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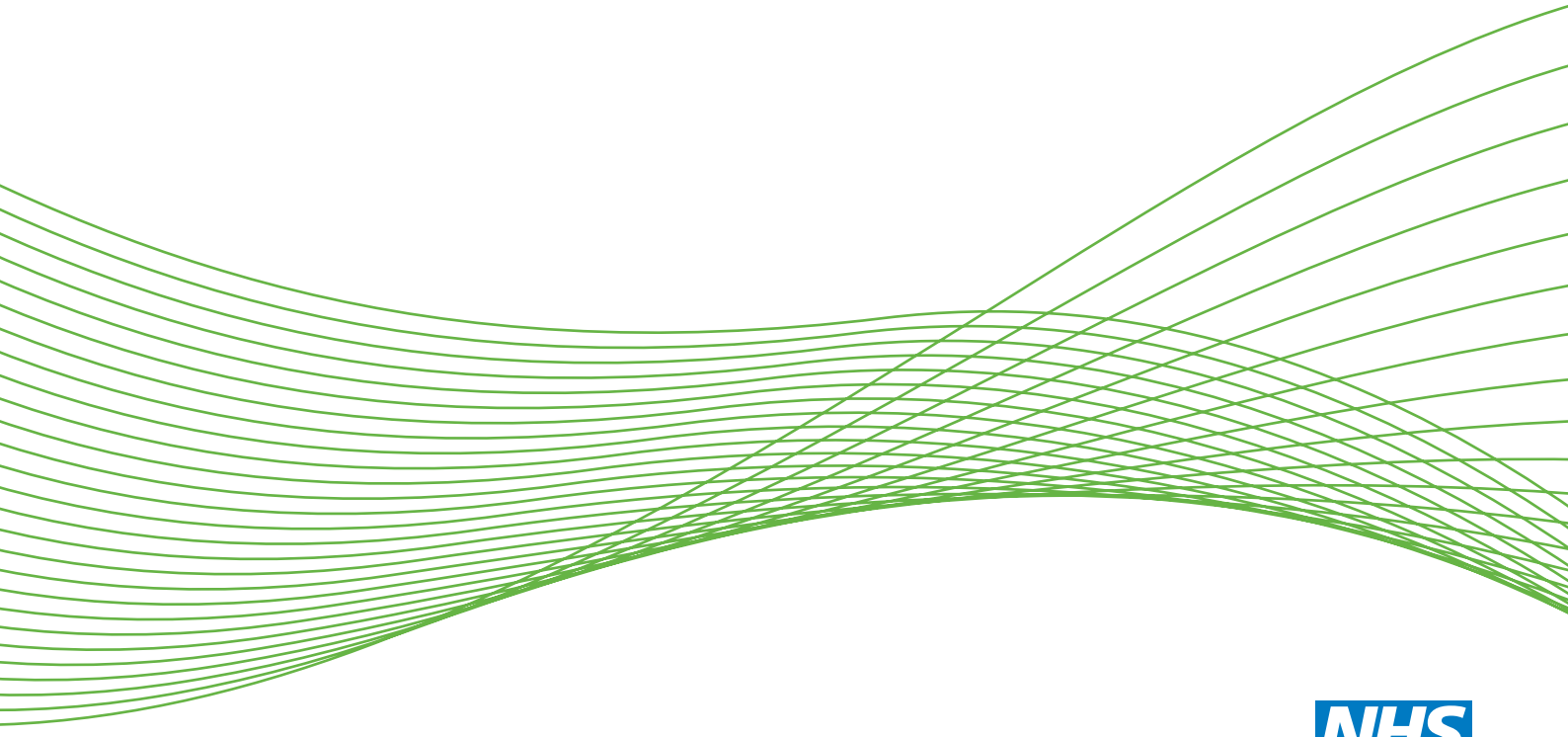

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Individual cognitive stimulation therapy for dementia: a clinical effectiveness and cost-effectiveness pragmatic, multicentre, randomised controlled trial

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Abstract

Individual cognitive stimulation therapy for dementia: a clinical effectiveness and cost-effectiveness pragmatic, multicentre, randomised controlled trial

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Background: Group cognitive stimulation therapy programmes can benefit cognition and quality of life for people with dementia. Evidence for home-based, carer-led cognitive stimulation interventions is limited.

Objectives: To evaluate the clinical effectiveness and cost-effectiveness of carer-delivered individual cognitive stimulation therapy (iCST) for people with dementia and their family carers, compared with treatment as usual (TAU).

Design: A multicentre, single-blind, randomised controlled trial assessing clinical effectiveness and cost-effectiveness. Assessments were at baseline, 13 weeks and 26 weeks (primary end point).

Setting: Participants were recruited through Memory Clinics and Community Mental Health Teams for older people.

Participants: A total of 356 caregiving dyads were recruited and 273 completed the trial.

Intervention: iCST consisted of structured cognitive stimulation sessions for people with dementia, completed up to three times weekly over 25 weeks. Family carers were supported to deliver the sessions at home.

Main outcome measures: Primary outcomes for the person with dementia were cognition and quality of life. Secondary outcomes included behavioural and psychological symptoms, activities of daily living, depressive symptoms and relationship quality. The primary outcome for the family carers was mental/physical health (Short Form questionnaire-12 items). Health-related quality of life (European Quality of Life-5 Dimensions), mood symptoms, resilience and relationship quality comprised the secondary outcomes. Costs were estimated from health and social care and societal perspectives.

Results: There were no differences in any of the primary outcomes for people with dementia between intervention and TAU [cognition: mean difference –0.55, 95% confidence interval (CI) –2.00 to 0.90; *p*-value = 0.45; self-reported quality of life: mean difference –0.02, 95% CI –1.22 to 0.82; *p*-value = 0.97 at the 6-month follow-up]. iCST did not improve mental/physical health for carers. People with dementia in the iCST group experienced better relationship quality with their carer, but there was no evidence that iCST improved their activities of daily living, depression or behavioural and psychological symptoms. iCST seemed to improve health-related quality of life for carers but did not benefit carers' resilience or their relationship quality with their relative. Carers conducting more sessions had fewer depressive symptoms. Qualitative data suggested that people with dementia and their carers experienced better communication owing to iCST. Adjusted mean costs were not significantly different between the groups. From the societal perspective, both health gains and cost savings were observed.

Conclusions: iCST did not improve cognition or quality of life for people with dementia, or carers' physical and mental health. Costs of the intervention were offset by some reductions in social care and other services. Although there was some evidence of improvement in terms of the caregiving relationship and carers' health-related quality of life, iCST does not appear to deliver clinical benefits for cognition and quality of life for people with dementia. Most people received fewer than the recommended number of iCST sessions. Further research is needed to ascertain the clinical effectiveness of carer-led cognitive stimulation interventions for people with dementia.

Trial registration: Current Controlled Trials ISRCTN65945963.

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AChEI	acetylcholinesterase inhibitor
AD	Alzheimer's disease
ADAS-Cog	Alzheimer's Disease Assessment Scale – Cognitive Subscale
ANCOVA	analysis of covariance
BADLS	Bristol Activities of Daily Living Scale
CDR	Clinical Dementia Rating Scale
CEAC	cost-effectiveness acceptability curve
CI	confidence interval
CSRI	Client Service Receipt Inventory
CST	cognitive stimulation therapy
DEMQOL	Dementia Quality of Life
DeNDRoN	Dementias and Neurodegenerative Disease Research Network
DMEC	Data Monitoring and Ethics Committee
DVD	digital versatile disc
EQ-5D™	European Quality of Life-5 Dimensions
EQ-5D-3L™	European Quality of Life-5 Dimensions-3 level response
GDS	Geriatric Depression Scale
HADS	Hospital Anxiety and Depression Scale
ICER	incremental cost-effectiveness ratio
iCST	individual cognitive stimulation therapy
MCS	mental component summary
MMSE	Mini Mental State Examination
NICE	National Institute for Health and Care Excellence
NWORTH	North Wales Organisation for Randomised Trials in Health
PCS	physical component summary
PSSRU	Personal Social Services Research Unit
QALY	quality-adjusted life-year
QCPR	Quality of Caregiver–Patient Relationship
QoL-AD	Quality of Life in Alzheimer's Disease Scale
RCT	randomised controlled trial
REC	Research Ethics Committee
RO	reality orientation
SAE	serious adverse event
SD	standard deviation
SE	standard error
SF-12	Short Form questionnaire-12 items
SMD	standardised mean difference
SPSS	Statistical Package for the Social Sciences
SUR	seemingly unrelated regression
TAU	treatment as usual
WTP	willingness to pay

Plain English summary

Cognitive stimulation approaches can improve cognition and quality of life for people with dementia but little is known about whether cognitive stimulation interventions led by carers are effective. This study used qualitative methods, professional expert feedback and a field-testing study to develop a home-based individual cognitive stimulation therapy (iCST) programme for people with dementia using the established group cognitive stimulation therapy approach. The carer-led intervention was tested using a randomised controlled trial design to evaluate whether iCST benefits cognition and quality of life for people with dementia, and mental and physical health for carers. We followed participants for 13 weeks and 26 weeks. People with dementia receiving iCST did not benefit in terms of cognition at either time point. There was no evidence that iCST improved quality of life for people with dementia or carers' mental or physical health. People with dementia engaging in iCST reported a better relationship quality with their family carer at 26 weeks. Carers taking part in iCST with their relative experienced better health-related quality of life at 26 weeks. Despite evidence of improvements in the caregiving relationship for people with dementia and health-related quality of life for carers, this study provides no evidence that carer-led cognitive stimulation interventions help cognition or quality of life for people with dementia. Further research is needed to evaluate the impact of carer-led cognitive-based interventions for people with dementia.

Scientific summary

Background

There is currently growing recognition and evidence that people with dementia and their family carers can benefit from non-pharmacological interventions, especially those of a psychosocial nature. Increasing attention has been given to cognitive-based interventions, such as cognitive stimulation approaches. A recent Cochrane review has shown that group cognitive stimulation programmes benefit cognition for people with mild to moderate dementia, over and above any medication effects, and may be associated with improvements in quality of life. Cognitive stimulation therapy (CST) is an evidence-based approach, associated with benefits in quality of life and cognition for people with dementia when used in a group setting. This approach is recommended by several organisations such as Alzheimer's Disease International and the National Institute for Health and Care Excellence (NICE) as a useful psychosocial intervention, with proven cost-effectiveness. However, as many people with dementia may be unsuitable or unwilling to participate in groups, investigating the potential utility and effectiveness of this approach when provided at home is likely to be useful in making the intervention more accessible to people with dementia and their family carers.

Objectives

The main objectives of this trial were to develop a home-based individual CST programme and to investigate whether individual cognitive stimulation therapy (iCST) benefits cognition and quality of life for people with dementia compared with treatment as usual (TAU) and to evaluate its cost-effectiveness as a home-based approach.

Methods

Design

This multicentre, single-blind, randomised controlled trial had two arms, an intervention group and a TAU control group. Assessments were blind to treatment and were carried out at baseline, 13 weeks and 26 weeks, with the 26-week assessment being the primary end point. Randomisation was carried out remotely by an accredited clinical trials unit. Researchers, who did not undertake any follow-up assessments, arranged for dyads to receive the treatment and supported them in getting started with the sessions. All follow-up data were collected by researchers who were blind to treatment allocation. Assessors rated their impression of allocation of each dyad and their confidence in that judgement.

Participants

There were 356 community-dwelling participants (mean age 78.2 years) with mild to moderate dementia [meeting *Diagnostic and Statistical Manual of Mental Disorders*-Fourth Edition (DSM-IV) criteria], who had a relative or other unpaid (informal) carer who acted as an informant and was willing and able to deliver the intervention. Most carers were spouses (63%). A total of 273 dyads completed the study. The most frequent diagnosis was Alzheimer's disease (64%), followed by vascular dementia (11%).

The trial was run in London, Bangor, Hull, Manchester, Dorset, Devon, Lincolnshire, and Norfolk and Suffolk. Recruitment to the trial took place in a variety of community settings, including NHS Memory Clinics, Community Mental Health Teams (CMHTs) for older people and associated outpatient clinics. Most people with dementia were recruited through Memory Clinics, referrals from consultant psychiatrists and CMHTs. All research activities, including assessments and intervention sessions, took place in the participants' homes.

Inclusion criteria

All participants were people with dementia who:

- met the DSM-IV criteria for dementia of any type
- scored 10 or above on the Mini Mental State Examination
- had some ability to communicate and understand communication, indicated by scoring either 0 or 1 on the Clifton Assessment Procedures for the Elderly Behaviour Rating Scale items
- could see/hear well enough to participate
- had no major physical illness or disability affecting participation
- lived in the community at baseline and had regular contact with a relative or other informal carer who could act as an informant and could participate in the intervention.

Exclusion criteria

People with dementia not living in the community (i.e. in a care home) and having no available family carer to deliver the sessions and act as an informant.

