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RESEARCH ARTICLE

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What are the current and projected future cost and health-related quality of life implications of scaling up cognitive stimulation therapy?

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Abstract

Objectives: Cognitive stimulation therapy (CST) is one of the few non-pharmacological interventions for people living with dementia shown to be effective and cost-effective. What are the current and future cost and health-related quality of life implications of scaling-up CST to eligible new cases of dementia in England?

Methods/design: Data from trials were combined with microsimulation and macro-simulation modelling to project future prevalence, needs and costs. Health and social costs, unpaid care costs and quality-adjusted life years (QALYs) were compared with and without scaling-up of CST and follow-on maintenance CST (MCST).

Results: Scaling-up group CST requires year-on-year increases in expenditure (mainly on staff), but these would be partially offset by reductions in health and care costs. Unpaid care costs would increase. Scaling-up MCST would also require additional expenditure, but without generating savings elsewhere. There would be improvements in general cognitive functioning and health-related quality of life, summarised in terms of QALY gains. Cost per QALY for CST alone would increase from £12,596 in 2015 to £19,573 by 2040, which is below the threshold for cost-effectiveness used by the National Institute for Health and Care Excellence (NICE). Cost per QALY for CST and MCST combined would grow from £19,883 in 2015 to £30,906 by 2040, making it less likely to be recommended by NICE on cost-effectiveness grounds.

Conclusions: Scaling-up CST England for people with incident dementia can improve lives in an affordable, cost-effective manner. Adding MCST also improves health-related quality of life, but the economic evidence is less compelling.

KEYWORDS
cognitive stimulation therapy, cost, dementia, economic evaluation, quality adjusted life year, scaling-up

Key points

- There are few evidence-based non-pharmacological interventions for people living with dementia. Cognitive stimulation therapy (CST) is both effective and cost-effective, but current availability is constrained
- This paper reports the cost and health-related quality of life implications of scaling-up cognitive stimulation therapy to eligible people with dementia in England over a 25 year period
- Scaling-up CST would improve general cognitive functioning and health-related quality of life, but also increase costs for health and social care services, and for family and other unpaid carers. Adding maintenance CST would also improve health-related quality of life, with even greater cost increases
- The higher costs of scaling-up CST to the full eligible population over a 25 year period would be considered worth paying by reference to criteria used by the National Institute for Health and Care Excellence (NICE) in England. The economic evidence for adding maintenance CST is less compelling

1 | INTRODUCTION

Responses to dementia are of three kinds: upstream prevention, efforts to find disease-modifying treatments, and better care and support. Current evidence suggests that about 40% of dementia cases can be prevented with better education and health behaviours in early or mid-life[1,2] and multidomain lifestyle interventions for slightly older people at known risk of dementia.[3] It is imperative that such preventive efforts are made, but benefits will be slow to materialise. There have been few breakthroughs in the search for disease-modifying interventions; in any case, prices of new medications and associated biomarkers could present challenging obstacles to widespread adoption.[4] An important aim must therefore be to deliver the best care to all people living with dementia and their carers.

Looking forward, if today's care arrangements and risk factors remained unchanged, expected growth in dementia prevalence will increase costs in England over a 25 year period by 249%.[5] This figure includes the costs of health and social care services that employ paid staff, as well as the estimated costs of unpaid support from family and other carers. It also takes into account the expected growth in other long-term conditions. Whether future governments or other funding bodies would be willing to increase their spending by this amount is uncertain, given that it would require higher taxes or funding to be diverted from other programmes. There must also be doubts about the future availability of family and other carers, given broad societal shifts such as reduced family size and labour force participation rates.[6] But even if this projected future cost was viable, it would still only fund a system that replicates today's diagnostic, treatment and care gaps and other failings. There is an obvious need to find and scale-up affordable, cost-effective interventions that support people with dementia and their carers to enjoy good quality lives.

Unfortunately, few such interventions are currently available. Of nine non-pharmacological interventions for promoting cognition, independence and wellbeing reviewed by the National Institute for Health and Care Excellence (NICE) for their 2018 clinical guideline on dementia, only two had sufficient evidence for broad recommendation and only group cognitive stimulation therapy (CST) was considered specific enough to replicate widely.[7]

What, then, are the current and projected future cost and health-related quality of life implications of scaling-up CST to eligible new cases of dementia in England? This is the question answered in this paper.

