation based on the NICE reference case, which shows that the intervention has a high probability of being cost effective for a range of decision thresholds for a QALY gain. The HomeHealth intervention also results in a significant reduction in avoidable hospital admissions. We then describe our conversations with commissioners regarding

the possibility of implementation and what the implementation models might look like. In the discussion we explore the details of why 'cost-saving' interventions may still not have the finances available to pay for them.

2 Methods

2.1 The HomeHealth Intervention

Interventions that can prevent or slow the progression of frailty are likely to be cost effective given that frailty accounts for significant additional resources and costs associated with hospitalisations [19, 20]. Falls' prevention has been shown to be a potentially cost-effective intervention [21], but there is otherwise limited evidence for the cost effectiveness of interventions to prevent or slow the progress of frailty.

One potential avenue for this is personalised health-promotion interventions emphasising early intervention. This is particularly important given that most services currently focus on managing older people with established frailty. These services and the associated guidelines recommend exercise programmes, social support, nutrition and care planning [22]. Given the complex, multidisciplinary nature of these services [23], they can be costly, but are potentially value for money as avoidance of frailty through an early intervention service is likely to cost less in the long run [24].

HomeHealth is a personalised health-promotion intervention for early frailty co-designed with service users and using evidence review [25–27]. It emphasises a person-centered approach based on the principles of behaviour change with the aim of promoting independence and preventing frailty and associated adverse outcomes in older adults.

2.2 HomeHealth Trial Study Design and Participants

Participants were recruited from general practices in three different areas in England (London North Thames Region, East & North Hertfordshire, and West Yorkshire) between January 2021 and July 2022. Recruitment occurred during a time when a range of COVID-19 pandemic-related restrictions were in place in the United Kingdom (UK), the implications of which are explored in other papers [28]. A study invitation pack was sent by practices to patients identified from practice-list searches who scored between 0.12 to 0.36 on the Electronic Frailty Index (eFI). Patient lists were screened by clinicians to remove those known to be ineligible.

Participants were eligible if they were aged 65 years or over, residing in the community (including those living in sheltered or extra care housing), 'mildly frail' on the Clinical Frailty Scale (CFS score = 5), had a life expectancy of > 6 months, and had capacity to consent to participate. Exclusion criteria included residing in nursing or care homes, moderate-severe frailty (CFS score 6–9) or non-frail (CFS score 1–4), receiving palliative care and already case managed (e.g. receiving a similar ongoing intervention from the voluntary sector or community service).

Participants were randomised (1:1) to the HomeHealth service or treatment as usual (TAU). Further information on trial processes is available in the trial protocol [29] and clinical outcomes paper [28].

2.3 Procedures

The development and structure of the HomeHealth service is reported in detail elsewhere [26, 29]. HomeHealth is a theory-based, manualised multi-domain tailored intervention, delivered over approximately six appointments over 6 months (minimum three, with up to 12 appointments for complex needs such as multiple hospitalisations). Three voluntary sector (non-governmental) organisations hosted between one and three part-time HomeHealth support workers (total $n = 7$) and provided organisation-specific training, office space, IT and local supervision. HomeHealth support workers followed a 1-week online training programme and were supervised in fortnightly group supervisions by the team leader, with one-to-one supervision provided as needed, and top-up case-based training in behaviour change approximately 3 months later.

During intervention sessions the older person discussed what was important for them to live well, including in the domains of mobility, nutrition, psychological wellbeing and socialising. They then agreed on an overall outcome goal, SMART (Specific, Measurable, Achievable, Relevant, Time-Bound) goals to achieve this, and an action plan, assessing capability, motivation and opportunity to achieve goals and building in ways to overcome any barriers. Participants were also signposted to relevant organisations and resources (e.g., information about benefits, psychological therapy services).

The control arm received TAU, standard care that any patient aged 65+ years would normally receive in primary care in England. No particular mild frailty intervention was widely available in the UK at the time; feasibility study data suggested that TAU consists of routine GP, practice nurse and outpatient appointments as needed.

2.4 Cost of the Intervention

The cost of HomeHealth included the time of the HomeHealth worker to deliver the intervention, including any

travel time for face-to-face appointments, plus the cost of any exercise equipment, such as resistance bands, ankle weights and grip strengtheners, and the cost of supervision and training. An intervention-costing template was developed as part of the feasibility study to allow for a granular costing and to account for different costing models (a direct time approach for utilising existing staff time and redistributing it to HomeHealth activities vs. a caseload model for employing a dedicated staff member who only provides HomeHealth). Some appointment durations are likely to be greater than if the intervention was to be implemented in the NHS as appointments also included some processes related to the trial. Travel times are also likely to be longer, as HomeHealth support workers covered a greater area than they would do as part of routine practice.

No additional costs were included for treatment as usual other than the cost of standard healthcare resource use.

2.5 Resource Use and Costs

Resource use in both groups was collected from self-reported questionnaires at baseline, 6 months and 12 months asking about the previous 6 months.

Health- and social-care resource use was collected using a version of the Client Service Receipt Inventory (CSRI) adapted based on the experience of the feasibility study [26]. The CSRI collected data on community healthcare services, over-the-counter medications, care homes and other supported accommodation. Paid and unpaid carer time was calculated based on the Institute for Medical Technology Assessment Valuation of Informal Care Questionnaire adapted based on our experience in a feasibility trial [26]. Unpaid carer time was costed using the replacement cost method, assuming that it could be provided by a social home-care worker [30]. Unit costs for costing the CSRI are reported in the Online Supplementary Material (OSM), Table 1.