Participants who met the specified inclusion criteria enrolled in the study only after providing informed consent in accordance with the provisions of the *Mental Capacity Act 2005* [Great Britain. The National Archives. *Mental Capacity Act 2005*. URL: www.legislation.gov.uk/ukpga/2005/9/contents (accessed 14 March 2011)]. Consent was viewed as a continual process, and willingness and capacity to continue participating was continually checked through discussion with participants during the assessments. Ethical approval was obtained through the East London 3 Research Ethics Committee (reference number 10/H0701/71).

Intervention

The intervention consisted of one-to-one, home-based, structured cognitive stimulation sessions for people with dementia, provided by the family carer. Dyads were asked to complete up to three 30-minute sessions per week over 25 weeks. The programme consisted of a total of 75 activity sessions, focusing on different themes, such as being creative, word games and current affairs. Dyads were given resources including a manual, an activity workbook, a carer's diary and a toolkit containing items such as compact discs, dominos and maps. Each dyad worked with an unblinded researcher who provided initial training and ongoing support to carers. Participants in the control group received TAU, which varied within and between centres and changed over time. In general, services offered to this group were also available to those in the treatment group.

Main outcome measures

The primary outcomes were cognition [Alzheimer's Disease Assessment Scale – Cognitive Subscale (ADAS-Cog)] and self-reported quality of life [Quality of Life in Alzheimer's Disease Scale (QoL-AD)] for the person with dementia, and mental and physical health [mental component summary-12 and physical component summary-12 derived from the Short Form questionnaire-12 items (SF-12)] for the family carer. Secondary outcomes for the person with dementia included proxy-rated quality of life, behavioural and psychological symptoms, activities of daily living and self-reported depressive symptoms. Depressive symptoms, anxiety, health-related quality of life ratings [as measured by the European Quality of Life-5 Dimensions (EQ-5D)™], and carer resilience were secondary outcomes for family carers. Perception of relationship quality was also measured for both carers and people with dementia. Units of health and social care service use were measured with an adapted version of the Client Service Receipt Inventory, and their costs established using nationally applicable unit costs. Quality-adjusted life-years (QALYs) were calculated from the European Quality of Life-5 Dimensions-3 level response.

Sample size

The main analysis was based on intention to treat for the primary outcome ADAS-Cog. The trial was initially powered to detect a standardised mean difference (SMD) of 0.35, using a conservative approach and based on previous studies and the Cochrane review. Using a two-group *t*-test with a 0.05 (two-sided) significance level comparing iCST and TAU with 80% power gave a sample size of 260. Assuming 15% attrition, we originally proposed to recruit 306 people with dementia. However, the attrition rate was observed to be closer to 25%; thus, we revised the recruitment target upwards by 50 dyads to accommodate this and so changed the recruitment target to 356 caregiving dyads.

Economic evaluation

The economic evaluation was a cost-effectiveness analysis, conducted first from a health and social care perspective, and then from a societal perspective. The primary outcome measures in the economic evaluation were the ADAS-Cog and QoL-AD for the person with dementia, and the QALY for the carer (derived from the EQ-5D with societal weights). The incremental cost-effectiveness ratio (ICER) for each outcome for the person with dementia, and perspective was calculated as the difference in mean costs between iCST and TAU groups over the period of follow-up, divided by the difference in the mean end point outcome measure between groups. In contrast, for the analysis of QALYs (for the carer), we compared mean QALY over 1 year by carrying the last value carried forward from the final assessment to 12 months post-baseline and we likewise annualised costs by doubling the costs estimated over the full follow-up period. Cost-effectiveness acceptability curves were produced to represent graphically the uncertainty around the point estimate of incremental cost-effectiveness. Seemingly unrelated regressions with bootstrapped standard errors, adjusting for baseline covariates, were estimated to calculate net monetary benefit over a range of willingness-to-pay values for incremental primary outcome measure changes and QALY gains.

Results

The overall attrition rate was 23% at week 26, falling to 21% if deaths are excluded. The intention-to-treat analysis indicated that there were no differences between intervention and control groups on any of the primary outcomes at either the primary or secondary time points [at week 26: cognition mean difference –0.55, 95% confidence interval (CI) –2.00 to 0.90; *p*-value = 0.45; self-reported quality of life mean difference –0.02, 95% CI –1.22 to 0.82; *p*-value = 0.97]. There were no differences between the two groups on carers' mental and physical health (at week 26: mental health mean difference 0.13, 95% CI –1.65 to 1.91; *p*-value = 0.89; physical health mean difference 0.46, 95% CI –1.21 to 2.13; *p*-value = 0.59). The intervention did not improve activities of daily living, depressive symptoms or behavioural and psychological symptoms for people with dementia. People with dementia allocated to iCST reported better relationship quality with their family carer in comparison to those in TAU at the primary end point (week 26: relationship quality mean difference 1.77, 95% CI 0.26 to 3.28; *p*-value = 0.02). There was no impact on carers' mood, resilience or relationship quality with the person with dementia. Carers in the treatment group reported higher health-related quality of life (week 26: health-related quality of life mean difference 0.06, 95% CI 0.02 to 0.10; *p*-value = 0.01) in comparison with those in TAU, at the primary end point.

Compliance analyses were conducted by taking into account the total number of sessions completed. Overall, 22% of participants did not complete any sessions, whereas 51% of dyads completed more than 30 sessions. Adherence analyses indicated that people with dementia completing more sessions showed improved quality in the caregiving relationship at 26 weeks, whereas carers reported lower depressive symptoms at the primary end point.

The intervention costs were approximately £481 per person for paid staff to deliver, or £652 if the costs of carer time were also taken into account. Adjusted mean health and social care costs looked higher, and adjusted societal costs looked lower in the intervention than in the control group (£4740 iCST vs. £4670 TAU and £9770 iCST vs. £10,630 TAU, respectively); however, from either perspective, costs were not significantly different between the groups (£70, 95% CI –£1050 to £1190 greater in the intervention group for health and social care costs only; £860, 95% CI –£2750 to £1040 less in the intervention group for societal costs). Cost-effectiveness analyses from the health and social care perspective yielded an ICER of £300 for achieving a SMD on the ADAS-Cog and £600 for achieving a SMD on the QoL-AD. Incremental cost-effectiveness ratios from the societal cost perspective were negative (where the intervention was dominant, costs were lower and effectiveness greater).

The incremental health and social care cost associated with a QALY gain for carers was £3100. The probability of iCST being cost-effective from the health and social care perspective was 72% at a willingness to pay (WTP) per QALY of £20,000 and 81% at a WTP per QALY of £30,000; the probability of iCST being cost-effective from the societal perspective was 90% at a WTP per QALY of £20,000 and 93% at a WTP per QALY of £30,000. A probability of cost-effectiveness greater than 97.5% was reached at a WTP of £84,200 per QALY (health and social care costs) or £47,300 per QALY (societal costs), and we can be confident that the intervention is cost-effective above these upper limits. The intervention can be considered to be cost-effective in improving unpaid carers' health-related quality of life at a societal WTP well above the NICE threshold of £20,000 to £30,000.

Conclusions

This trial showed that iCST does not improve cognition or quality of life for people with dementia. There was no impact on activities of daily living, behavioural and psychological symptoms, or depression for people with dementia. There was no benefit for carers' mental and physical health. People with dementia participating in iCST perceived the relationship with their carer as more positive compared with those in TAU. Carers' reported levels of utility were significantly higher at the 5% level (on the EQ-5D index); however, physical and mental health scores (on the SF-12) did not differ. The costs of providing the intervention appeared to be offset by some reductions in social care and other services, although the cost difference was not significant at the 5% level. The overall compliance rates were much lower than expected. This trial suggests that in contrast to group approaches, carer-led cognitive stimulation interventions do not improve cognition and quality of life for people with dementia.

Implications for dementia care

The trial provides important information about the use of carer-led cognitive stimulation approaches. Although carers and people with dementia initially expressed interest in taking part, only 65% of the sample allocated to treatment completed more than 10 sessions, with 22% completing no sessions, indicating that for some people with dementia and their carers this type of intervention will not be feasible and that methods for compliance need to be improved. Despite overall negative findings, there was some improvement in terms of the caregiving relationship and carers' health-related quality of life. However, our study suggests that carer-led cognitive stimulation interventions are unlikely to lead to a clinical benefit for cognition and quality of life for people with dementia, limiting the wider implementation of individual approaches.

Recommendations for further research

Future research will be useful in identifying whether or not the mode of intervention provision, such as a group-versus home-based setting, is key to the effectiveness of cognitive stimulation approaches, given the lack of results of benefit in cognition and quality of life for people with dementia. Future studies should investigate factors such as compliance in carer-led cognitive stimulation interventions alongside clinical effectiveness.

Trial registration

This trial is registered as ISRCTN65945963.

Funding

Funding for this study was provided by the Health Technology Assessment programme of the National Institute for Health Research.

Chapter 1 Introduction to the individual Cognitive Stimulation Therapy trial

Background

Cognitive stimulation therapy for dementia

Developing and evaluating psychosocial interventions for people with dementia and their family carers is becoming increasingly important both in the UK and internationally. In fact, recent evidence indicates that psychosocial interventions are useful and may therefore be utilised either as standalone treatments or in addition to pharmacological treatments for dementia. Although a large number of non-pharmacological interventions are available, there is now consistent evidence of at least moderate quality that those interventions incorporating psychosocial[1,2] or psychological approaches[3] can benefit people with dementia.

Given the growing development and application of cognitive-based interventions in dementia care, it has been emphasised that each of the different approaches should be clearly defined, in order to avoid confusion in relation to the various interventions used.[4] For example, cognitive stimulation approaches allow opportunities for general enhancement of cognitive and social functioning through a range of activities, usually in a group setting, that differ from cognitive training and cognitive rehabilitation techniques.[2]

Cognitive stimulation approaches originate from reality orientation (RO),[5] a theoretical tradition postulating that provision of intellectual and social stimulation for people with dementia can positively affect their well-being. Cognitive stimulation interventions are, in fact, those that have been researched most frequently and have been associated with benefits for people with dementia. A recent Cochrane review, for example, has concluded that cognitive stimulation programmes can benefit cognition in people with mild to moderate dementia and may have a potential beneficial effect for self-reported quality of life.[2]

Among cognitive stimulation approaches used, cognitive stimulation therapy (CST)[6] is an evidence-based psychosocial intervention for people with mild to moderate dementia, consisting of structured sessions of stimulating activities delivered in a group setting. Being one of the few manualised approaches and designed to be facilitated by health and social care professionals, the original CST programme was evaluated in a single-blind, multicentre, randomised controlled trial (RCT), which reported benefits in cognition and quality of life for people with dementia living in residential care.[6] CST compares favourably with trials of acetylcholinesterase inhibitors, and economic analysis has demonstrated that CST is cost-effective.[7]

Participation in cognitive stimulation approaches for people with dementia has been recommended by the National Institute for Health and Care Excellence (NICE)[8] and the 2011 World Alzheimer's Report,[9] which concluded that CST interventions are among the few associated with evidence of efficacy in comparison to other psychosocial interventions currently available and should be made available to people with mild to moderate dementia. The recent Cochrane review[2] suggested that, although cognitive stimulation interventions can benefit cognition, further randomised controlled studies are needed to evaluate effects of modality of delivery, such as carer-led, home-based approaches. The Cochrane review also suggested that there is currently minimal evidence in relation to in-depth qualitative studies of these approaches.

Individual cognitive stimulation approaches are likely to increase access to this intervention, specifically for those people with dementia who are unable to participate in groups owing to local service constraints, personal preference, or health or mobility issues. The justification of evaluating individual carer-led programmes stems from promising findings from studies that have applied home-based cognitive

interventions. A carer-led, home-based programme of active training in memory management including cognitive stimulation, orientation and family carer counselling[10] reported long-term benefits for cognition for people with dementia, reduced care home admissions and improved carer well-being. Home-based cognitive stimulation has also been associated with improvements in problem solving and memory, and a reduction in carers' depressive symptoms,[11] whereas the first RCT evaluating a home-based RO/cognitive stimulation intervention demonstrated improvements in cognition for the person with dementia.[12]

Costs of dementia and use of cognitive stimulation interventions

Dementia is a health and social care priority for many countries worldwide. It is currently estimated that population ageing is likely to exert an enormous impact on the dementia epidemic, with rapid increases in the number of people affected in many countries.[13] Over 700,000 older people currently living in the UK have dementia, leading to high costs of treatment, care and support, with the current overall annual cost of dementia exceeding £26B.[14] Given that a high proportion of this overall economic impact is the value of unpaid care and support by family and other carers,[14] it is important to find interventions that make good use of society's limited resources, including the substantial inputs from carers. Cognitive stimulation approaches have been shown to be promising in this regard, being among the few post-diagnostic support interventions demonstrated to be cost-effective.[7] Moreover, given the high proportion of cost carried by unpaid carers, it is important that interventions targeting well-being in people with dementia also accommodate any associated effects on family carers and support them in their caring roles.