2 | MATERIALS AND METHODS

We combine evidence on effectiveness and cost-effectiveness with projections of numbers of people with dementia to estimate potential overall costs and health-related quality of life outcomes for the period 2015 and 2040 (in 5 year intervals). We start from 2015 because our baseline calculations of dementia costs and future projections relate to that year.

This study was part the MODEM project[6] and draws on its other components:

- estimates of current and future dementia prevalence in England over the period 2015–2040 using microsimulation modelling;[8]
- estimates of current and future care, treatment and support costs under today's arrangements using macrosimulation modelling,[5,9] including new data collected from a sample of people with dementia and carers to fill evidence gaps;[10]
- systematic mapping of evidence on interventions in dementia care which identified, as did NICE,[7] that CST is one of few interventions considered to be effective and cost-effective.

Estimates are combined in a cell-based model (MS Excel).

2.1 | Intervention

Group CST is a manualised intervention targeted at people with mild or moderate dementia. It is a brief intervention involving small groups of people with dementia engaging in activities and discussions to improve cognitive and social functioning. It is based on the bio-psychosocial model of dementia and disuse theory, emphasising enjoyment and information-processing. Session themes include physical games, sound, childhood, food, current affairs, faces/scenes, word association, being creative, categorising objects, orientation, using money, number games and word games.[11]

Trials demonstrate that CST has beneficial effects on general cognition and quality of life,[11–13] without significantly increasing total care costs.[14] Such benefits are achieved over and above any medication effects.[13]

A trial of additional CST over a longer period (maintenance CST (MCST)), based on the same theory of cognitive stimulation, demonstrated modest outcome gains over 6 months for people with mild-to-moderate dementia,[15] and reasonable likelihood of cost-effectiveness based on cognition scores and both self-rated and proxy-rated quality of life.[16] Although lack of longer-term follow-up data from England or elsewhere[17] leaves ongoing uncertainty about long-term impacts, there is nevertheless potential to extend short-term benefits by making CST available to a wider population.

We assume the same implementation scenarios as in relevant trials[11,15]: fourteen group-sessions of standard CST (45 min each, twice per week for 7 weeks, groups of approximately five persons) delivered within community-based care; followed by 24 group-sessions of MCST delivered weekly in community or residential settings. We assume every person accessing CST is offered MCST shortly after CST (except for those expected to die between those events).

2.2 | Target population

Our estimates are for a target population of diagnosed eligible new cases from 2015 onwards (without any catch-up delivery for previously identified new cases). Our starting point is the number of people expected to develop mild-to-moderate dementia, derived by applying incidence rates[7] to population projections[18] by age and sex. We then make three *sequential* subtractions, at a constant annual rate: 10% of the incident population would never be diagnosed; 35% of the remainder would be ineligible for CST because of severe disability; and 41% of the remainder would decline participation when offered CST (sources in Table 1).

To estimate numbers receiving MCST, we further subtract: 1% expected to die between receiving CST and being offered MCST; 6% too disabled to remain eligible; and 6% declining MCST.[14] We assume that everyone receiving CST and MCST also receives pharmacological treatment for dementia. (There are very few people with mild-to-moderate dementia for whom AChEIs are not recommended or who may have intolerance.[7])

2.3 | Costs

Comprehensive costs for delivering the intervention average £464 per person for CST and £655 for MCST, based on groups of five persons.[7,16]

Impacts on other health and social care costs are estimated from previous cost-effectiveness studies.[14,16] To account for any differences in baseline costs in these studies, we calculate cost differences between intervention and control groups in terms of *difference in change in costs between baseline and follow-up*. CST reduces both NHS and social care costs, while MCST reduces NHS costs but increases social care costs. We assume that these changes occur in the same year in which CST/MCST is provided. There is no available evidence to account for longer-term cost impacts.

Impacts on unpaid care costs are available for MCST: D'Amico[16] reported unpaid care costs of £3913 and £2527 (2011 prices) for intervention and control groups, respectively, for the 6-month period pre-baseline, and £5504 and £3,752, respectively, for the 6 month follow-up period. Change in costs over time (£1591 intervention group, £1226 control group) represented respective proportional increases of 1.41 and 1.49. Between-group difference in change in unpaid care costs (£366 in 2011 prices, equivalent to £379 in 2015 prices) is used in our MCST model.