Primary and secondary healthcare contacts and prescriptions were collected from primary-care medical records using a bespoke proforma. This covered 12 months after and 6 months before randomisation.

All costs are reported in British pounds (GBP) for the year 2021/2022.

2.6 Outcome Measures

The EQ-5D-5L [31] and ICECAP-O [32] were collected at baseline, 6 months and 12 months to allow the calculation of QALYS and years of full capability (YFC), respectively. For the main analysis, EQ-5D-5L scores were converted to utility scores using the algorithm to map EQ-5D-3L to EQ-5D-5L scores [33]. YFC was calculated from the ICECAP-O tariff [32].

2.7 Sample Size

We required 308 participants to provide 90% power at the 5% significance level to detect a minimum clinically important difference of 1.85-points [34] on the modified Barthel Index (BI), with a standard deviation (SD) of 5. Assuming 20% attrition over 12 months, we aimed to recruit 386 participants (193 per arm). We did not adjust for clustering by therapist as previous similar studies suggested this would be minimal [26]. The health economic evaluation has not been powered for and hence we focus on the probability of cost effectiveness.

2.8 Statistical Analysis

A combined statistics and health economics analysis plan (SHEAP) was signed off and published prior to database lock [35].

We calculated complete case-descriptive statistics for the percentage of participants and mean number of contacts for each type of resource use. Complete cases were defined as people who completed that questionnaire at that follow-up time or who had medical records available. Differences in resource use were calculated using generalised linear models, with models chosen based on the Akaike Information Criterion and Bayesian Information Criterion, with baseline adjustment and fixed effects for site. Complete case means and standard deviations for costs were also calculated. The mean difference in costs, 95% confidence interval (CI), and p-value for each resource use type were calculated using regression analysis adjusting for baseline costs, with fixed effects for site for 5000 iterations for complete cases (available at all time-points). For people who died before they reached a specific follow-up point, primary and secondary healthcare contacts from medical records were included in analysis, but all other costs are included as 0.

QALYs and YFC were calculated as the area under the curve using responses to the EQ-5D-5L [36] and ICECAP-O [32], respectively. People who died before they reached a specific follow-up point are included as 0 for each follow-up point after they died, assuming a straight line from their last complete questionnaire until death. We report the mean values at each time point and mean unadjusted QALYs and YFCs from baseline to 12 months. Mean difference in QALYs and YFCs, 95% CI, and p-value were calculated using regression analysis adjusting for baseline [36], with fixed effect for site calculated using bias-corrected 5000 iterations for complete cases (available at all time points).

The incremental cost-effectiveness ratios, cost-effectiveness acceptability curves, and cost-effectiveness planes were calculated using seemingly unrelated regression to account for the correlation between costs and outcomes.

Missing data sensitivity analyses were conducted in line with the SHEAP.

As the trial-based analysis covers a 12-month duration no discount rate was applied. Analyses were conducted using Stata version 17 [37].

2.9 Perspective

For the main analysis, costs from a health- and social-care perspective only are reported. A secondary analysis includes wider societal costs including private health and social care, out-of-pocket costs, and unpaid carer time. The inclusion of welfare payments in economic evaluations is controversial, given they can represent a transfer payment (there is not a net loss to the system as the money is transferred to another payer) [38], and hence total wider costs have been reported excluding welfare payments.

A budget impact-costing tool was developed in Excel [39] to identify the cost implications for the different stakeholders.

2.10 Stakeholder Consultation

Health- and social-care service commissioners from three regions were engaged throughout the study as part of the implementation group, which included representation from three voluntary and community sector organisations. Results of the study including cost effectiveness and budget impact were reported to stakeholders as part of discussions about implementing HomeHealth in health- and social-care services, including a stakeholder symposium at Wellcome in November 2023 and a presentation to a regional commissioning frailty board in March 2024. There were 51 attendees at the symposium including integrated care board (ICB $n=3$) and service (ICS $n=3$) falls programme managers ($n=5$), clinicians ($n=10$) and third-sector management including social enterprise providers ($n=9$), charities and interest groups ($n=10$). Feedback was gathered as notes taken as part of the symposium. Further details on how we evaluated the feasibility and acceptability of implementing HomeHealth are reported elsewhere [40].

2.11 Ethics and Patient and Public Involvement (PPI)

Public contributors were involved throughout study development and setup, and were critical in helping us to adapt the study to pandemic-related restrictions in ways that were acceptable to older people, and discussed barriers and facilitators to implementation as part of our Implementation group, which met throughout the trial.

The study was reviewed and approved by the Health Research Authority Social Care Research Ethics Committee (ref 20/IEC08/0013). Participants gave written or verbal (audio-recorded) informed consent to take part in the trial. HomeHealth RCT was overseen by an independent Trial Steering Committee (TSC, including three independent public contributors) and Data Monitoring and Ethics Committee (DMEC).

3 Results

3.1 Trial Findings

Three hundred and eighty-eight participants were recruited to the trial, with 195 participants randomly allocated to receive HomeHealth and 193 to TAU. 321 (82.9%) were followed up at 6 and 12 months and 348 (89.9%) were followed up with medical records. There were 12 deaths between randomisation and 12 months (three in the HomeHealth group and nine in TAU). Demographic information for the included participants is shown in Table 1.