Aims and objectives

This report presents data on the development and evaluation of a home-based individual cognitive stimulation therapy (iCST) programme for people with dementia and their family carers. The intervention was evaluated using a pragmatic, single-blind, RCT design comparing the effectiveness of iCST to treatment as usual (TAU). The objectives of the study were the following:

- to develop an individual, home-based programme of CST for people with dementia and their family carers
- to assess the effectiveness of iCST in improving cognition and quality of life for people with dementia, mental and physical health in carers, and other outcomes in conjunction with TAU
- to assess the cost-effectiveness of iCST in comparison with TAU.

Chapter 2 Intervention development

Development of individual cognitive stimulation therapy: overview and framework of development studies

The development of the iCST programme involved three separate components that informed the key characteristics of the intervention and its delivery in the main trial. We followed guidelines of the Medical Research Council[15] for the development and evaluation of complex interventions characterised by multiple interacting components.[16] Following these guidelines, we used the best available evidence on group CST,[2,6] appropriate theories[5,17] and a series of development studies in order to develop the individual CST programme. The key objectives of the development phase were: (1) to ensure that the therapeutic materials were easy to use, clear and appropriately tailored to the needs of people with dementia and their carers; (2) to collect professional expertise data on the development of iCST; and (3) to gather data in relation to feasibility, appropriateness of materials and factors influencing fidelity.[18]

Development study 1: service users' views about the intervention

This component of the development phase involved assessing the appropriateness and acceptability of the intervention, by consulting people with dementia and their family carers using individual interviews and focus groups. During initial consultations of manual development, two family carers and two health and social care professionals were consulted. Carers' and professionals' feedback was sought in relation to the adaptation of group CST approaches[6,19] and the key characteristics of previous individual cognitive-based interventions involving carers.[10,12] These consultations concluded that a carer-led manual should adapt similar layouts to those used in previous literature (i.e. group CST) but overall length should be reduced, academic terms should be simplified and simple instructions should be incorporated. At this stage, carers and professionals also identified the need to emphasise the dyadic nature of the intervention and to ensure that the manual is engaging. Data gathered from these first consultations resulted in the first draft of the iCST manual (and associated workbook). People with dementia and family carers taking part in the individual interviews and focus groups were recruited from local NHS and voluntary organisations in the North East London Foundation Trust. First drafts of the iCST manual and activity workbook were presented to service users for appraisal in a series of 10 individual interviews and six focus groups. Demographic characteristics of the sample taking part in Development study 1 can be seen in *Appendix 1*.

Ten caregiving dyads were recruited to participate in the individual interviews. People with dementia and their carers were interviewed separately, using a discussion guide that was applied to direct the content of the interviews, with each interview typically lasting 30–45 minutes. The interview with the person with dementia started with an appreciation of the concept of mental stimulation and involved completing a sample of iCST activities and collecting feedback about participants' enjoyment and the level of difficulty. A general discussion about perceptions of, and needs for, a home-based programme of mentally stimulating activities followed. The aims of the carer interviews were similar, focusing primarily on collecting data about the quality and appropriateness of iCST, and identifying any practical issues that might affect the delivery of the programme and areas of support for carers.

Six focus groups were conducted with people with dementia and family carers. Thirty-two people participated in the groups, which aimed to identify key characteristics of mentally stimulating activities, to assess the feasibility of a home-based activity programme and to obtain feedback about the quality of materials

presented. Two groups were held with carers, three groups were held with people with dementia and one group was held with both carers and people with dementia. Group discussions were conducted in a semistructured style guided by a series of pre-determined focus points. Details of the discussion points of the individual interviews and focus groups are presented in *Appendix 1*.

All individual interviews and focus groups were transcribed. Inductive thematic analysis techniques were employed in the coding and analysis of data,[20] with meaningful excerpts of text extracted and used for categories emerging (i.e. 'perceived barriers'). Two researchers independently reviewed all excerpts and additionally examined whether or not any could be coded to more than one category, reaching consensus over their category placement. Data from all focus groups were collated, then examined further by source (carers and people with dementia) to identify any variations in views. Individual interview data were also grouped by source and compared with data gathered from the focus groups.

The response to the first draft of the iCST manual and activity workbook was positive overall, with carers commenting that materials were clearly laid out and written in a way that was easy for people with dementia and carers to understand. Recommended changes to the manual included editorial changes to improve the clarity of instructions provided and alterations to the size of text and images. 'Monitoring progress' forms of overall enjoyment of activities underwent significant adjustments at this stage in response to feedback from carers that appraisal sessions should be informal in order to avoid the person with dementia feeling that their performance on the activities is being scrutinised. *Appendix 1* provides a summary of the qualitative results of both the individual interview and focus group data.

Development study 2: expert feedback

The main purpose of Development study 2 was to gather 'expert data' on the suitability of the iCST manual and associated workbook. We used consensus methods guidelines to collect 'expert data' from dementia care professionals.[21] Additional objectives were to address and identify key components of the intervention in order to inform its final development. This study comprised an online survey evaluating the draft of the iCST manual and associated workbook, followed by a consensus conference. Health-care professionals, academics, service users, and private and voluntary sector professionals were invited to participate in an online survey and were asked to provide their opinions on the suitability of the iCST manual and workbook. We also sought input from European experts in dementia care.

Experts evaluated the iCST manual and activity workbook on the following domains: overall quality and layout; language used; font size; amount of information presented; clarity and variety of activities; and level of engagement. Statements were evaluated on a 5-point scale as follows: 'strongly disagree' (1); 'disagree' (2); 'neutral' (3); 'agree' (4); and 'strongly agree' (5). Very high agreement was defined as a median of 5, an interquartile range of 0 and $\geq 80\%$ of participants scoring 4 or 5. High agreement was defined by a median of 5, an interquartile range of ≤ 1 and $\geq 80\%$ scoring a 4 or 5. Moderate agreement was defined by a median value of 4–5, an interquartile range of ≤ 2 and $\geq 60\%$ of participants scoring a 4 or 5.[22] For overall quality a 4-point scale was used: 'poor' (1); 'fair' (2); 'good' (3); 'excellent' (4).

A total of 25 dementia experts took part in the online consensus survey, of which two were family carers (8%), 11 (44%) were working in the NHS or social services, three (12%) were working in the private sector, seven (28%) were academics in dementia care and two (8%) were professionals working in the voluntary sector. Of these experts, 16 (64%) attended the consensus conference and additional workshops. Results of the online survey for the iCST manual and associated workbook appear in *Appendix 2*.

Additional qualitative comments from the online survey data were subjected to a thematic analysis. Analyses of these data emerged in the following key domains:

- Person-centred focus: the activities and key principles of iCST should be more person-centred; there should be an emphasis on positive emotions and pleasurable experiences for both the person with dementia and family carer, and the manual should emphasise the dyadic nature of the intervention.
- iCST activities: for each activity the level of difficulty of the session should be clearly separated and additional activities for people with mobility issues or compromised hearing should be accommodated. It was emphasised that activities should be accessible to all demographics and that all iCST sessions should be 'collaborative', highlighting that people with dementia and carers 'work together'.
- Layout and clarity of intervention: the manual should provide key information about the intervention only; it should incorporate a smaller and more manageable number of key principles and should emphasise that discussion is one of the key purposes of iCST by including open-ended questions.

Consensus workshops

An additional component of Development study 2 was consensus workshops inviting experts to comment on specific components of the development of the intervention, with a total of 16 experts taking part. Themes discussed were: *Getting started with iCST, iCST toolkit of resources, Overview of iCST manual and associated workbook, Support for carers* and *Home-based training in iCST*. A thematic analysis was used to analyse data in each of the four workshops. In the *Getting started with iCST* theme, results indicated that this aspect of the intervention would need to be tailored to individual needs and that carers should be encouraged to identify their own style, with the use of warm-up activities that incorporate person-centred interests. In relation to the *iCST toolkit of resources* theme, experts commented that physical games should be adapted for indoors use and have an increased cognitive component, and that maps of counties will be a useful relevant resource. In the workshop discussing the *Overview of iCST manual and associated workbook* theme, it was discussed that principles of iCST should avoid replication and should be shortened to a more manageable key list.

In the remaining two consensus expert workshops, issues of support for carers and set-up of home-based training for iCST were discussed. Analyses indicated emphasis by experts on the importance of empowering carers by providing extra information and help if requested, encouraging the involvement of other family members and inclusion of a Carers Diary providing easy access and navigation to sessions completed. Experts advised that a digital versatile disc (DVD) could be used for problem solving but that it should not become a barrier for carers adopting their own style.

Development study 3: field testing for final refinement prior to the main trial

The main aim of the third development study was to assess further key elements and components of adaptation of the intervention through field testing. Twenty-six people with dementia and their carers took part in this study. The majority of carers were family members of the person with dementia and were recruited either from the voluntary sector or from memory services in the North East London Foundation Trust. A small proportion of carers taking part were paid carers ($n = 6$), who were recruited from a private home care agency. People with dementia were screened for eligibility using the inclusion criteria of the main trial. Family carers were usually approached about the research study first by dementia care professionals (consultant old age psychiatrist) and then by the research team. A senior member of staff at the home care agency contacted potential carers working with people with mild to moderate dementia. If the dyad consented to participate, a set-up visit was arranged by local researchers. Written consent was provided by both the carer and the person with dementia at the beginning of the set-up visit. Demographic characteristics of the sample can be seen in *Appendix 3*.

For the purposes of the field testing, the 75-session programme was divided into six draft manuals and accompanying workbooks. Manuals 1–5 comprised a total of 60 sessions and manual 6 contained the remaining 15 sessions. Carers were asked to deliver up to 3 sessions per week. Participants were asked to complete a total of 24 sessions on average.

Training and support

Family carers were trained by a member of the research team in their own home. Paid carers were trained as a group, with training sessions lasting 1–1.5 hours. Carers were provided with materials including the iCST manual and associated workbook and additional toolkit items (such as dominoes and playing cards). The first part of the session focused on describing the programme, familiarising carers with the iCST materials and explaining key principles of the intervention. A clip of a DVD developed in the recent maintenance group CST trial[19] was shown in order to demonstrate principles and examples of activities. The second part of the session focused on practising an iCST session with support from the researcher. In all set-up visits, carers were invited to participate in a session with their relative with dementia. At the group training session for paid carers, staff were divided into pairs in order to practise iCST. The guided session aimed to help carers understand the key principles of iCST and how these can be implemented in the delivery of the sessions.

Carers completed a short evaluation questionnaire at the end of the training session rating knowledge and confidence in delivering iCST, alongside information about the anticipated amount of support needed. An evaluation questionnaire was also completed by the researcher in order to assess the success of the carer's training session and to measure additional fidelity-related components. Researchers contacted carers weekly to provide support and to gather feedback about the dyads' experiences with the iCST programme. Carers provided additional feedback about each activity on 'monitoring progress' forms, rating the person with dementia's interest, communication, enjoyment and level of difficulty of each session using a 5-point Likert scale.

Final visit

Debriefing visits were arranged with dyads who completed their allocated sessions. The purpose of the visit was to collect written feedback about the sessions and to interview the dyad about their experience in using iCST. Carers completed a modified version of the training visit evaluation questionnaire, assessing knowledge and confidence in delivering iCST, the quality of support received and their perceived success in engaging with the person with dementia. Similar data were also completed by the researcher at the end of the visit.

Appendix 3 shows number of sessions completed for dyads taking part in the field-testing phase. The average number of sessions completed was 12 out of 24, indicating that most dyads were able to complete approximately half of the sessions, as opposed to 3 sessions per week. For a total of nine dyads, additional information for each of the sessions was collected in the areas of enjoyment, communication and interest by the person with dementia. Information related to the difficulty level for each of the sessions was also collected, as well as fidelity parameters (see *Appendix 3*). Pre–post evaluations of the field-testing phase showed that carers' knowledge of [before: mean = 2.78, standard deviation (SD) = 0.97; after: mean = 3.11, SD = 0.93] and confidence in iCST (before: mean = 3.78, SD = 0.83; after: mean = 4.11, SD = 0.78) increased.

Information from the field-testing phase was incorporated into the main trial, by revising sessions that were rated either low on items of interest, communication and enjoyment for the person with dementia, or rated high in levels of difficulty. Qualitative data were also collected during Development study 3 via standard telephone interviews. Carers delivering iCST were asked to comment on parameters such as barriers to being able to complete the sessions, and on the content of the manual and activity workbook. An overview of these findings appears in *Appendix 3*. The most common barrier in iCST was lack of time and availability for delivering the sessions followed by issues around the health of the person with dementia or the carer. An additional barrier noted by both family and paid carers was experiencing

difficulties in motivating and engaging people with dementia in the sessions. When discussing potential gains, a high percentage of carers mentioned that iCST provided opportunities to spend more time with their relative and assisted in improving the caregiving relationship.