Unpaid care costs were not measured in the original CST trial, so we use the proportional difference from MCST to estimate these costs for CST. First, we assume that (pre-)baseline 6 month costs of unpaid care for MCST represent the follow-up costs for CST, given that MCST is provided shortly after CST ends. We then apply the above proportional changes in costs to estimate baseline unpaid care costs for CST: £3913/1.41 = £2782 (intervention group) and £2527/1.49 = £1702 (control group). Changes in costs between baseline and follow-up are thus estimated at £1131 (intervention) and £825 (control); the between-group difference in the change (£306 at 2011 prices; £318 at 2015 prices) is used in the CST model.

All costs are henceforth presented in pounds sterling (£) at 2015 constant prices (if necessary, standardised to 2015 levels using the Hospital and Community Health Services Index[20]), but rise in real terms over time with average wages, as assumed by the Office for Budgetary Responsibility.

2.4 | Outcomes

A Cochrane review concluded that the most consistently shown benefit of CST across studies is short-term improvement in cognitive function.[13] There are also benefits across *other* outcome domains: quality of life, staff ratings of participants' communication and social interaction outside intervention sessions. We focus on quality of life given that quality-adjusted life years (QALYs) are widely used metrics to inform healthcare allocation decisions in England.

While Knapp et al.[14] demonstrated reasonable probabilities of cost-effectiveness for CST based on point-improvements in the Quality of Life in Alzheimer's disease (QoL-AD) measure, QALY data

TABLE 1 Modelling parameters: values, sources and details

Parameter	Value	Sources and details
Cognitive stimulation therapy (CST)		
Annual incidence of dementia, base value for 2015	124,700	Cognitive function and ageing study (CFASII) incidence rate.[8] incidence for subsequent years was estimated by applying office for national statistics (ONS) population projections for England, by age and sex.[18]
Proportion never diagnosed	0.10	NHS data analysis show that 70% of prevalent cases of dementia have been diagnosed. Since we know that there is often a delay before people receive a diagnosis, we assumed the proportion of people who ultimately receive a diagnosis must logically be higher than 70%.
Proportion ineligible for CST due to severe disability	0.35	Average of estimates obtained for North East London NHS foundation trust (NELFT; personal communication) and pan-London services.[19] for NEFLT, we excluded from our calculations the proportion of service users for whom it was unclear whether CST was offered at all (undocumented). For pan-London, we excluded the proportion for whom no service was available. Rate assumed to remain constant each year.
Proportion not using memory clinic or day centre	0	Assumption that everyone has access to the facilities in which CST is provided.
Proportion declining CST	0.41	Average of estimates obtained for North East London NHS foundation trust (NELFT; personal communication with two clinicians) and a report on pan-London services.[19] for NEFLT, we excluded from our calculations the proportion of individuals for whom it was unclear whether CST was offered at all (undocumented). For pan-London, we excluded the proportion for whom no service was available. Rate assumed to remain constant each year.
Cost of CST, per person (2015 prices)	£464	£478 in 2017 prices;[7] deflated to 2015 prices using the hospital & community health services (HCHS) index.[20]
Change in NHS costs from CST in first year, per person (2015 prices)	-£14.39	Knapp et al.[14] – refers to medication, hospital and community services. A real cost of care inflation index (modelling based on office for budget responsibility data) is applied to estimates for subsequent years.
Change in social care costs from CST in first year, per person (2015 prices)	-£71.81	Knapp et al.[14] – refers to residential care, day care and accommodation. A real cost of care inflation index (modelling based on office for budget responsibility data) is applied to estimates for subsequent years.
Change in unpaid care costs from CST in first year, per person (2015)	£318	No evidence of impact so estimate was derived drawing on unpaid care impacts reported for MCST,[16] and applying proportional differences to costs reported by Knapp et al.,[14] as described in the methods section. A real cost of care inflation index (modelling based on office for budget responsibility data) is applied to estimates for subsequent years.
QALY gain linked to CST, per person, in first year only	0.03	NICE[7] – from meta-analysis of various interventions that were considered under CST; refers to QALY gain derived from benefits on outcomes measured with clinical scales using the following formula (health utility = 0.359 + 0.00745 x MMSE + 0.00394 x DAD - 0.0054 x NPI); health utility is then applied to mean times over which benefit is assumed to last (this includes intervention, follow up and convergence periods); after this period (in NICE base case about 600 days) the health state of person who participated in CST is assumed to return to the one of a person in control group; whilst NICE takes a period of 600 days over which benefits last, we assume for simplicity that those changes occur in the first year.
Maintenance cognitive stimulation therapy (MCST)		
Mortality between CST and time for MCST	0.05	Assumption based on orrell et al.[15] – 5% of people in MCST trial died over period of 6 months; Newcomer et al.[21] found a 1 year mortality of 14.3% but that relates to a wider population of people with dementia in the community.