3.2 Cost of the Intervention

A costing tool was developed to provide a micro costing of the intervention given that the delivery of the intervention may differ by area (provided in OSM 2). Participants randomised to HomeHealth attended an average of five sessions per participant, with an average of 360 min in total per participant, an average time spent travelling per participant of 210 min, and £7 in consumables. As noted earlier, this includes additional time spent on trial-specific tasks or increased travel time as the catchment areas were larger due to the trial limitations. The cost of the intervention was £408 (170 SD) per participant. Supervision, training and other overheads including IT and a hosting cost came to £49 per participant, with a total cost per participant of £457. If a caseload model instead is used, based on data from our Voluntary Sector Organisation providers from provision of similar services, the total cost per staff member including training and supervision is £33,788. It is assumed that the average yearly caseload per staff member would be 120 patients, with a cost per patient of £295.

3.3 Resource Use and Costs

At 12 months, 19% ($n=32$) of participants in the HomeHealth group compared to 27% ($n=47$) of participants in TAU had an emergency hospital admission, with a mean length of stay of 14.81 days (SD 19.54) in the HomeHealth group and 17.21 days (SD 28.47) in the TAU group. Participants allocated to HomeHealth had a significant reduction

Table 1 Demographic information

Characteristic	Mean (SD); *N* (%); median (LQR–UQR)	
	HomeHealth (*N* = 195)	TAU (*N* = 193)
Age (years)	81.0 (76.0–86.0)	82.0 (76.0–86.0)
Gender		
Male	72 (36.9%)	67 (34.7%)
Ethnicity		
White	181 (92.8%)	183 (94.8%)
Asian	7 (3.6%)	3 (1.6%)
Black	3 (1.5%)	3 (1.6%)
Any other or mixed ethnic group	4 (2.1%)	4 (2.1%)
Birthplace		
United Kingdom	159 (81.5%)	167 (86.5%)
In another country	36 (18.5%)	26 (13.5%)
Living arrangements		
Lives alone	111 (56.9%)	113 (58.5%)
Lives with spouse/partner	66 (33.8%)	62 (32.1%)
Lives with children	6 (3.1%)	6 (3.1%)
Lives with a friend/other	12 (6.2%)	12 (6.2%)
Marital status		
Single	18 (9.2%)	15 (7.8%)
Co-habiting/ married/civil partnership	74 (37.9%)	68 (35.2%)
Separated/ divorced	27 (13.8%)	30 (15.5%)
Widowed	76 (39.0%)	78 (40.4%)
Other	0 (0%)	2 (1.0%)
Housing		
Owner-occupied	139 (71.3%)	127 (65.8%)
Council rented/housing association	29 (14.9%)	47 (24.4%)
Rented/social housing rented	9 (4.6%)	4 (2.1%)
Private rented	10 (5.1%)	9 (4.7%)
Sheltered housing	8 (4.1%)	6 (3.1%)
Other		
Education level		
No formal qualifications	63 (32.3%)	63 (32.6%)
General certificate of education/O-level or equivalent	37 (19.0%)	34 (17.6%)
A level or equivalent	12 (6.2%)	17 (8.8%)
Higher national diploma or equivalent	27 (13.8%)	23 (11.9%)
Degree/higher degree	56 (28.7%)	56 (29.0%)
Mean Index of Multiple Deprivation (IMD) score (deciles with 1 = most deprived, 10 = least deprived)	5.8 (2.8)	6.1 (2.8)

SD standard deviation, *LQR* lower quartile range, *UQR* upper quartile range

in emergency hospital admissions (difference 0.65; 95% CI 0.45–0.92).

Descriptive statistics for costs are reported in Table 2. Participants allocated to HomeHealth had a significant reduction in the cost of emergency hospital admissions at 12 months (difference −£586, 95% CI −821, to −351) compared to TAU. There was no significant difference in total primary and secondary care combined costs at 12 months (difference −£796; 95% CI −2016 to 424).

Descriptive statistics for informal care are reported in Table 3. There was a significant reduction in unpaid carer hours at 6 months with 16 h (95% CI −18 to −14) fewer per patient in the HomeHealth group over 6 months or the equivalent of −£360 (95% CI −369 to −351) per patient if carer time was paid at the same rate as a home-care worker. At 12 months the adjusted difference was −£911 (95% CI −2557 to 736).

3.4 Outcomes

Descriptive statistics for outcomes are reported in Table 4. There were no significant differences for any of the outcomes, with a mean difference of 0.009 (95% CI −0.019 to 0.037) for QALYs calculated using the EQ-5D-5L mapped to the EQ-5D-3L. The difference in YFC was 0.012 (95% CI −0.011 to 0.034).