Patient and public involvement

We held initial meetings with two members of the public as part of our public and patient involvement for the iCST study. Both were family carers of people with dementia and were asked to read all previous group CST manuals and comment on their content and suitability for carer use. During the development phase of iCST and the main trial, we invited two additional family carers to be consultants on the project to comment on carer training issues and support around iCST. They both took part in meetings held to provide peer supervision to unblinded researchers supporting carers and people with dementia with iCST. Their feedback emphasised the need for paying attention to the needs of both people with dementia and family carers as well as the importance of focusing on positive aspects of the intervention during carer support.

Chapter 3 Final intervention tested in the main trial

The iCST intervention was developed primarily as a home-based programme of structured iCST for people with dementia to be delivered by carers. Dyads completed up to 3 30-minute sessions per week over 25 weeks. The programme consisted of a total of 75 themed activity sessions, including being creative, number games and art discussion (*Box 1*), which were intended to provide opportunities for general cognitive stimulation via a choice of specific activities. In order to accommodate personal interests, dyads were encouraged to adapt the materials provided and to take a flexible approach in relation to choosing sessions, such as omitting any activities not suited to their interests, or revisiting activities that were particularly enjoyable. Each iCST session followed a consistent structure, where the first few minutes involved engaging in discussions of orientation information prompted by family carers (i.e. day, date, weather, time, location), followed by discussion of current events (i.e. a news story, a community event or family occasion) and the main iCST activity (15–20 minutes).

We used recent guidelines[23] aimed at improving the description of interventions evaluated in RCTs consistent with the Consolidated Standards of Reporting Trials (CONSORT) 2010 and Standard Protocol Items: Recommendations for Interventional Trials statements, which enables replication of the specific intervention tested. An overview of the iCST intervention using the Template for Intervention Description and Replication checklist and guide is presented in *Table 1*.

Contents of individual cognitive stimulation therapy

Dyads were provided with the iCST manual, the iCST activity workbook, two carer diaries and the iCST toolkit. The iCST manual provides guidance on how to run the iCST sessions, the key principles of iCST (*Box 2*) and

BOX 1 Themes of iCST sessions

- My life.
- Current affairs.
- Food.
- Being creative.
- Number games.
- Quizzes.
- Sounds.
- Physical games.
- Categorising objects.
- Household treasures.
- Useful tips.
- Thinking cards.
- Visual clips discussion.
- Art discussion.
- Faces/scenes.
- Word games.
- Slogans.
- Associated words.
- Orientation.
- Childhood.

TABLE 1 Template for Intervention Description and Replication checklist describing the iCST intervention

Item	Description
Name	iCST for people with dementia
Why	iCST is based on theoretical principles of RO and uses the same structure and principles of the group CST approach. Carer-led iCST adapts a person-centred approach, in which the person is engaging in home-based cognitive stimulation activities. iCST activities focus more on opportunities to express opinions and less on discussing factual information, and place an emphasis on the person with dementia and their family carer spending enjoyable time together, using a specific framework of discussion
What	*Materials*
	iCST manual (guidance for carers)
	iCST activity workbook (activities materials)
	iCST carer diary (reporting and evaluating activities)
	iCST toolkit (boules, playing cards, dominoes, magnifying card, sound activity compact discs, coloured pencils, and world and UK map)
	iCST training pack (iCST role-play exercises)
	Procedure
	Carers trained at their home, using a standardised training package aimed at demonstrating key principles of iCST. Additional support provided over the phone and additional home support visits
Provider	iCST was provided by family carers. Carer training and support was provided by the research team of unblinded researchers who were either mental health nurses, clinical psychologists, occupational therapists or research assistants. All unblinded researchers received standardised training in supporting family carers in iCST
How	iCST was delivered by carers. iCST carer training was delivered by unblinded researchers. Unblinded researchers received training in a group. Support on iCST was provided as an additional home visit and over the phone by unblinded researchers
Where	iCST was delivered at the dyad's home
When and how much	iCST consisted of 75 sessions delivered by the family carer for 30 minutes, three times a week, over 25 weeks
Tailoring	Tailoring included additional home visits or telephone support, or provision of additional resources related to the intervention (i.e. books, DVD player)
Modifications	No modifications occurred during the intervention
How well	Planned: intervention compliance was assessed by self-reported questionnaires completed by carers and researchers
	Actual: mean compliance was 31.6 (SD = 26.8) sessions, where 22% completed 0 sessions, 13% completed 1–10 sessions and 51% completed more than 30 sessions

BOX 2 Individual cognitive stimulation therapy key principles

iCST should:

- be 'person-centred'
- offer people with dementia choice in a range of home-based CST activities
- focus on opinions rather than facts
- use reminiscence
- always use a focus such as senses, stimuli or objects
- aim at maximising potential
- recognise that enjoyment and fun are key for both the person with dementia and their family carer
- provide opportunities to stimulate language
- provide opportunities to strengthen the caregiving relationship.

guidance on activities. This manual was disseminated at the ninth UK Dementia Congress and has been published.[24] The iCST activity workbook contains paper-based resources for activities suggested in the manual, such as word puzzles and images to stimulate discussion.

Carer training

Carers were trained in their home by an unblinded researcher. A standardised training package was developed with interactive features, including a role-play exercise and the opportunity to see clips of group CST activities. The first part of the training session introduces the dyad to the iCST materials (manual, activity workbook, toolkit and carer diaries) and explains the session structure and key principles. Carers were encouraged to take part in a role-play exercise with the researcher, developed to demonstrate 'good' and 'bad' practice in iCST. In the final part of iCST training, family carers were invited to deliver their first iCST session with support from the unblinded researcher, who provided feedback afterwards. Where multiple family carers were involved in delivering the programme, the researcher invited them to be trained with the main carer.

Individual cognitive stimulation therapy support for carers

An unblinded researcher provided dyads with telephone support throughout their participation, providing weekly, fortnightly or monthly telephone support depending on carer needs and preference. Additional monitoring visits took place at 12 weeks and 25 weeks, which were aimed at collecting the iCST carer diaries, providing further support if necessary and completing measures of compliance. There were a total of 21 unblinded researchers supporting carers, of whom 81% were qualified professionals working in the local NHS trusts. Among qualified professionals, the majority were nurses ($n = 13$) or clinical psychologists ($n = 3$), with one member of staff being a qualified occupational therapist. The remaining staff were clinical studies officers ($n = 2$) or research assistants ($n = 2$). All unblinded researchers supporting carers received training in iCST.

Individual cognitive stimulation therapy fidelity

To ensure that psychosocial interventions can be replicated, and to ensure that the treatment delivered was indeed the treatment intended (known as 'treatment integrity'),[25] iCST components were described in detail in a treatment protocol. This protocol formed the basis of training of all unblinded researchers supporting and training family carers in delivering iCST. iCST diaries provided a method of tracking compliance to the programme, whereby in each theme, carers were required to record whether or not the session had been completed, the date of completion and their relative's interest, enjoyment and communication. Space was provided for dyads to provide any additional comments related to the sessions. The progress of dyads and compliance to the programme was also measured during support activities via treatment questionnaires during both the telephone support and visits. A telephone support questionnaire was used to gather data on the average number of sessions completed per week, average duration of sessions, average time spent preparing and any difficulties encountered. Carers completed a self-report measure of confidence and knowledge in the delivery of iCST, level of engagement of the person with dementia, use of iCST principles and satisfaction with the support provided in treatment visits.

Chapter 4 Trial phase methods

Design

A multicentre, pragmatic, single-blind, two-treatment arm (iCST vs. TAU), randomised, controlled, clinical trial was conducted over 26 weeks. Participants were randomised to the two groups using a dynamic adaptive randomisation stratified for site and whether or not the person with dementia was taking acetylcholinesterase inhibitors at baseline. Data collection was at baseline, 13 weeks and 26 weeks after completion of the intervention. The primary outcomes were assessed at both time points, with the primary hypothesis examining outcomes at 26 weeks.

Ethics approval

A protocol was submitted for ethical review to the East London 3 Research Ethics Committee (REC) (reference number 10/H0701/71) in January 2010, with provisional approval being granted in July 2010. The following information was identified by the Committee as needing further clarification and amendment:

- Participant Information Sheet to be modified to cover video-recordings and information about the control/usual care group and minor editing changes (i.e. language use)
- consideration of a cross-over or add-on scheme and whether or not participants will be given a copy of a DVD and manual
- provision of additional information about the interviews in both consent and participant forms and further clarification over whether or not recruitment posters and leaflets would be used.

Final approval was granted in September 2010. Participating centres obtained approval from the appropriate local REC and relevant NHS research and development departments.

Intervention and control conditions

Participants randomised to the intervention group received iCST at their own home. The control condition was TAU, with participants in this group receiving no additional intervention. The services and interventions available to people with dementia and family carers randomised to receive TAU varied between and within the iCST centres and may have changed over time. We recorded the use of drugs and services across the two groups and any changes that occurred. In general, services offered to the TAU group were also available to those in the active treatment group condition.

It is very unlikely that any comparable (or even any other) individual cognitive stimulation intervention for the person with dementia would have been available, as these types of therapies are generally unavailable in the UK. We followed standard best-practice methods around pragmatic trials involving an intervention group compared with usual care. Outside the iCST intervention, both groups, in general, would have access to the same kinds of mentally stimulating activities. It is possible that some participants in the TAU group may have engaged in some form of mentally stimulating activities in day-centres; however, this is unlikely to have been as structured as iCST. We asked sites to note instances in which the person with dementia may have been engaged in cognitive stimulation groups by their local services. Those participants who have engaged in such activities during the 3 months prior to recruitment were considered to be ineligible.

Study population

Eight centres in England and Wales were involved in the study: London, Bangor, Hull, Manchester, Norfolk and Suffolk, Dorset, Lincolnshire and Devon (covering Devon North and Devon South), which comprised 12 recruitment sites in total. Researchers in three centres (London, Bangor and Manchester) were based in universities, whereas those in Hull, Norfolk and Suffolk, Dorset, Lincolnshire and Devon were based in NHS mental health services (*Table 2*). Recruitment commenced in April 2012 and was completed in July 2013.

Eligibility criteria

Inclusion

All participants were people with dementia who:

- met the *Diagnostic and Statistical Manual of Mental Disorders*-Fourth Edition criteria for dementia of any type (Alzheimer's, vascular, Lewy body type and mixed)
- scored 10 or above on the Mini Mental State Examination (MMSE)
- had some ability to communicate and understand communication, indicated by a score of 1 or 0 on the relevant items of the Clifton Assessment Procedures for the Elderly – Behaviour Rating Scale
- could see/hear well enough to participate in the programme activities
- had no major physical illness or disability affecting their participation
- lived in the community at baseline, had regular contact with a relative or other unpaid carer who could act as an informant and could participate in the intervention.

Exclusion

People with dementia were excluded if:

- they were not living in the community (i.e. living in a care home)
- they had no available family carer to deliver the sessions and act as an informant.

TABLE 2 Centres in the iCST trial

iCST centre	iCST recruitment site
London	North East London NHS Foundation Trust
	Barnet Enfield and Haringey Mental Health NHS Trust
Bangor	Betsi Cadwaladr University Health Board
Hull	Hull Humber NHS Foundation Trust
Manchester	Manchester Mental Health and Social Care Trust
	Lancashire Care NHS Foundation Trust Site A
	Lancashire Care NHS Foundation Trust Site B
Dorset	Dorset Healthcare University NHS Foundation Trust
Lincolnshire	Lincolnshire Partnership NHS Foundation Trust
Norfolk and Suffolk	Norfolk and Suffolk NHS Foundation Trust
Devon	Devon Partnership NHS Trust
	Northern Devon Healthcare NHS Trust

Sample size

The main analysis was based on intention to treat for the primary outcome of cognition [Alzheimer's Disease Assessment Scale – Cognitive Subscale (ADAS-Cog)]. Our group CST study[6] had an effect size of 0.32. Our Cochrane review of RO[26] found a standardised mean difference (SMD) of 0.58, whereas the individual RO/CST study[12] found a SMD of 0.41. Taking a conservative approach, we estimated the SMD relative to TAU to be 0.35. A sample size of 260 will have to yield 80% power to detect a SMD of 0.35 using a two-group *t*-test with a 0.05 (two-sided) significance level comparing the iCST and the TAU groups. Assuming 15% attrition, we originally proposed to recruit 306 people with dementia. During the course of the trial the observed attrition rate was nearer to 25% than the 15% accounted for in the sample size calculation and, therefore, the target recruitment was revised to account for this. The final recruited sample size was 356.