TABLE 1 (Continued)

Parameter	Value	Sources and details
Proportion too disabled to remain eligible	0.06	Derived from orrell et al.[15] – 6% (15/272) of those who started CST had health issues that were too severe to continue.
Proportion declining MCST	0.06	Derived from orrell et al.[15] – 6% (17/272) declined MCST because they did not like CST.
Proportion not using day or residential care	0	Assumption that everyone had access to either residential or community care.
Cost of MCST, per person (2015 prices)	£655	D'Amico et al.[16] – £623 in 2011 prices; inflated using the HCHS index.
Change in NHS costs from MCST in first year, per person (2015 prices)	-£151.2	D'Amico et al.[16] – refers to hospital and community services, medication. A real cost of care inflation index (modelling based on office for budget responsibility data) is applied to estimates for subsequent years.
Change in social care costs from MCST in first year, per person (2015 prices)	£273.9	D'Amico et al.[16] – refers to residential and day care, equipment and adaptations. A real cost of care inflation index (modelling based on office for budget responsibility data) is applied to estimates for subsequent years.
Change in unpaid care costs from MCST in first year, per person (2015)	£379.6	D'Amico et al. [16] – refers to hours of unpaid care. A real cost of care inflation index (modelling based on office for budget responsibility data) is applied to estimates for subsequent years.
QALY gain linked to MCST per person in first year	0.026	D'Amico et al.[16] – refers to people using medication (i.e. ACHEIs and MCST vs. ACHEIs).

Abbreviations: CST, cognitive stimulation therapy; QALT, quality-adjusted life years; MCST, maintenance CST.

for CST are lacking. NICE[7] estimated utility values (for calculating QALYs) from clinical outputs from relevant trials, using multivariate modelling previously developed by others. Although this approach has some limitations, NICE estimated average gain of 0.033 QALYs for CST compared to control at additional cost of £653 (incremental cost-effectiveness ratio of £19,966). Probabilistic sensitivity analyses suggested that CST versus control was unlikely to generate more than 0.1 QALYs or cost more than £1000. We assign this estimate of 0.033 QALY gain to the number of people estimated to receive CST. For MCST, average QALY gain of 0.026 over 6 months has been reported,[16] based on proxy EQ-5D assessments for the sub-group of participants taking acetylcholinesterase inhibitors (ACHEIs).

Given lack of evidence on QALY outcomes beyond 6-month follow-up for either CST or MCST, QALY gains are conservatively assumed to occur in the first year and to be achieved only once per lifetime.

2.5 | Total impacts

It is not known how many people received CST in 2015 in England, making it impossible to calculate the *extra* costs and QALY gains from expanding provision. Our estimates give total cost and total QALY gains in each year from scaling-up CST to the full eligible population, compared to not providing CST to anyone with dementia.

Values, sources and assumptions for all parameters are detailed in Table 1. Calculations for CST and MCST are undertaken separately and aggregated only as relevant (see below).

2.6 | Sensitivity analyses

We examine alternative assumptions for four key parameters through one-way sensitivity analyses. Our base-case analyses assume CST and MCST are delivered separately from usual care, as implemented in relevant trials, and thus entail additional costs. However, it is feasible to integrate CST into routine care with existing, rather than additional, staffing (including clinical psychologists, occupational therapists, care workers, nurses),[22,23] thereby reducing implementation costs. We therefore examine the impact of reducing CST and MCST intervention costs by 50%.

D'Amico et al.[15] found marginally lower increase in social care costs for people receiving MCST compared to control, although this could potentially be explained by slightly lower social care costs for the MCST group at baseline. To account for the possibility of no social care cost advantages for MCST, we explore reducing this difference to zero.

Third, there is uncertainty about QALY gains from CST and MCST. Our base-case value for CST (0.03[7]) is probably an upper estimate, and that for MCST (0.026[16]) related to people receiving medication (given our assumption in the model that everyone receives medication). The equivalent estimate for D'Amico's full sample (i.e., including those *not* receiving ACHEIs) was 0.0176, equivalent to 68% of the QALY gain for the medicated sub-sample. We therefore examine the impact of reducing QALY gain for MCST to 70% of that for the base-case, and assume a similar reduction for CST.