Table 2 Health and social care costs in 2021/22 British pounds

	HomeHealth		TAU	Mean (SD)	Adjusted[a] difference (95% CI)
	N	Mean (SD)	*N*		
Self-reported					
Community services cost					
Baseline	195	153 (175)	193	136 (192)	
6 months	179	152 (175)	164	161 (203)	
12 months	171	164 (210)	156	161 (308)	
Total at 12	169	313 (314)	152	312 (402)	£−9.00 (£−84.11 to £66.11)
State-funded social care					
Baseline	195	75 (568)	193	24 (235)	
6 months	179	105 (842)	164	33 (199)	
12 months	171	20 (149)	156	47 (356)	
Total at 12	169	89 (684)	152	63 (328)	£−16.40 (£−83.89 to £51.10)
Medical records					
GP costs					
Baseline	171	36 (50)	174	46 (59)	
12 months	171	98 (106)	174	96 (95)	£9.63 (£−10.52 to £29.78)
Primary-care total					
Baseline	171	155 (299)	174	247 (594)	
12 months	171	405 (617)	174	540 (966)	£−56.15 (£−189.74 to £77.43)
Outpatient attendances					
Baseline	171	532 (535)	174	466 (559)	
12 months	171	1000 (979)	174	1062 (1065)	£−116.25 (£−299.53 to £67.04)
A&E attendances					
Baseline	171	117 (317)	174	130 (327)	
12 months	171	306 (566)	174	394 (671)	£−87.36 (£−207.53 to £32.81)
Day cases					
Baseline	171	351 (733)	174	331 (769)	
12 months	171	644 (1129)	174	760 (1565)	£−132.25 (£−411.20 to £146.70)
Unplanned inpatient attendances					
Baseline	171	348 (1198)	174	268 (1085)	
12 months	171	784 (2206)	174	1284 (3213)	£−586.30 (£−821.37 to £−351.24)
Planned inpatient attendances					
Baseline	171	290 (1406)	174	122 (924)	
12 months	171	579 (2092)	174	569 (2210)	£−42.47 (£−167.58 to £82.64)
Total inpatient					
Baseline	171	638 (1815)	174	390 (1592)	
12 months	171	1363 (3300)	174	1853 (4480)	£−556.55 (£−903.48 to £−209.62)
Total secondary care					
Baseline	171	1637 (2359)	174	1316 (2025)	
12 months	171	3313 (4436)	174	4069 (5644)	£−998.82 (£−1812.18 to £−185.47)
Medication					
Baseline	172	890 (3952)	174	512 (642)	
12 months	172	1173 (3953)	174	793 (1005)	£0.56 (£−127.04 to £128.16)
All costs					
Baseline	172	2912 (4798)	174	2224 (2557)	
12 months	157	5343 (6221)	149	5539 (6580)	£−768.57 (£−1944.17 to £407.04)

[a]Adjusted for baseline and site. Baseline covers the previous 6 months

Table 3 Descriptive statistics for proportion of participants receiving informal care and mean hours per week

	HomeHealth			TAU		
	N	% (*n*)	Mean (SD)	*n*	% (*n*)	Mean (SD)
Baseline: proportion receiving care and hours per week	195	72% (143)	5.3 (SD 6.8)	193	72% (139)	4.7 (SD 7.6)
6 months: proportion receiving care and hours per week	179	71% (127)	4.0 (SD 5.7)	164	68% (112)	4.9 (SD 7.5)
12 months: proportion receiving care and hours per week	171	74% (127)	5.5 (SD 7.5)	156	68% (111)	5.9 (SD 7.5)
Adjusted total mean (95% CI) cost per participant of care at 12 months	169		£3901 (£3104 to £4698)	152		£4812 (£3277 to £6347)

CI confidence interval

3.5 Cost-Effectiveness Analysis

Based on the adjusted seemingly unrelated regression analysis, HomeHealth was dominant to TAU in that the mean point estimate for costs was lower (mean incremental cost −£822 including the cost of the intervention; 95% CI − 2057 to 412) and the mean point estimate for outcomes was higher (mean incremental QALY 0.004, 95% CI − 0.025 to 0.033). The cost-effectiveness plane and cost-effectiveness acceptability curve are reported in Figs. 1 and 2, respectively. There is an 89% probability that HomeHealth is cost effective at a £20,000 decision threshold for a QALY gained and a 90% probability at a £0 decision threshold for a QALY gain (where decision makers are motivated by interventions that have a net 0 cost or better). Although outside of the scope of the NHS reference case, the results of the analysis including private community care, unpaid and private carer time are reported in OSM Table 2 and OSM Figs. 1 and 2. From the wider cost perspective (healthcare, social care and intervention cost inclusive), the mean point estimate for incremental costs of HomeHealth compared to TAU is − £851 (95% CI − 3195 to 1494 adjusted seemingly unrelated regression).

Sensitivity analyses around missing data found that there were no variables associated with missingness and there was limited impact on the results of different imputation analyses. This is likely due to unplanned admissions collected from medical records being a key driver of costs, and medical record data likely to be missing completely at random. Further details are available in the clinical effectiveness paper [28].