Recruitment procedures

In each iCST centre, people with dementia and their family carers were recruited through mental health services for older people, such as Memory Clinics and Community Mental Health Teams, through dementia care professionals, including psychiatrists, and through local voluntary sector organisations, such as the Alzheimer's Society (see www.alzheimers.org.uk). The centres in London, Bangor and Manchester were supported by clinical studies officers accessed through the National Institute for Social Care and Health Research Clinical Research Centre in Wales and the Dementias and Neurodegenerative Disease Research Network (DeNDRoN) in England. In Hull and the East Riding of Yorkshire, all patients and carers referred with dementia (and their general practitioners who currently have additional DeNDRoN support to assist with recruitment to dementia trials) were automatically provided with 'opt-in information' on current NHS portfolio studies in dementia care, via a centralised clinical academic unit, The Hull Memory Clinical Resource Centre.

The aim of the project was briefly described to potential participants by members of the research and clinical team, and permission for them to be contacted by local researchers was obtained prior to further contact. Research assistants discussed the project and provided full details to participants, answered any questions related to the project and, if participants agreed, undertook informed consent.

Informed consent

Participants enrolled to the study only after providing informed consent in line with guidelines set by the *Mental Capacity Act 2005*.[27] Participants were in the mild to moderate stages of dementia and were therefore expected to be competent to give informed consent for participation, provided that appropriate care was taken in explaining the research and sufficient time was allowed for them to reach a decision. It was helpful for a family member to be involved, and we aimed to ensure that this was done wherever possible. Both people with dementia and family carers were informed that no disadvantage would accrue if they chose not to participate, and all participants were provided with at least 24 hours to review information about the study prior to making a decision. In seeking consent, we followed current guidance from the British Psychological Society[28] on the evaluation of capacity. In this context, consent is regarded as a continual process rather than a one-off decision, and willingness to continue participating was continually checked through discussion with participants during the assessments. If, at any point, the person with dementia or family carer became uncomfortable with the assessments, these were discontinued.

Ethical arrangements

The study was approved through the appropriate REC. All researchers received training in Good Clinical Practice guidelines.[29] There appear to be no documented harmful side effects from participating in CST interventions or other types of cognitive-based interventions. Regular monitoring by, and support from, the key local unblinded researchers in each centre was undertaken during the intervention to ensure that people with dementia participating in the iCST sessions did not feel deskilled or undervalued.

Prospective participants were fully informed of the potential risks and benefits of the project. A reporting procedure was put in place to ensure that serious adverse events (SAEs) were reported to the Chief Investigator (see *Appendix 8*). On becoming aware of an adverse event involving people with dementia or their carers, a member of the research team assessed whether or not it was 'serious'. A SAE was defined as any untoward occurrence experienced by either a person with dementia or carer that:

- resulted in death
- was life-threatening
- required hospitalisation or prolongation of existing hospitalisation
- resulted in persistent or significant disability or incapacity
- was otherwise considered medically significant by the investigator
- came within the scope of the Protection of Vulnerable Adults protocol,[30] which was in place to ensure that suspected cases of abuse or neglect were followed up in an appropriate manner.

A reporting form was submitted to the Chief Investigator who assessed whether or not the SAE reported was:

- related to the conduct of the trial
- unexpected.

Serious adverse events that were judged to be related and unexpected were to be reported to the REC and the trial Data Monitoring and Ethics Committee (DMEC) within 15 days of occurrence.

Randomisation

Remote randomisation of participant allocation treatment was undertaken via a web-based randomisation service managed by the North Wales Organisation for Randomised Trials in Health (NWORTH) clinical trials unit, after baseline assessment and informed consent. Randomisation was completed using a dynamic adapative allocation method,[31] with an overall allocation ratio of 1 : 1. Random allocation was stratified by site and receipt of acetylcholinesterase inhibitors (AChEIs). For each participant randomised, the likelihood of their allocation to each treatment group is recalculated based on the participants already recruited and allocated. This recalculation is done at the overall allocation level, within stratification variables and within stratum level (the relevant combination of stratification levels). By undertaking this recalculation, the algorithm ensures that balance is maintained within acceptable limits of the assigned allocation ratio while maintaining unpredictability.

Allocation concealment

The randomisation database was held at NWORTH, and the analysts involved in the trial did not have access to the database. The dynamic adaptive algorithm is tuned using weighting parameters. These parameters are chosen by simulation modelling to ensure that the balance is maintained at an acceptable level, while ensuring that the sequence of allocations does not become predictable. Strong parameters would make the randomisation algorithm behave in a deterministic way, thus making allocation concealment difficult. Unblinded researchers were the only staff who were informed at each of the iCST centres of participants' allocation.

Implementation

A web-based randomisation system was set up at NWORTH. Unblinded researchers could log into the system, enter participants' details and receive randomisation results on screen and by confirmation e-mail. The system ensured that each entry had a unique trial identification number.

Blinding

As with all psychosocial interventions, participants cannot be blind to the allocation they receive. Within each iCST centre, there were nominated blinded and unblinded researchers; both were able to conduct baseline assessments and request randomisation. However, once participants were randomised, follow-up data were collected by the team of blinded researchers only, whereas the training and carer support in delivering iCST was run by unblinded researchers. Given that participants may occasionally and inadvertently inform researchers of the treatment they are receiving, we aimed to reduce this bias by use of self-report measures wherever feasible and brief reminders to participants. We asked all blinded researchers to record their impression of the group to which each participant was allocated and their confidence in that prediction. Statisticians remained blind to allocation for the main analysis, whereas compliance analysis incorporating compliance to the intervention was conducted after the main analyses only.

Data collection

Primary and secondary measures were completed at baseline, 13 weeks after baseline (week 13) and 26 weeks after baseline (week 26). Researchers were instructed to conduct all week-13 assessments within the 13-week period, but no later than 2 months from the scheduled first follow-up appointment (starting at date of baseline assessment), and to conduct all week-26 assessments by 26 weeks, but no later than 2 months from the scheduled second follow-up (starting at date of baseline assessment).

Most interviews were conducted in dyads' homes. All questionnaire instruments were arranged in the form of booklets, with additional show cards of responses supporting the person with dementia during the assessment. If, at any point, the person with dementia felt uncomfortable with the assessment this was discontinued and was only rescheduled to take place during a second visit where appropriate.

Measures

Primary outcome measures for person with dementia

(a) Cognition for the person with dementia, assessed by ADAS-Cog,[32] measuring the severity of the most important cognitive symptoms of Alzheimer's disease (AD). ADAS-Cog is the most popular cognitive testing instrument used in clinical trials of drug treatments for dementia consisting of 11 tasks assessing disturbances of memory, language, praxis, attention and other cognitive abilities, often referred to as the core symptoms of AD. This widely used test has good reliability and validity,[33] and is scored from 0 to 70, with higher scores indicative of greater cognitive impairment.
(b) Quality of life of the person with dementia, measured using the Quality of Life in Alzheimer's Disease Scale (QoL-AD).[34] QoL-AD is a widely used, brief, self-report questionnaire, covering 13 domains of quality of life. The QoL-AD has good validity and reliability.[35] Both self and carer ratings were collected, in which higher scores indicate better quality of life.

Secondary outcome measures

(a) Quality of life, assessed using the Dementia Quality of Life (DEMQOL) measure,[36] covering five domains of quality of life, including daily activities, health and well-being, cognitive functioning, social relationships and self-concept. The scale uses self-rated reports of quality of life administered to the person with dementia. The measure was also administered to the family carer in order to collect DEMQOL-proxy ratings.
(b) Neuropsychiatric symptoms, measured by the Neuropsychiatric Inventory.[37] The Neuropsychiatric Inventory assesses 10 behavioural disturbances occurring in people with dementia, using a screening strategy to minimise administration time by examining and scoring only those behavioural domains with positive responses to screening questions. Both frequency and severity of each behaviour are determined, with both validity and reliability for the measure established.[37]
(c) Functional ability for the person with dementia, measured by the Bristol Activities of Daily Living Scale (BADLS),[38] a carer-rated instrument consisting of 20 daily-living abilities. The BADLS shows sensitivity to change in people with AD receiving anticholinesterase medication and significantly correlates with changes in the MMSE and the ADAS-Cog.[39]
(d) Depression, measured using the Geriatric Depression Scale (GDS)-15,[40] one of the most commonly used self-rating depression scales in geriatric populations. The shorter version of the scale comprises easy-to-use items, designed to exclude somatic symptoms of depression that are also seen in non-depressed elderly people. The GDS-15 has acceptable sensitivity and specificity when used with people with mild to moderate dementia.[41]
(e) Quality of the relationship, measured by the Quality of Caregiver–Patient Relationship (QCPR),[42] applicable to both spousal and adult child carers, completed by both the person with dementia and family carer. The QCPR has good internal consistency and concurrent validity with other measures of relationship quality and carer distress.[42]
(f) Use of health and social care services provided by public or non-public bodies, as measured on the Client Service Receipt Inventory (CSRI),[43] adapted for use in this study. The CSRI was used to collect information on the identified carer's costs and the participant's use of health and social care services. Additional data collected included medications for mental health, the carer's provision of unpaid care and employment status, and out-of-pocket costs to both participant and carer (travel expenses to health and social care appointments, payment for equipment and adaptations).

Primary outcome measures for carers

(a) Mental and physical health, measured by the Short Form questionnaire-12 items (SF-12).[44] The SF-12 measures health by scoring standardised responses, which are expressed in terms of two meta-scores: the physical component summary (PCS) and the mental component summary (MCS).

Secondary outcome measures

(a) Depression, measured by the Hospital Anxiety and Depression Scale (HADS),[45] a self-completed measure, generating scores for generalised anxiety and depression, used widely to identify caseness for clinically significant depression and anxiety.[46]
(b) Health-related quality of life, measured using the three-level response version of the European Quality of Life-5 Dimensions (EQ-5D™) (hereafter EQ-5D-3L),[47] a standardised instrument for use as a measure of health outcome. Applicable to a wide range of health conditions, the EQ-5D-3L provides a simple descriptive profile and a single index value for health status.
(c) Resilience, measured by the Resilience Scale-14 items,[48] in which responses are summed and higher scores indicate stronger resilience. The measure demonstrates high construct validity.[49]

Data checking

A full data-management plan was written, encompassing data storage and processing, data filing, data sharing, data freezing and data archiving. Data were collected in questionnaire packs and entered into a data-management system (MACRO version 4.1.2.3750, InferMed, London), which was audited for data entry accuracy, before being exported to Statistical Package for the Social Sciences (SPSS) files. SPSS Predicative Analytics SoftWare version 20 (IBM Corporation, Armonk, NY, USA) was used for all further data manipulations and analysis. In all SPSS files, cleaning processes were undertaken, including checks for consistency and out-of-range data. If applicable, questionnaire data were cross-checked with the SPSS data to explore any issues of inconsistency. CSRI data were cleaned and analysed in Stata 13 (StataCorp LP, College Station, TX, USA), again checking for consistency. Adherence data were entered by unblinded researchers into the MACRO system and used in both outcomes and economic analyses.

Data analysis

Missing data for clinical effectiveness

Data were not imputed for participants who did not provide any information at a particular time point. However, standard statistical tests were employed to ensure that there were no significant differences in demographics or baseline outcome scores between those who completed at a time point and those who did not. There were two types of missing data: missing items within measures and missing measures at time points.

Missing items within measures: pro-rating

For items missing within measures, the rules for completing missing data for the relevant measure were applied. The missing data rules implemented for each measure are considered to be part of the validated tool and were therefore used as designed in line with the original validation.

Pro-rating within participant measures were undertaken at the 20% missing level (i.e. if there was one item missing for a 5-item score, this was completed with the mean of the other items).

Missing measures at time points: regression model using multiple imputation

A regression within the treatment group was applied to impute total scores in line with the trend seen in the group, as multiple imputations, allowing an assessment of the sensitivity of the data. The multiple imputation model included demographic variables such as sex, age, ethnicity, type of relationship and site. It also included the completed scores for the other outcome measures at each time point. At both follow-up time points, the model included the allocated treatment group. Scores at baseline were used to predict scores at week 13. Scores at baseline and week 13 were used to predict scores at week 26.

Baseline characteristics

No statistical tests were conducted for significant differences in baseline characteristics between the two treatment arms.[50]

Interim analyses

No interim analyses were planned for the data. No additional analyses were requested or identified by the DMEC.

Primary effectiveness analyses

We used an analysis of covariance (ANCOVA) model to assess the differences between the two groups in the ADAS-Cog and the QoL-AD as the primary outcome measures for people with dementia. The dependent variable in the model was the outcome at week 26, with covariates being the baseline measurement, age of participants with dementia and relationship with the carer. The fitted fixed factors considered were sex, marital status and receipt of acetylcholinesterase inhibitors. Site was added as a random factor. Both stratification variables were included in the model (site and acetylcholinesterase inhibitors).