Finally, there is uncertainty surrounding uptake rates for CST. Orrell et al.[15] reported that, of the 13% of participants who withdrew

from their study, about half did so due to not liking CST groups. Given the potential to address this barrier (e.g., through individual delivery models),[24] we explore the impact of reducing the rate who decline CST by 50% (from 41% to 20.5%). We assume that average costs and QALY gains per person remain unchanged: we have no way of knowing whether they might alter if 'decline rates' fell.

3 | RESULTS

3.1 | Incidence and target population

Between 2015 and 2040, the number of people with mild-to-moderate dementia is projected to grow from 124,700 to 203,200 (Table 2). Accounting for proportions never diagnosed, ineligible for CST and declining CST, we estimate the number receiving CST would grow from 43,040 to 70,134 over that period. Further deductions for MCST (death, ineligibility, declining) result in estimates of 36,129 people receiving MCST in 2015 and 58,872 in 2040.

3.2 | Costs and QALYs

Scaled-up implementation of CST for eligible people is estimated to cost £24.2 million in 2020 (Table 3). Some of these additional costs would be offset by savings in health and social care, so *net* health and social care costs are estimated to be £19.7 million, with a QALY gain of 1431. By 2040, annual costs rise to £41.2 million and annual QALY gains to 2104. A more conservative estimate of QALY gains, at 70% of per-person gain in the base-case, reduces total QALY gains to 1350 (2020) and 1473 (2040).

Cost of delivering MCST is likely to be greater (£28.7 million in 2020). Given evidence that MCST generates savings only for health care, not social care, net annual health and social care costs for MCST are projected to be £34.0 million in 2020 and £71.2 million in 2040. A more optimistic scenario that assumes no difference in change in social care costs would reduce these estimates to £22.1 million and £46.1 million, respectively. MCST is expected to generate 1041 annual QALY gains in 2020 and 1531 in 2040; a more conservative estimate, at 70% of per-person gain in the base-case, reduces total annual QALY gains to 982 (2020) and 1071 (2040).

Including costs of unpaid care increases total costs in 2020 to £36.3 million for CST and £50.7 million for MCST (Table 3; Figure 1). By 2040, the combined costs of CST and MCST reach £181.7 million. Reducing cost of CST and MCST delivery by 50% reduces these combined total annual costs to £60.5 million (2020) and £126.5 million (2040). Reducing the proportion of people who decline CST by 50% increases combined costs to £117.2 million (2020) and £244.9 million (2040), whilst QALY gains increase to 3331 (2020) and 4898 (2040).

3.3 | Cost per QALY

Cost per QALY, which is the usual way of summarising cost-effectiveness analyses in NICE appraisals, ranges from £12,596 (in 2015) to £19,573 (2040) for CST alone; and £19,883 (in 2015) to

TABLE 2 Estimation of incident and target population for England, 2015–2040

	Base	Projections				
	2015	2020	2025	2030	2035	2040
Cognitive stimulation therapy (CST)						
Annual overall incidence of dementia	124,700	138,200	157,700	180,000	196,900	203,200
Proportion never diagnosed	0.1	0.1	0.1	0.1	0.1	0.1
Proportion ineligible for CST	0.35	0.35	0.35	0.35	0.35	0.35
Annual number eligible for CST	72,950	80,847	92,255	105,300	115,187	118,872
Proportion not using memory clinic or day centre	0	0	0	0	0	0
Annual number offered CST	72,950	80,847	92,255	105,300	115,187	118,872
Proportion declining CST	0.41	0.41	0.41	0.41	0.41	0.41
Annual number receiving CST	43,040	47,700	54,430	62,127	67,960	70,134
Maintenance cognitive stimulation therapy (MCST)						
Mortality between CST and time for MCST	0.05	0.05	0.05	0.05	0.05	0.05
Proportion too disabled to remain eligible	0.06	0.06	0.06	0.06	0.06	0.06
Proportion declining MCST	0.06	0.06	0.06	0.06	0.06	0.06
Proportion not using day or residential care	0	0	0	0	0	0
Annual number receiving MCST	36,129	40,040	45,690	52,151	57,047	58,872

Abbreviations: CST, cognitive stimulation therapy; QALT, quality-adjusted life years; MCST, maintenance CST.