3.6 Discussions with Stakeholders

Health and social care commissioners were presented with the results of the trial, as well as the cost implications of the service via the costing tool. The discussions at the Wellcome Trust symposium mostly focused on identifying the mechanism for the reduction in unplanned admissions, particularly as it could not be identified by the existing process evaluation. At the regional commissioning board for frailty services, we received feedback that although the cost per patient for the interventions is minimal (£457 per participant, or £295 with a caseload model) the service

Table 4 Results for outcomes

	HomeHealth		TAU		Adjusted[a] difference (95% CI)
	N	Mean (SD)	*N*	Mean (SD)	
EQ-5D-5L mapped to 3L					
Baseline	194	0.597 (0.214)	192	0.610 (0.189)	
6 months	181	0.603 (0.245)	170	0.611 (0.230)	
12 months	175	0.604 (0.235)	167	0.588 (0.258)	
QALYs	173	0.601 (0.214)	161	0.609 (0.196)	0.009 (− 0.019 to 0.037)
ICECAP-O					
Baseline	192	0.772 (0.141)	189	0.759 (0.151)	
6 months	171	0.768 (0.155)	166	0.740 (0.192)	
12 months	168	0.765 (0.158)	158	0.739 (0.222)	
YFC	156	0.773 (0.135)	151	0.746 (0.167)	0.012 (− 0.011 to 0.034)

QALYs quality-adjusted life-years, *YFC* years of full capability

[a]Adjusted for baseline and site

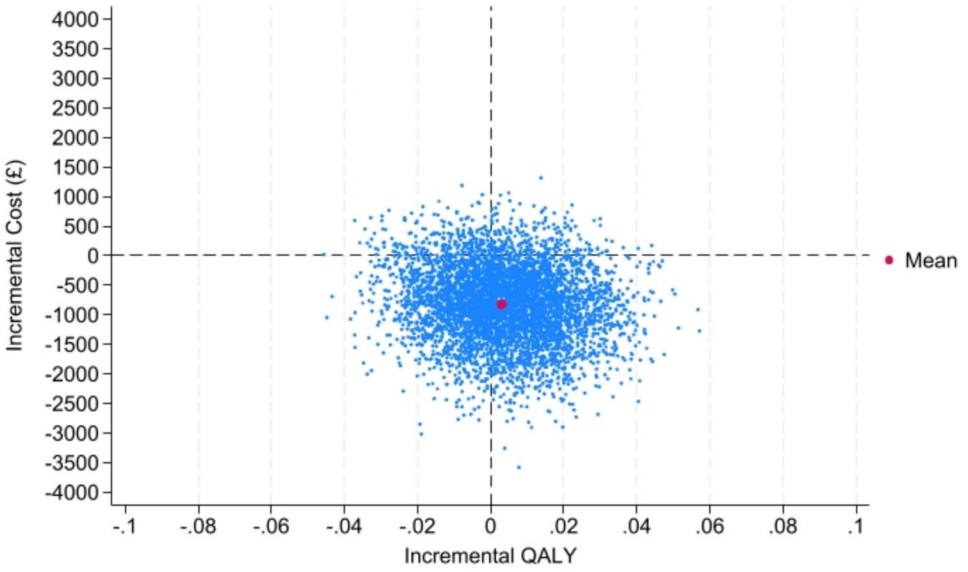

Fig. 1 Cost-effectiveness plane for HomeHealth compared to TAU over 12 months with quality-adjusted life-years (QALYs) calculated using the EQ-5D-5L mapped to the EQ-5D-3L health and social care cost perspective

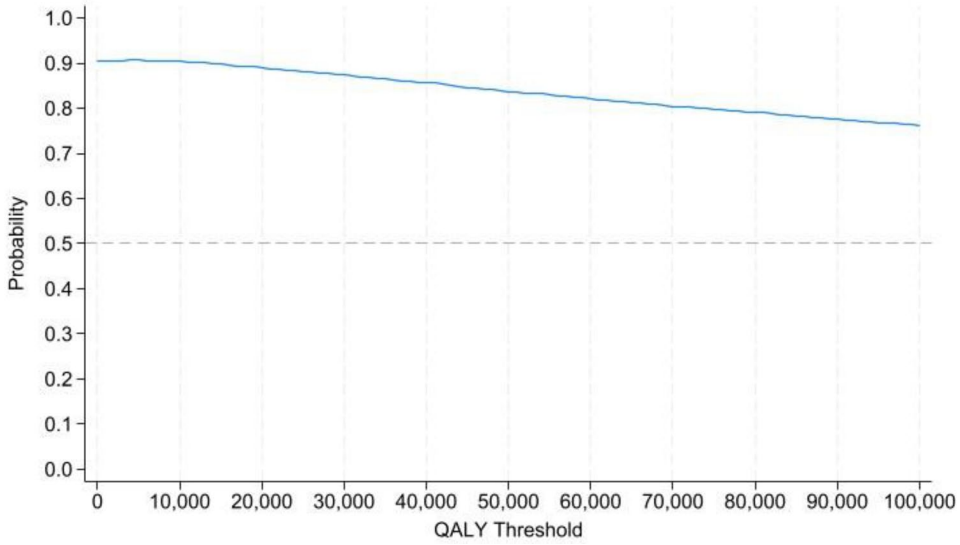

Fig. 2 Cost effectiveness acceptability curve for HomeHealth compared to TAU over 12-months with quality-adjusted life-years (QALYs) calculated using the EQ-5D-5L mapped to the 3L health and social care cost perspective

would require additional financial investment to cover the cost of the staff time, resources that the commissioners could not identify at this time.

There are three potential service delivery models that could be employed to roll out HomeHealth. The first is to utilise staff currently employed by frailty services or social prescribing to deliver HomeHealth. This would require either additional staff capacity somewhere to deliver the intervention or for staff to stop doing a specific activity to shift over to delivering HomeHealth. Although it may not require identifying potential budgetary spend given that staff are already employed, it does require identification of staff with sufficient capacity to deliver HomeHealth. Given that HomeHealth targets patients with mild frailty, and frailty services see patients with moderate to severe frailty, it is likely that a shift to HomeHealth will reduce service provision to more frail patients. It is also the model of delivery with the highest opportunity cost given the additional cost of training more staff and lost efficiency.