A similar ANCOVA model was fitted for the carer primary outcome. The dependent variable in the model was the outcome at week 26, with the covariates being the baseline measurement, age of carer and relationship with the person with dementia. The fitted fixed factors considered were sex and marital status. Site was fitted as a random factor.

Secondary effectiveness analyses

The ANCOVA model described above was used to assess the differences between the two groups on all secondary outcomes for people with dementia. A similar ANCOVA model was fitted for all carer secondary outcomes.

Additional analyses

A basic adherence analysis was undertaken. The number of iCST sessions completed was held as a continuous variable and added to the model of the main analysis. This would allow an insight into whether or not the number of sessions completed was important to the outcome.

Economic analyses

The economic evaluation was a cost-effectiveness analysis, conducted first from a health and social care perspective and, second, from a societal perspective. The primary outcome measures for the person with dementia were the incremental cost of achieving:

(a) one SMD (taken to be 2.4 points on the scale) in the ADAS-Cog
(b) one SMD (taken to be 1.7 points on the scale) in the QoL-AD.

The primary outcome measure for the carer was the incremental cost per quality-adjusted life-year (QALY) (derived using the EQ-5D-3L with societal weights).

In the analysis plan, the secondary economic measures for the person with dementia were set out as: QALYs derived from the DEMQOL-U and DEMQOL-Proxy-U, the MMSE, BADLS, GDS-15 and QCPR. Secondary economic measures for the carer were the HADS, MCS-12, PCS-12 and QCPR.

Valuation strategy for outcomes

Carers' utility scores were calculated from the EQ-5D-3L, applying published societal weights.[51]
We also derived utility scores for people with dementia based on self-ratings and carer proxy-ratings (the DEMQOL-U and DEMQOL-Proxy-U indexes, respectively) from the DEMQOL and DEMQOL-Proxy instruments, using published societal weights.[52] All QALYs were calculated using the area-under-the-curve method with linear interpolation between the three assessment points and the last value carried forward from the final assessment to 12 months post-baseline.

The ADAS-Cog scores were reversed so that an increased score can be interpreted as a positive change for the purposes of deriving net benefit in order to plot cost-effectiveness acceptability curves (CEACs). For the QCPR, an estimate of the points equivalent of the SMD was obtained by taking the baseline SD for the QCPR and multiplying by the effect size[53] of 0.35 set for the study. This gave a difference of 3.1.

Costs

Perspective

Costs from the health and social care perspective covered services used by the person with dementia, including care/nursing home care, hospital care (inpatient, day, outpatient and accident and emergency services), primary and community health and social care. Costs from a societal perspective covered the aforesaid services, plus the costs of care and support provided by unpaid carers.

Time horizon

The economic analysis used the mean end point (week 26) outcome measure (as the primary outcome for people with dementia and secondary outcomes) and costs over the 26-week period. In the case of the ICER for the primary outcome for caregivers (cost per QALY), we calculated QALYs over the year from the baseline assessment; we likewise assumed that mean costs remained unchanged since the end of the intervention period and calculated annual equivalent costs by doubling the costs estimated for the 26-week period.

Cost data collections

Costs were calculated based on several collections:

1. data on services used by the person with dementia, as observed and reported by carers using the CSRI.[43] Service use items were collected and aggregated into cost categories
2. data on time spent by professionals (unblinded researchers) in supporting carers to deliver the training package, using one of a suite of 'treatment adherence' forms
3. data on professionals' labour costs, using a pro-forma distributed to the unblinded researchers
4. data on time spent by carers to deliver the training package:

    i. average time spent in preparing and in delivering the session: these data were collected by unblinded researchers during their telephone contacts, using one of a suite of 'treatment adherence' forms
    ii. number of sessions completed: this information was collected from carers who were asked to complete a workbook feedback form after every session. A manual count of sessions completed was conducted by unblinded researchers at each follow-up monitoring visit (one per follow-up period)

5. data on carer time spent on care and support activities, and lost employment and out-of-pocket costs, using the CSRI
6. costs of training materials (excluding costs of the initial development and testing of the package), supplied by the project management team.

Unit costs/valuation of health and social services and unpaid care

Unit costs were applied to units of resources in the estimation of per-participant costs. The base year for unit costs was 2012–13. Unit costs employed are summarised in *Table 3* (unit costs and sources are given in further detail in *Appendix 4*). Costs of health and social care were calculated from service-use data by applying relevant, nationally generalisable unit costs [e.g. NHS reference costs[54] and the Personal Social Services Research Unit (PSSRU) costs compendium[55]]. Costs of carers' inputs were calculated using two methods: replacement costs and opportunity costs.[56–58] The primary analysis used opportunity costs, attaching a value equal to the national minimum wage to each hour of unpaid carer time spent on care and the cost of lost production; a replacement costs approach was employed in the sensitivity analyses (valuing time spent on care at the unit cost of a home care worker) (see *Table 3*). Certain out-of-pocket payments were also considered to be a cost to the dyad rather than to health and social care: the travel costs of accompanying the person with dementia to dementia-related appointments by car, public transport or taxi, and the private purchasing of equipment and adaptations.

TABLE 3 Unit costs summary

Service use item	Unit cost (£), 2012–13
Inpatient bed-day, per specialty (range)	344–1495
Inpatient bed-day, weighted average across adult specialties	577
Day attendances, per specialty (range)	540–817
Day case, weighted average across specialties	693
Outpatient attendances (range)	27–468
A&E attendances, admitted and non-admitted (range)	115–160
Outpatient, weighted average of follow-up attendances across adult specialties	98
Primary, community and community mental health services, per contact (range)	36–115
Primary and community health services, per minute (range)	0.5–3.6
Residential care, per day (range)	76–143
Nursing home care, per day	107
Community-based social care, per minute (range)	0.4–2.7
Day services, per session/day (range)	5–38
Medications, standard quantity units (range)	0.1–6.0
Equipment and adaptations, cost over 3 months (range)	0.1–104.0
Carer hour, valued at replacement cost: home care worker, per hour	19
Carer hour, valued at opportunity cost: minimum wage, per hour	6

A&E, accident and emergency.

Valuation strategy for intervention costs

The iCST intervention was produced from both professional and carer inputs. Unblinded researchers from the nursing and psychology disciplines worked to set up and train carers to deliver the sessions and then provided ongoing face-to-face and telephone support to carers throughout the study period.

In order to value the costs of professional time taken to deliver the intervention, we collated information on each researcher's Agenda for Change band,[59] on costs and full-time equivalents on the project. We estimated workers' indirect and direct overheads using PSSRU unit costing methods;[56] in estimating capital costs we assumed that workers were based in premises with a shared treatment space. A weighted hourly cost of professional support was then calculated based on the full-time equivalent contribution per Agenda for Change band. In addition, we calculated site-level average travel costs per visit, including professionals' travel time and costs of mileage (unblinded researchers were asked to estimate their average travel time and miles driven in visiting participants on their iCST case load in each site). The costs of iCST training, including professional time and travel expenses and venue costs, were provided by the University College London project team. The project team also provided an estimate of the cost of the iCST training manual and materials (excluding the costs of developing the manual). We calculated an average training cost per participant and the average cost of manual materials per participant. The unit costs of professional support time and travel, training and materials costs of the intervention are summarised in *Table 4*. These unit costs were used to calculate a total cost of the package of materials and professional support in the cost-effectiveness analysis. We attached the weighted hourly cost of professional time to the reported telephone and face-to-face contact time for each participant, and a site average cost of mileage and travel time to reported face-to-face visits. We spread the per-participant manual and training costs, and the costs of professionals' time spent in providing the set-up visit, across the two follow-up periods, allocating half the cost to each period.

TABLE 4 Individual cognitive stimulation therapy intervention unit costs: summary of components of professional support to carer

Costs of professional support (intervention)	Unit cost (£), 2012–13
Total iCST training costs	17,288
Per participant (total divided by 180 intervention participants)	96
iCST manual and materials, per participant	94
Professional time, per hour	49
Mileage costs per one-way journey (per site) (range)	4–32

Carers provided data on the number of iCST sessions completed over each follow-up period (see also *Cost data collections*); they were asked by the unblinded researchers to estimate the time spent in preparing for and delivering the sessions during scheduled telephone support calls. The average time spent in preparing and delivering sessions in each follow-up period was calculated and this estimate was used in turn to calculate the total hours spent in these activities in each period. This time was valued at the national minimum wage in the primary analysis and at the unit cost of a home care worker in the sensitivity analysis.

Missing data for cost-effectiveness

For missing service-use data (collected from the CSRI), the following rules were applied: when service use was indicated but frequency was missing, a suitable nationally applicable unit cost was used if available (e.g. cost per visit). If no suitable unit cost was available, the cost was calculated as follows: (1) establish the mean duration of use of those with frequency information; (2) assign that mean value to cases with missing duration data; (3) estimate the average cost by multiplying frequency by duration by unit cost and estimate the mean cost of those where any use of the service has been indicated; (4) assign the mean cost to cases where both frequency and duration of use information are missing. For each case, items in each cost category (see *Trial results*) were summed to give a total cost per category. Category-level costs were summed to give a total overall cost per case. If all costs in the category were missing, the category total (per case) was also calculated as missing; if some items were missing, these were treated as zeros and the case was assigned the cost of the sum of available costs in the category. Missing outcomes and costs data were multiply imputed separately for the person with dementia and the carer. We used the *MI impute chained* command in Stata 13[60] to build a regression model, including demographic variables (site, whether or not acetylcholinesterase inhibitors were being taken, sex, relationship with the other member of the dyad, ethnicity, who the carer/person lived with, level of education), treatment allocation, cost categories and scale-level non-missing primary and secondary outcome measure variables as predictors. For the adherence data entered by unblinded researchers, the same procedure was followed; professional support costs were imputed within the model for imputing carers' costs. The cost of carers' time in delivering the intervention was imputed in cases where unblinded researchers had not recorded the time taken to prepare and deliver sessions within the adherence forms (so that the cost of the session time could not be estimated). Again, these costs were imputed within the model for imputing carers' costs. The multiple imputation procedure was used to generate five complete data sets, to be combined according to Rubin's rules.[60,61] Service use and intervention contact counts were not multiply imputed, only the costs. If the CSRI had not been completed (e.g. no questions or just one or two initial questions had been answered), these cases were considered wholly missing and were not included in the cost-effectiveness analyses.

Cost-effectiveness analyses

The iCST intervention was to be defined as cost-effective compared with TAU if it was:

1. less costly and more effective
2. more costly and more effective, and society is willing to pay the additional cost in order to achieve the gain in outcome
3. less costly and less effective, and society is willing to sacrifice some of the outcome difference in order to make a saving.

The iCST intervention was to be defined as not cost-effective if it was both significantly more costly and less effective compared with TAU.

The criteria for this decision was based on the following rule:

$$\Delta C/\Delta E < \lambda, \quad (1)$$

where ΔC represents the additional cost, ΔE represents the gain in outcome associated with the treatment and λ represents the willingness to pay (WTP) for that outcome gain.[62] The incremental cost-effectiveness ratio (ICER) ($\Delta C : \Delta E$) must be below λ to be considered cost-effective.

The ICER was defined as the difference in the mean costs of the iCST and TAU groups over the period of follow-up, divided by the difference in the mean end point outcome measure (primary outcome for people with dementia and secondary outcomes) between groups. In the case of the ratio of incremental costs and QALY, the denominator was the difference in the mean QALY over the year from the baseline assessment. The numerator was the difference between annualised costs, calculated by doubling the costs estimated over the full follow-up period. The decision rule can be rearranged to be expressed in terms of the net monetary benefit as $\lambda \times \Delta E - \Delta C > 0$,[62] the monetary value of gains in outcome associated with the treatment at a given WTP, net of the additional cost of the treatment.[62] CEACs were produced to represent graphically the uncertainty around the point estimate of the ICER.

Health economic modelling methods

Incremental costs and outcomes and their ratio ($\Delta C : \Delta E$) were estimated by seemingly unrelated regressions (SURs), with bootstrapped standard errors (SEs). This system of equations was used to obtain the cost/outcome difference between groups by estimating the coefficients on the intervention term in each (cost/outcome) equation. The SUR approach is useful for obtaining an estimator for the ICER and for net benefit for a given WTP, while also allowing for adjustment for a set of baseline covariates (which can differ between cost and outcome equations).[63] The analyses were performed on 300 bootstrapped replications from each complete data set (generated by the multiple imputation process), using the Stata command *gsem*, and the results combined. The estimates of costs and outcomes for the person with dementia were adjusted for the covariates: site, whether or not the person with dementia was taking AChEIs, who the person lived with, and baseline costs (cost equation only) or baseline outcome (outcome equation only). The estimates of costs and outcomes for the carer were adjusted for the covariates: site, whether or not the person with dementia was taking AChEIs, baseline costs and who the person with dementia lived with (cost equation only), who the carer lived with, carer sex, carer age (outcome equation only) and baseline outcome (outcome equation only). This approach was used to calculate the net monetary benefit over a range of WTP values for incremental benefits (SMDs in the primary and secondary outcome measures, QALY gains), including the £20,000–30,000 NICE threshold range.[64]

Summary of changes to the protocol

Approval was obtained from the REC for one substantial amendment to the protocol during the trial. This was related to the inclusion of additional questionnaires for both the person with dementia and their family carer. There was one non-substantial amendment notified to the study's sponsor (University College London) representative, which was related to minor changes to the study protocol and inclusion of new sites and investigators. There was one protocol violation (this is described in detail in *Appendix 9*).