TABLE 3 Total care costs and QALYs for CST and MCST (England, 2015 prices)

	2015	2020	2025	2030	2035	2040
Cognitive stimulation therapy (CST)						
CST (£, 000)	19,971	24,197	29,454	36,755	44,390	50,579
CST plus other care costs (without unpaid care) (£, 000)	16,261	19,702	23,982	29,927	36,144	41,182
CST plus other care costs (with unpaid care) (£, 000)	29,947	36,286	44,168	55,116	66,566	75,846
QALY gain	1291	1431	1633	1864	2039	2104
Cost (without unpaid care) per QALY (£)	12,596	13,328	14,686	16,055	17,726	19,573
Maintenance cognitive stimulation therapy (MCST)						
MCST (£, 000)	23,664	28,673	34,901	43,553	52,601	59,934
MCST plus other care costs (without unpaid care) (£, 000)	28,097	34,044	41,439	51,712	62,454	71,161
MCST plus other care costs (with unpaid care) (£, 000)	41,812	50,661	61,666	76,952	92,939	105,895
QALY gain	939	1041	1188	1356	1483	1531
CST and MCST, aggregated						
CST and MCST (£, 000)	43,635	52,870	64,355	80,308	96,991	110,512
CST and MCST plus other care costs (without unpaid care) (£, 000)	44,358	53,746	65,421	81,638	98,598	112,343
CST and MCST plus other care costs (with unpaid care) (£,000)	71,759	86,947	105,833	132,069	159,505	181,741
QALY gain	2231	2472	2821	3220	3522	3635
Cost (without unpaid care) per QALY (£)	19,883	21,742	23,191	25,353	27,995	30,906

Abbreviations: CST, cognitive stimulation therapy; QALT, quality-adjusted life years; MCST, maintenance CST.

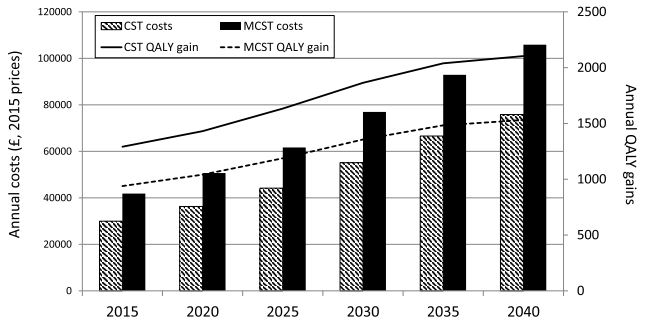

FIGURE 1 Annual costs and annual quality-adjusted life years gains for scaled-up cognitive stimulation therapy and maintenance CST projected to 2040 for England

£30,906 (2040) for CST followed by MCST. These cost-per-QALY calculations exclude unpaid care because NICE only considers service costs.

4 | DISCUSSION

4.1 | Scaling-up CST

Scaling-up CST to all eligible people will require year-on-year increases in investment. For example, in 2025 this would be approximately £29 million (at 2015 prices), partially offset by reductions in health and care costs. Investing in MCST for that same year requires investment of £35 million, but would not generate savings elsewhere. In return, there would be improvements in general cognitive functioning, language comprehension and production, and quality of life.[17] We followed the approach used by NICE to summarise this effectiveness in terms of QALYs gained: for 2025, for example, these would be 1633 (CST alone) or 2821 (CST + MCST). Cost per QALY in 2025 would be £14,686 (CST alone) or £23,191 (CST + MCST), the former clearly below the usual NICE cost-effectiveness threshold, and the latter meaning that CST followed by MCST may be less likely to be recommended.

4.2 | Strengths and limitations

We used a well-constructed microsimulation model to project future dementia prevalence, and a macrosimulation model to estimate current and future costs. Evidence on cost and QALY consequences of CST and MCST was drawn from robust randomised trials. However, the CST trial did not collect data on unpaid care costs and so we estimated them from MCST trial findings; our assumption of the same proportional change figures is a limitation.

CST uptake data came from current practice in a few English localities, and our assumptions on uptake may therefore not be generalisable: there is, for example, variation in CST delivery across England, Wales and Scotland.[25] There are also uncertainties about CST eligibility, and we could only obtain routine practice data from a

few local services. In using those data, we adopted conservative assumptions throughout.