The second is to employ a dedicated staff member to deliver HomeHealth. Although the easiest to implement and with the lowest opportunity cost, it requires specific finances to be identified to employ the new staff member(s). Assuming a healthcare assistant at NHS band 5 employed full time, this would cost on average £29,803 per year, excluding the costs of training

The third is for HomeHealth to be incorporated into current third-sector provision. This is likely to be the lowest cost to the NHS, with the total cost being highly dependent on how third-sector providers absorb the cost of the additional staff time required to deliver HomeHealth. It is

not clear to what extent this cost would be passed on to the commissioner.

With the commissioners we spoke to, the viewpoint was that to implement HomeHealth it was likely to require additional financial funds. This is because although the board was attended by a range of stakeholders including the ICB, local authority, third-sector and NHS community providers, none of the stakeholders would see direct cash savings from the intervention that would free up the resources to commission the service. The cash-savings would only be seen by the secondary care providers, if at all (see below).

4 Discussion

HomeHealth as an individualised health promotion intervention to prevent frailty has a high probability of being cost effective based on the NICE reference case, although there was no statistically significant difference in costs or QALYs. The high probability of cost effectiveness is due to participants randomised to HomeHealth having significantly fewer emergency hospital admissions over 12 months. The intervention also reduced the impact on unpaid carers, although this is not captured by the NICE reference case. HomeHealth illustrates a key issue with cost-effectiveness analyses that follow the NICE reference case when presented to local commissioners: The presentation of the results in the format of a NICE reference case did not convince commissioners that they should commission HomeHealth. In particular, it was not presented in a way where they could identify where the funding for the intervention could come from.

4.1 Cost Effective, Cost Saving and Cash Releasing?

When conducting an economic evaluation to calculate cost effectiveness, we are interested in opportunity cost: the benefit foregone when resources are allocated to intervention A instead of intervention B. Economic evaluations based on the NICE reference case do this from a health and personal social services' (PSS) perspective [14], encompassing the whole system and assuming a national average across the population as a risk-neutral approach. An ICER cannot, however, indicate the financial winners and losers when intervention A is implemented, as health and social care is made up of a number of payers and providers who have different financial responsibilities.

The results of the HomeHealth trial suggest that the intervention is cost saving, i.e. there is an overall net positive impact on the finances of the NHS due to the cost related to a reduction in emergency admissions being greater than the total cost of the intervention. Cost savings, however, tend to require that the intervention is scaled up to a large population due to the variability between patients in resource use. Cost saving is also not the same thing as cash releasing. Although cost saving is a net benefit to the system, cash releasing is when there is a direct reduction to the spend or budget of a department within a specific financial year. It usually requires that a budget is no longer allocated to a particular activity or member of staff. In theory, cost saving can mean cash releasing, but only if it can identify where the spend will be reduced and when.

For HomeHealth to be commissioned, either new finances need to be identified to fund it or the cost savings are cash releasing and can be re-allocated to fund it.

Under the current NHS funding structure there are four potential sources of funding for the HomeHealth intervention: (i) within the general practitioner (GP) contract; (ii) through the ring-fenced public heath funding to local authorities; (iii) through social care funding; or (iv) commissioned as a specialist community service by the ICB.

Primary care is commissioned mostly through NHS England, with contractual payments to GPs being based on list numbers, a weighted formula, meeting quality outcomes framework targets (voluntary), and other contractual services and training [41]. As part of the GP contract, HomeHealth could be delivered in a primary-care context given the role of primary care in the identification and management of patients with complex health problems. This would then be similar to the identification and management of patients with diabetes mellitus and serious mental illness. The HomeHealth worker could potentially be integrated into a multi-disciplinary team responsible for the management of older people or people with complex needs. There is currently no financial incentive for GPs to reduce hospital admissions. As a result, without specific ear-marked funds for this intervention, GPs are unlikely to be able to identify the funds to pay for this intervention.

Local authorities are funded for health-promotion and -prevention activities through the ring-fenced public health budget. Funding to public health has also reduced significantly over recent years, with local authorities funding the short fall [10]. As noted in the introduction, HomeHealth would also have to compete with the delivery of mandatory public health services such as sexual health clinics and substance misuse treatment. These other pressures mean that it is hard to identify funds to implement HomeHealth.

Another area that HomeHealth could be financed through is social care. Social care is primarily funded through local authority revenue. Significant pressure on local authority finances has meant social care has been significantly underfunded in recent years, although the government has identified additional funding to address this gap. Even with additional funding in 2025/2026, there is still likely to be a £1.1 billion gap in social-care funding [42]. The underfunding of social care is reflected in the HomeHealth results that most caring is through family or close others providing care or

private (out-of-pocket) care. Although HomeHealth resulted in a significant reduction in unpaid carer time, it did not have a sufficient impact on publicly funded social care to meet the total cost of delivering the HomeHealth intervention. People eligible for the HomeHealth intervention are also unlikely to be sufficiently frail to be eligible for social care.