Chapter 5 Trial results

Figure 1 presents the details of the flow of participants through the trial. In total, 1340 people were considered for recruitment to the study. From these, 356 were randomised and together constituted the final sample for the study. The most common reason for loss between referral and randomisation was participants not wishing to take part in the study. Losses in 22% of cases were attributable to people with dementia not meeting the clinical criteria, indicating that this factor was, to some extent, a barrier to study recruitment (*Table 5*). *Table 6* shows sources of referrals to the project, of which 45% came from Memory Clinics. Conversion of referrals to randomisation for each of the centres can be seen in *Table 7*. Variation between centres may be attributable to, in part, differences in recruitment methods (e.g. note screening vs. personal invitation by clinician).

Randomised allocation

The 356 dyads gave informed consent to the study and were randomised after completion of the baseline assessment between April 2012 and July 2013. A total of 180 dyads were randomised to iCST and 176 to TAU. *Table 7* provides rates of randomisation for each of the iCST centres.

Follow-up retention rates

Retention rates at week 13

Between randomisation and week 13 there were a total of 68 losses (*Table 8*), of which four were deaths. Sixteen of the dyads were not available to complete the week-13 assessment but indicated availability to complete the week-26 assessment. There were no differential rates of retention between sites at week 13 [$\chi^2 = 11.9$; degrees of freedom $= 11$; p-value $= 0.37$].

Retention rates at week 26

At week 26 (see *Table 8*), a further 31 dyads were lost to follow-up, which included a further four deaths, equating to a total of 83 losses (including eight deaths) and a retention rate of approximately 77%, which was the predicted rate used in the updated sample size calculations. There were no differential retention rates between sites at week 26 ($\chi^2 = 12.5$; degrees of freedom $= 11$; p-value $= 0.33$). In terms of losses to follow-up from the study (i.e. excluding deaths), the attrition rate was 21%.

Retention rates by allocated group

Table 8 indicates that there was a total of 83 losses to follow-up. There were 46 (25%) losses in the intervention group and 37 (21%) in the TAU group. Analyses comparing the baseline characteristics of those who dropped out in the intervention group versus those in the TAU group did not indicate any significant differences. Baseline characteristics for the test included sex, ethnicity, marital status, relationship with the person with dementia, living with the person with dementia or not, living with other, living alone, highest level of education and age.

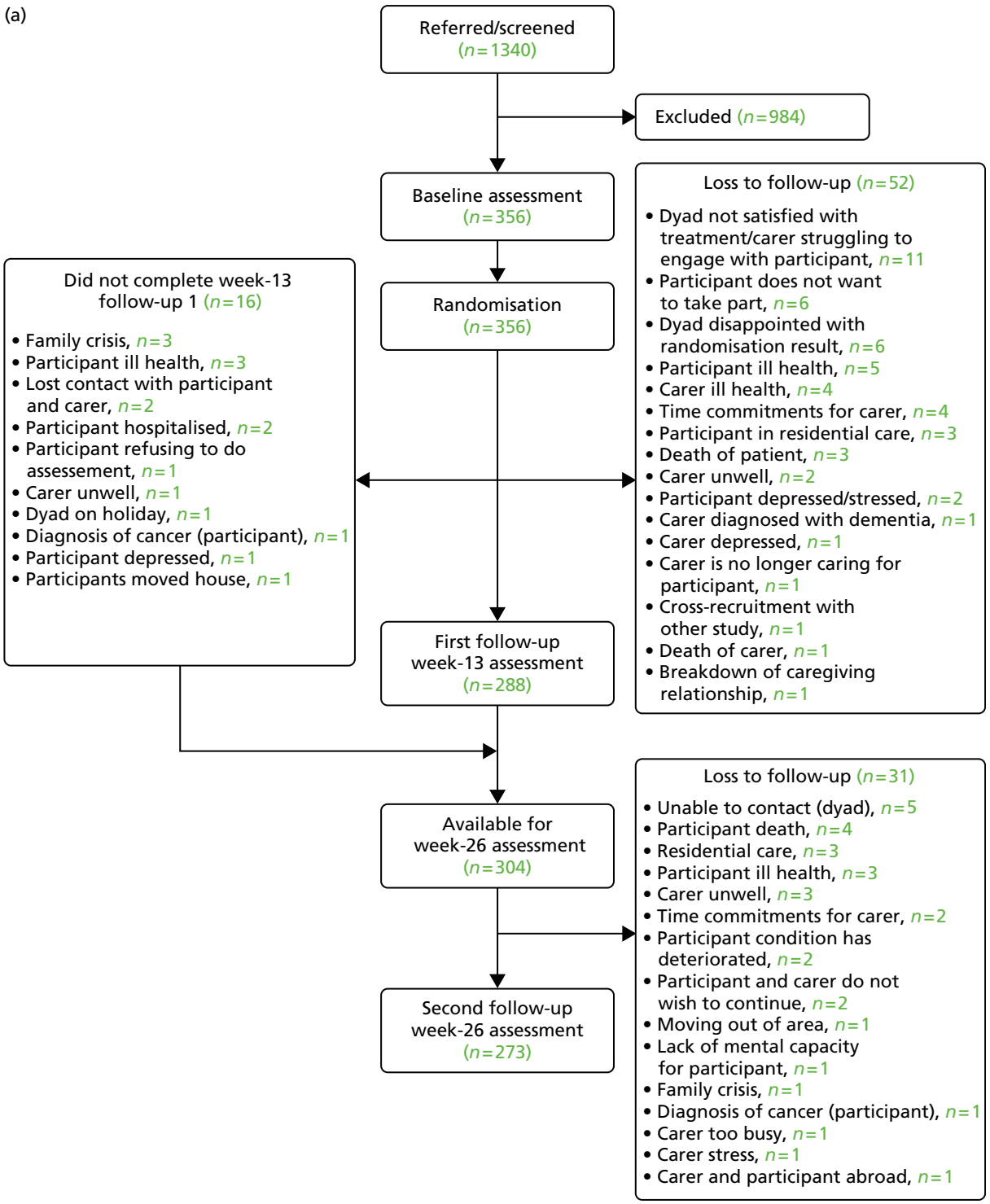

FIGURE 1 (a) Participant flow through trial; and (b) participant flow through trial indicating treatment allocation. DNC, did not complete. (*continued*)

(b)

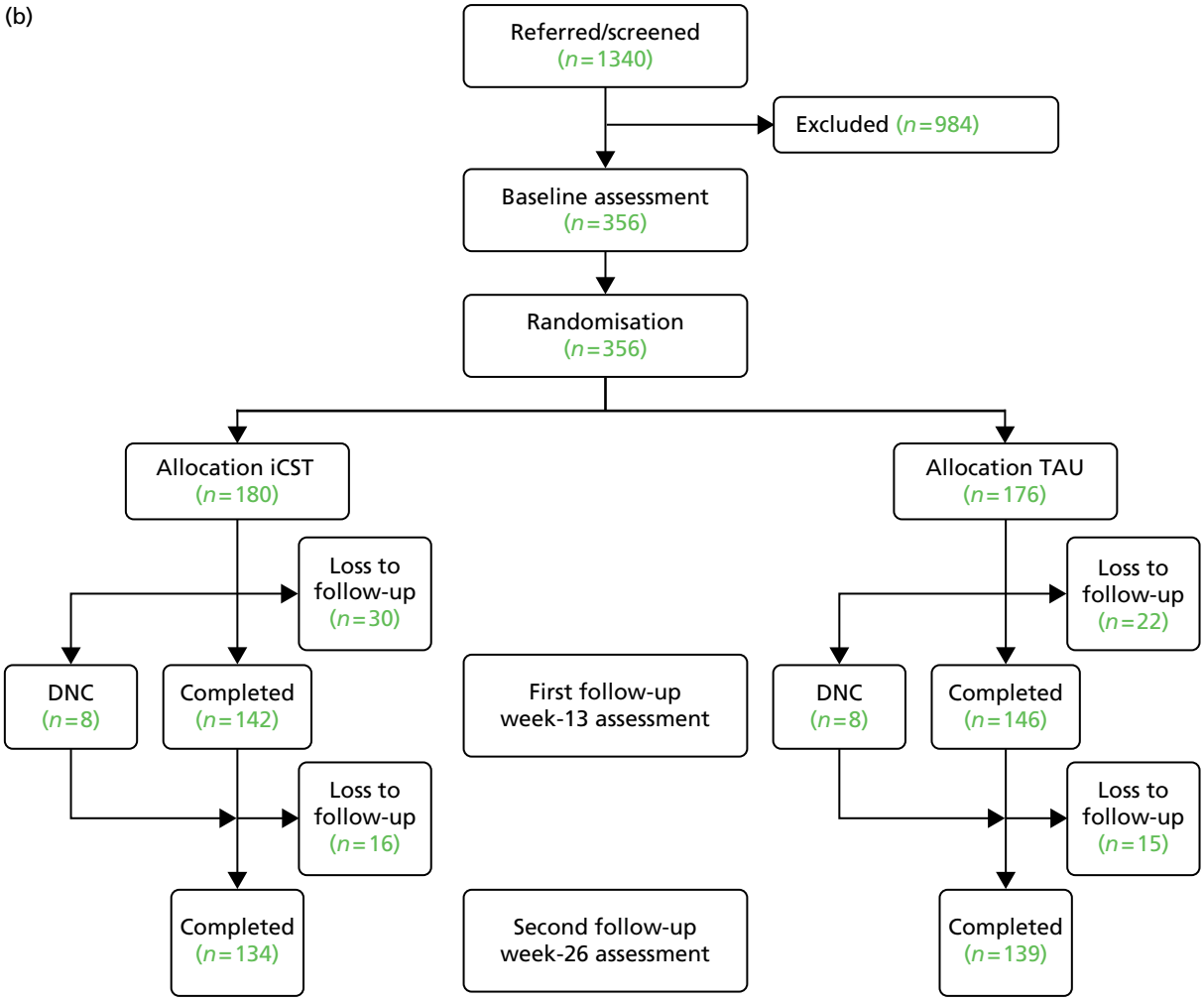

FIGURE 1 (a) Participant flow through trial; and (b) participant flow through trial indicating treatment allocation. DNC, did not complete.

TABLE 5 Losses between referrals and randomisation

Reason	Total, *n* (%)
Does not wish to take part	320 (24)
iCST exclusion criteria apply	295 (22)
Dyad has not responded	215 (16)
Could not make contact/reason not known	53 (4)
Not available owing to holiday/family/work commitments	33 (2)
Health problems for dyad	21 (2)
Subtotals	**937 (70)**
Other	
Prefers group activities/does activities at home/considers intervention not suitable	18 (1)
Already participating in similar study	16 (1)
Distressed during interview	4 (< 1)
Family not discussing diagnosis	3 (< 1)
Moved out the area	3 (< 1)
Person with dementia has died	3 (< 1)
Subtotals	**47 (3)**
Total lost between referral/screening and randomisation	984 (73)
Total number randomised	356 (27)
Total referred or screened	1340

TABLE 6 Sources of referrals

Source	Total, *n* (%)
Memory Clinic	602 (45)
Consultant psychiatrist referral	315 (23)
CMHT	119 (9)
DeNDRoN clinical studies officer	67 (5)
Consultant psychologist referral	57 (4)
Alzheimer's Society	52 (4)
Primary care dementia practitioner	41 (3)
Previous studies	25 (2)
Local Voluntary Organisation	20 (1)
Carers Support Services/Association	19 (1)
Age Concern	10 (< 1)
Newspaper article/media release	7 (< 1)
Local day centre	4 (< 1)
Admiral nurse	2 (< 1)
Total	**1340**

CMHT, Community Mental Health Team.