In their modelling of cost-effectiveness, NICE emphasised that their estimates were sensitive to changes in all parameters, with variations in their plausible ranges generating estimates on either side of the £20,000 per QALY cost-effectiveness threshold; and, at this threshold, probabilities of cost-effectiveness were estimated at around 50% (i.e., equivalent to the control group).[7]

While several studies demonstrate effectiveness of CST/MCST based on specific outcomes, including quality of life, a Cochrane review noted methodological limitations associated with the evidence base and the need for research into potential benefits of *longer-term* CST programmes.[13] We assumed that outcomes (QALY gains) occur over a 1-year period, which probably underestimates true impacts.

There have been very few previous projections of expected future numbers of people living with dementia or their needs; our microsimulation model is the best currently available, but can obviously only generate estimates subject to error.

In calculating the target population, we assumed that everyone accessed memory clinics, day centres or residential care, so that there was no further reduction in numbers due to restrictions in access to facilities where CST/MCST is provided, and that investment for such facilities increases commensurately with incidence.

CST is now available in at least 29 countries, including some low-resource settings, with culturally adapted guidelines. Our findings are couched in the English context, and generalisation of our findings to other settings would not be straightforward. Nor would our findings necessarily generalise to *online* delivery of CST, now being explored in some services.[26,27]

4.3 | Implications

CST offers one of the few evidence-based opportunities to achieve health and wellbeing improvements for people with mild-to-moderate dementia. There is emerging evidence that it may also counteract the progression of neuropsychiatric symptoms.[28] Scaling-up CST to the full eligible population, even allowing for those who decline the intervention or are too ill to join a group, has the potential to improve the lives of many more people than currently benefit from this intervention.

This would require commitment of additional funds across England, and the corresponding recruitment of staff to deliver CST. But, relatively speaking, the cost is not large: in 2015, providing group CST to all eligible people who would accept it would have cost £16 million in services and another £14 million in unpaid care. This is tiny when compared with the overall cost of dementia in England of £24.2 billion.[9] If MCST followed on for the eligible population, the overall cost would have been £72 million, still less than 0.5% of total national cost of dementia. Moreover, as shown by the trials, this additional expenditure would have generated QALY gains large enough for NICE to consider group CST to be cost-effective. Whether MCST would be considered a good investment is less clear: it is more expensive since it involves more sessions, it appears not to reduce social care costs (which can be substantial for people with dementia[9]). Over time, cost per QALY increases because of the expected real increases in unit costs of care (since wages usually run ahead of general inflation). Since NICE thresholds have not, to date, been adjusted for inflation, MCST looks less cost-effective later in the period covered by our projections.

Both CST and MCST carry potential for reducing costs of *formal* care, but they appear to have limited capacity to affect unpaid care costs, and so the ongoing impact on family and other carers (which can be considerable[29,30]) must not be overlooked. Our modelling assumes that availability of carer support for people with dementia continues at the rate observed in England in 2015, but there may be proportionately fewer dementia carers by 2040 because of demographic and economic changes.[6]

Are there ways to bring down the cost of CST or improve quality-of-life benefits? Our estimates are based on an implementation model that is staff-intensive, even when delivered in groups. It is therefore worth further exploration of ways to reduce staff costs, for example through exploration of whether there are (more) 'active ingredients',[31] through greater integration into routine care as shown to be feasible elsewhere,[22,23] or through online delivery.[26]

There may also be scope to reduce the number of people who are eligible for, but decline CST. Reducing that rate by a half could substantially increase total annual QALY gains, as we showed, but would also raise implementation costs.

Even though there is evidence that dementia incidence rates might be declining slightly,[32] the total number of people with dementia is not expected to reduce substantially over the coming decades. Symptomatic medication can help slow down cognitive decline for a time,[7] and to do so cost-effectively,[33] but CST is one of very few non-pharmacological interventions known to improve health or quality of life whilst also being cost-effective.

5 | CONCLUSIONS

Drawing on microsimulation projection modelling, new cost data and evidence from previous trials, we find that scaling-up group CST across England for people with incident dementia and mild-to-moderate symptoms offers an excellent opportunity to improve lives in an affordable, cost-effective manner. Adding maintenance CST would further improve health-related quality of life, although the economic case is less compelling.

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CONFLICT OF INTEREST

None of the authors has any actual or potential conflicts of interest to declare with respect to the research, authorship, and/or publication of this article

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in UK Data Service at https://ukdataservice.ac.uk/, reference number SN 854,887.

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