The ICB is responsible for commissioning healthcare services for their local population across primary and secondary care, although, as previously mentioned, primary care is predominately covered through the GP contract. The Health and Social Care Bill 2021 and other initiatives such as the Better Health Fund also make it possible for ICBs to pool budgets across sectors, as has happened for falls' prevention [43]. The largest cost savings for HomeHealth were seen in avoidable hospital admissions and potentially of a sufficient magnitude to finance the HomeHealth intervention. If the secondary-care provider passes on the cost savings that result from HomeHealth to the ICB, this could be sufficiently cash releasing to pay for the HomeHealth intervention either as a community healthcare service or through a third-sector provider. Prior to the COVID-19 pandemic secondary-care providers were paid based on activity as part of payment by results (PbR), where each attendance had a set tariff based on healthcare resource groups, which allowed for higher payments for more complex patients. If ICBs were to implement the HomeHealth intervention within secondary care, assuming a PbR system, cash-releasing savings should hypothetically be seen as a result of reduced hospital admissions. If the intervention was implemented at the start of the financial year, the reduction in payments should have happened by the end of the financial year to balance their budgets and pay for the HomeHealth intervention.

However, this relies on the following: Firstly, that the cost savings from the avoided hospital admissions are greater than the cost of delivering HomeHealth. Using a caseload model of 120 patients for a healthcare professional plus training at £33,788 per year it requires a sufficient number of hospital attendances avoided from the 120 patients to add up to the cost of the healthcare professional. This is possible given the mean cost saving of £586 per patient from reduced emergency admissions seen in the HomeHealth intervention (see Table 2) and would equate to £36,532 (£586 × 120 − £33,788) in savings per HomeHealth caseworker per year. Secondly, for a reduction in admissions to be cash releasing and hence have the possibility to balance the budgets, the hospital has to be operating at or above demand so that the reductions in activity can actually be seen. If secondary care is paid based on activity, for admissions with a net monetary gain to the provider per admission, the provider is incentivised to increase activity. If hospitals are not meeting demand, then the admission that was avoided by one patient due to the HomeHealth intervention is likely to be taken up by another patient and hence no cash-releasing savings will be realised as the activity will remain the same. Since 2020, 12-h waits to be admitted following a decision to admit have gone from rare pre-pandemic to 5600 patients a day in January 2024 [3]. This figure suggests that the healthcare system is struggling to meet demand. Although reducing avoidable admissions might reduce the number of people waiting on trolleys in corridors for a hospital bed, and is obviously something services should strive for, it may only have minimal impact on the total spending of the ICB. As a result, there needs to be large numbers of people prevented from going to hospital each year before an intervention can become cash releasing.

Thirdly it also requires activity-based funding. Under the current block contract arrangements (a yearly lump sum payment based on previous activity and spend) that have been in place since 2021 [44], there is no financial benefit to the ICB for any reduction in hospital attendances.

This may explain why initiatives such as virtual wards have become attractive without overwhelming evidence, as they allow for a shifting of resources within the secondary care provider rather than the identification of new resources.

4.2 Recommendations

The argument that more needs to be done to incentivise investment in health promotion and prevention has been made previously by bodies such as the World Health Organization (WHO) [7], commonly based on a rationale of cost effectiveness or other value-for-money metrics. The issue is that reporting an intervention is cost effective or value for money achieves little if the healthcare system is not financially set up to allow for the prioritisation of health prevention and promotion [6]. The HomeHealth case study demonstrates that even for a health prevention intervention that significantly reduces avoidable admissions and has a high probability of being cost effective based on the NICE reference case, there is no clear mechanism for how the intervention could be funded under the current structures. It also demonstrates the disconnect between economic evaluation methods for health technology assessment and local decision making that have been discussed in detail elsewhere [43]. This issue is not limited to health promotion and prevention activities that prevent hospital admissions, but is potentially even more acute for health promotion and prevention where the benefits are long term, such as dementia prevention initiatives. E-health interventions, such as apps to reduce alcohol consumption, can equally find it hard to find funding. This is because although they may be cheaper than a face-to-face service, they cost more than current practice if there is currently no treatment in place.

Instead, health promotion and prevention activities need to be funded and prioritised in a system-wide way. This is likely to mean the identification of new funds to pay for these activities given that the current funding is tied up in dealing

with acute health problems. Pooled budgets can potentially present a way forward if cash-releasing savings can be identified, but in the current financial climate this is unlikely. Anecdotally pooled budgets have almost disappeared from commissioning practice for this reason. This is also reflected in evidence that shows that the pooling of budgets does not result in reduced bed days [45]. Our key recommendation is that commissioning needs to be conducted in a way where payments are more aligned with health outcomes and economic evaluation methods, and not just process measures [46]. This would potentially provide a mechanism for incentivising the provision of more health-promotion activities. It would also make NICE reference-case economic evaluations more relevant to decision makers. One way to do this is through GP commissioning arrangements, something which has been shown to work elsewhere [8, 9].

4.3 Strengths and Limitations

The cost-effectiveness analysis of the HomeHealth study adds to the current evidence base for non-pharmacological interventions in older adults. The pragmatic nature of the trial means that the intervention was relatively close to what might be delivered in a real-world setting. Participants were also relatively similar to the eligible population, although there may be some under-representation of older people from minority ethnic groups [28]. The use of medical records to collect resource-use data minimised loss to follow-up on key outcomes such as hospital admissions. As participants could not be blind to the intervention, use of non-self-reported outcomes reduced potential reporting bias. Recall and reporting bias though are still a limitation of any costs reported beyond health and social care, and medical records do not always accurately capture healthcare contacts. Although the study covered three diverse areas within England, it is possible that the results are not generalisable to other geographical areas or healthcare systems. The time horizon for the analysis is only 1 year and hence excludes any costs or consequences beyond this time horizon that may impact on the probability of HomeHealth being cost effective.

5 Conclusion

Health promotion and prevention initiatives will struggle to find funding in the current financial set-up for NHS England, even when the interventions are cost saving within the same financial year. Health prevention and promotion initiatives where the health benefits are even further in the future face an even greater hurdle. Demonstrating cost effectiveness to commissioners or even budget impact is unlikely to change this unless the intervention is clearly cash releasing, i.e. by stopping or replacing another service. Instead, this needs clear direction and change from the top, either with ring-fenced specific money for health promotion and prevention initiatives or changing the payment mechanisms to better incentivise health promotion and prevention activities, particularly with GPs.

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Declarations

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Conflict of interest RMH has received funding from AstraZeneca: advice on commissioning cardiovascular disease management in primary care, is treasurer for the Health Economists' Study Group (unpaid role), receives National Institutes for Health Research (NIHR) funding for DenPRU-QM and sits on trial steering committees for NIHR trials. KW has received funding from NIHR programmes and is a member of the NIHR School of Public Health Research and NIHR Three Schools Prevention Advisory Boards. RF is Chair of the Study Steering Committee for the NIHR-funded CASCADE project and is Treasurer for the British Society of Gerontology (unpaid voluntary role). DAS is Director and holds shares in Later Life Training, a not-for-profit training organisation that delivers exercise delivery training to health and fitness professionals, which supported the exercise training programme for HomeHealth support workers included in the intervention. DAS has received funding as a Co-Investigator on grants funded by NIHR Applied Research Collaboration National Priority for Ageing, Dementia, and Frailty, Chief Scientists Office, UK Research and Innovation Public Health Intervention Development, European Commission (H2020-MSCA-ITN), Orthopaedic Research UK, and Singapore Physiotherapy Association. DAS is Chair of the British Geriatrics Society Rehabilitation Group, a member of the British Geriatrics Society Special Interest Group on Falls and Fractures, a member of the Scientific Advisory Board for the Older People and Frailty NIHR Policy Research Unit, is Chair of Academic Advisory Group, PACES Project, and the Medical Research Council funded project, University of Glasgow, and a member of the NIHR Advanced Fellowship Selection Committee. AC led the development and UK implementation of the electronic frailty index, which is licensed to suppliers of electronic

health-record systems at no cost, on the basis a premium charge is not applied to the end UK National Health Service user. AC has received funding from NIHR, Dunhill Medical Trust, UK Research and Innovation, Geras Centre for Aging Research (2023 Centre Review), and Australia and New Zealand Society of Geriatric Medicine, and is Chair of global Ageing Research Trialists collaborative, member of National Institute for Health and Care Excellence Falls Prevention Guideline Development Group, and sits on Trial Steering Committee and Data Monitoring and Ethics Committee for NIHR trials. All other authors declare no additional competing interests.

Data sharing Data collected for the study, including the statistical and health economics analysis plan, de-identified participant data, and a data dictionary defining each field in the set, will be made available to others on receipt by Priment CTU (priment@ucl.ac.uk) of a reasonable request, at any date after publication of this paper. All requests will be reviewed by Priment CTU in line with Priment CTU guidance on sharing data and anonymising data. This process is to ensure that the request is reasonable and the data set is suitably anonymised. The study protocol is available on open access [29].

Ethics approval The study was reviewed and approved by the Health Research Authority Social Care Research Ethics Committee (20/IEC08/0013). Modifications caused by the COVID-19 pandemic were reviewed and approved by the Research Ethics Committee and by our independent Trial Steering Committee.

Consent to participate All participants provided written or verbal (audio-recorded) consent to take part in the trial. Consent for access to medical records was optional and data were only accessed and recorded for trial participants who provided consent.

Consent for publication Not applicable as no identifiable participant information has been reported.

Code availability Code for the analysis of the health economics analysis will be made available to others on receipt by Priment CTU (priment@ucl.ac.uk) of a reasonable request, at any date after publication of this paper. All requests will be reviewed by Priment CTU in line with Priment CTU guidance.

Author contributions RMH conducted the analysis and wrote the first draft of the paper. KW was Chief Investigator, and contributed to review and editing the of report together with RF, SK, LM, SP, CA, AC, CC, VMD, BG, CG, PL and DAS. RMH, RF, SK, LM, CA, AC, CC, VMD, BG, CG, PL and DS contributed to conceptualisation and funding acquisition. All authors contributed to methodology and oversight. RF was the trial manager, SK was the deputy trial manager. CA was the clinical safety lead and site PI, CG and AC were site PIs and supervised trial delivery at their site. SP did the main statistical analysis, and PS and LM provided statistical oversight and advice. RMH, SP and LM directly accessed and verified the underlying data reported in the manuscript. All authors had full access to all the data in the study, contributed to review and editing of the manuscript, and had final responsibility for the decision to submit for publication.

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