TABLE 7 Breakdown of referrals and randomisations by centre

Centre	Total referrals, *n*	Total randomisations, *n* (%)
London	255	127 (50)
Bangor	296	35 (12)
Hull	111	45 (40)
Manchester	482	53 (11)
Dorset	29	20 (69)
Lincolnshire	36	20 (55)
Norfolk and Suffolk	83	28 (34)
Devon	48	28 (58)
Total	**1340**	**356**

TABLE 8 Follow-up retention rates for each of the centres

Centre	Baseline	Completed week 13 (retention rate), *n* (%)	Completed week 26 (retention rate), *n* (%)
London	127	101 (79)	96 (76)
Bangor	35	30 (86)	31 (89)
Hull	45	34 (75)	32 (71)
Manchester	53	39 (74)	37 (70)
Dorset	20	18 (90)	18 (90)
Lincolnshire	20	16 (80)	14 (70)
Norfolk and Suffolk	28	26 (93)	23 (82)
Devon	28	24 (86)	22 (79)
Total	**356**	**288 (81)**	**273 (77)**

Ratings of perception of allocation of dyads by blinded researchers

A total of 264 perception ratings were completed during week 13. These perception ratings asked the blinded researcher to assess, after a follow-up visit, which treatment the dyad had been allocated to using a 5-point Likert-type scale ('definitely in iCST group', 'more likely to be in iCST group', 'equally likely to be in iCST or TAU', 'more likely to be in TAU group', 'definitely in TAU group'). *Table 9* provides the results of these perception ratings in terms of the proportion that were correct, neutral and incorrect for treatment allocation at week 13. A total of 60% of blinded researchers rated dyads as being equally likely to receive iCST or TAU, with 23% making a correct judgement, of which 7% of these ratings were a definite judgement, and 17% making an incorrect judgement, of which only 5% were definite.

A total of 255 perception ratings were completed during week 26. *Table 10* provides the results of these perception ratings in terms of the proportion that were correct, neutral and incorrect for treatment allocation at week 26. In a similar manner to the judgements for week 13, 57% of researchers rated treatment allocation equally to iCST and TAU, with a total of 23% making a correct judgement, of which 10% were definite judgements. A similar percentage to week 13 (20%) also made an incorrect judgement about dyad allocation.

TABLE 9 Researchers' perceptions of allocation at week 13

	Actual treatment allocation (*N* = 264)		
Researcher rating	iCST, *n* (%)	TAU, *n* (%)	Total, *n* (%)
Correct 'definite' judgement	13 (12)	6 (4)	19 (7)
Correct 'more likely' judgement	14 (13)	28 (18)	42 (16)
Equally likely to be in iCST or TAU	68 (65)	92 (58)	160 (60)
Incorrect 'more likely' judgement	11 (10)	20 (13)	31 (12)
Incorrect 'definite' judgement	0	12 (7)	12 (5)
Total	**106**	**158**	**264**

TABLE 10 Researchers' perceptions of allocation at week 26

	Actual treatment allocation (*N* = 255)		
Researcher rating	iCST, *n* (%)	TAU, *n* (%)	Total, *n* (%)
Correct 'definite' judgement	22 (19)	4 (3)	26 (10)
Correct 'more likely' judgement	17 (15)	17 (12)	34 (13)
Equally likely to be in iCST or TAU	65 (57)	80 (57)	145 (57)
Incorrect 'more likely' judgement	10 (9)	31 (22)	41 (16)
Incorrect 'definite' judgement	0	9 (6)	9 (4)
Total	**114**	**141**	**255**

Analysis

Baseline characteristics by treatment allocation

Demographic information

Demographics information for people with dementia and their family carers appears in *Tables 11* and *12*, respectively. *Table 13* provides the means and SDs for age for people with dementia and their carers. There were 226 spousal and 130 non-spousal caregiving dyads. For the 130 non-spousal dyads there were 113 carers (113/356, 31.7%) who were the son or daughter, son-in-law or daughter-in-law, or brother or sister of the person with dementia. The remaining carers were described as having other relationships with the person with dementia (9/356, 2.5%) or as being another relative (8/356, 2.2%). At baseline, 270 people with dementia were taking AChEIs. In practice, it would be expected that a relatively small proportion would be stopping/starting AChEIs and randomisation should mean that this would be consistent across groups.

Table 14 details the sex of carers/participants in the caregiving dyads. Details of dementia diagnosis for the sample are provided in *Table 15*. A total of 68% of participants had a diagnosis of AD alone, 13% had a diagnosis of vascular dementia and 8% had a diagnosis of AD in combination with vascular dementia.

Severity of dementia was measured by the Clinical Dementia Rating Scale (CDR),[65] and general cognition by the MMSE.[66] A total of 70% of the sample had a CDR score of 1, 18% had a CDR score of 0.5, 12% had a CDR score of 2, and one person with dementia received a score of 0. The total mean MMSE score for the sample was 21.23 (SD = 4.30), with those allocated to iCST scoring a mean of 21.12 (SD = 4.48) and those allocated to TAU scoring a total of 21.33 (SD = 4.11).

TABLE 11 Demographics of person with dementia

Characteristic	Total, *n*/*N* (%)	iCST, *n*/*N* (%)	TAU, *n*/*N* (%)
Sex			
Female	165/356 (46)	83/180 (50)	82/176 (50)
Ethnicity			
White	331/356 (93)	164/180 (50)	167/176 (50)
Marital status			
Married/cohabiting/civil partnership	252/356 (71)	125/180 (50)	127/176 (50)
Living situation			
Living with spouse/partner	225/356 (63)	113/180 (50)	112/176 (50)
Highest level of education			
School leaver (14–16 years)	213/356 (60)	113/180 (53)	100/179 (47)
Taking acetylcholinesterase inhibitors			
Yes	270/356 (76)	136/180 (76)	134/176 (76)

TABLE 12 Demographics of carer

Characteristic	Total, *n*/*N* (%)	iCST, *n*/*N* (%)	TAU, *n*/*N* (%)
Sex			
Female	261/356 (73)	135/180 (52)	126/176 (48)
Ethnicity			
White	329/356 (92)	164/180 (50)	166/176 (50)
Marital status			
Married/cohabiting/civil partnership	297/356 (84)	149/180 (50)	148/176 (50)
Living situation			
Living with spouse/partner	236/356 (66)	119/180 (50)	117/176 (50)
Highest level of education			
School leaver (14–16 years)	156/356 (45)	79/180 (50)	80/179 (50)

TABLE 13 Summary statistics of age (years) for people with dementia and carers

	iCST			TAU			Total		
Dyad participant	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
Person with dementia	180	78.40	7.30	176	78.00	7.70	356	78.20	7.49
Carer	179[a]	66.01	12.76	174	65.49	13.11	353[a]	65.73	12.92
Spousal carer	112	73.11	7.57	111	72.50	8.22	223[a]	72.80	7.89
Non-spousal carer	67	54.13	10.67	63	53.16	11.00	130	53.66	10.80

a There were missing data for age for three carers.

TABLE 14 Details of the sex of participant/carer in caregiving dyads

Sex of carer and participant in caregiving dyads	Sex of person with dementia	
	Female	Male
Sex of carer	165	191
Female	82	179
Male	83	12
Total	**165**	**191**

TABLE 15 Details of dementia diagnosis

Diagnosis	Total, *n*/*N* (%)	iCST, *n*/*N* (%)	TAU, *n*/*N* (%)
AD	227/355 (64)	108/179 (60)	119/176 (68)
Vascular dementia	40/355 (11)	18/179 (10)	22/176 (13)
Lewy body dementia	11/355 (3)	5/179 (3)	6/176 (3)
Mixed AD and vascular dementia	36/355 (10)	22/179 (12)	14/176 (8)
Not known	41/355 (12)	26/179 (15)	15/176 (8)

Primary analyses of outcomes

The mean values for the iCST group and TAU group at each of the time points are given in *Table 16*. ANCOVA models were fitted for each of the measures. The primary model fitted was ANCOVA using the week-26 time point as the dependent variable and site as the random factor. Fixed factors were marital status, living status, sex of participant, whether or not the person with dementia was currently on AChEIs and treatment allocation. Fitted covariates were age, baseline outcome score and relationship with the carer. Models have also been fitted using the shorter-term week-13 follow-up as an outcome.

The number of cases with missing data, ANCOVA group means, mean differences, 95% confidence intervals (CIs) of mean differences and *p*-values for the original data to compare the iCST and TAU groups for the dementia patient outcome measures at week 26 and week 13, after adjusting for the baseline outcome measures and covariates, are given in *Tables 17* and *18*. There was little difference between the imputed value data and complete data; therefore, for ease of reading, complete case data have been presented. The carer outcome measures at week 26 and week 13 after adjusting for the baseline outcome measures are given in *Tables 19* and *20*.

A further analysis, in which imputation of the entire data set (356 participants) using the regression model is detailed, can be found in *Appendix 6*. The tables presented there indicate the results for the data if the multiple imputation model had been used to impute the data for all 356 participants at each time point. Various methodologies for different types of missing data (e.g. death vs. ill health) have not been taken into account as the number of each of these circumstances was minimal and would have limited impact on the results of any imputation method. Ten imputation sets were created to establish a robust adjustment to the data missing from each time point. There was no substantial difference between any of the results presented.

TABLE 16 Unadjusted means for each of the outcomes for iCST and TAU at each time point

Outcome measure	Baseline				Week 13				Week 26			
	Mis., *n*	iCST (*n* = 180), mean (SD)	Mis., *n*	TAU (*n* = 176), mean (SD)	Mis., *n*	iCST (*n* = 142), mean (SD)	Mis., *n*	TAU (*n* = 146), mean (SD)	Mis., *n*	iCST (*n* = 134), mean (SD)	Mis., *n*	TAU (*n* = 139), mean (SD)
Person with dementia												
ADAS-Cog	1	21.47 (9.22)	1	19.79 (8.03)	4	20.86 (9.73)	6	19.50 (8.97)	6	20.69 (9.39)	5	20.39 (9.91)
QoL-AD		38.01 (5.44)		37.96 (6.04)	2	37.90 (5.52)	2	38.09 (5.63)	5	37.86 (5.13)	1	37.71 (5.91)
DEMQOL	3	93.85 (11.76)	3	92.18 (13.55)	7	94.08 (10.92)	4	94.05 (11.80)	6	95.46 (11.17)	3	95.12 (11.11)
NPI total		11.21 (13.96)		10.99 (11.98)	2	10.67 (13.30)		12.07 (12.61)	1	11.57 (13.72)	1	11.59 (12.80)
GDS-15	3	3.14 (2.64)	3	3.16 (3.15)	9	2.98 (2.56)	3	3.03 (2.86)	8	2.90 (2.55)	3	2.85 (2.67)
QCPR total	6	55.17 (8.89)	2	56.72 (8.73)	4	56.30 (8.98)	3	55.82 (9.06)	3	56.88 (8.59)	1	55.55 (10.25)
QCPR (warmth)	1	33.19 (5.08)	1	33.98 (5.20)	1	33.32 (5.49)		33.25 (5.38)	1	33.78 (4.97)		33.07 (5.92)
QCPR (criticism and conflict)	1	22.07 (4.78)	1	22.69 (4.66)	1	22.80 (4.46)		22.54 (4.75)		22.95 (4.59)		22.46 (5.15)
MMSE		21.12 (4.48)		21.33 (4.11)	1	20.59 (5.02)	2	20.89 (4.83)	4	20.68 (4.76)	1	21.19 (5.21)
BADLS [P]		5.16 (5.45)		4.49 (4.09)		14.53 (10.34)	1	13.55 (8.20)	3	15.39 (10.78)	1	14.56 (8.86)
QoL-AD [P]	0	32.88 (6.83)		33.09 (6.22)	1	32.64 (6.25)	2	31.93 (5.84)	1	32.46 (6.20)		31.99 (6.30)
DEMQOL [P]	1	97.99 (13.17)	2	98.59 (12.76)	2	99.26 (12.38)	1	98.75 (11.96)	1	99.42 (12.41)	1	98.18 (12.80)

continued

TABLE 16 Unadjusted means for each of the outcomes for iCST and TAU at each time point (*continued*)

Outcome measure	Baseline				Week 13				Week 26			
	Mis., *n*	iCST (*n* = 180), mean (SD)	Mis., *n*	TAU (*n* = 176), mean (SD)	Mis., *n*	iCST (*n* = 142), mean (SD)	Mis., *n*	TAU (*n* = 146), mean (SD)	Mis., *n*	iCST (*n* = 134), mean (SD)	Mis., *n*	TAU (*n* = 139), mean (SD)
Carer												
SF-12 PCS	1	51.46 (10.25)	1	50.20 (10.32)		51.13 (9.73)		49.97 (10.34)		50.06 (10.53)	1	48.63 (10.87)
SF-12 MCS	1	49.42 (8.10)	1	48.14 (9.42)		47.98 (9.90)	2	47.93 (9.96)		48.88 (9.41)		47.88 (10.13)
HADS (total)	3	9.63 (6.11)		10.02 (6.67)	1	10.37 (6.98)		10.41 (6.89)	1	10.06 (6.92)		11.16 (7.59)
HADS (anxiety)	3	5.84 (3.58)		6.03 (3.88)	1	6.33 (4.35)		6.06 (4.00)	1	6.03 (4.32)		6.36 (4.44)
HADS (depression)	3	3.79 (3.30)		3.99 (3.40)	1	4.03 (3.30)		4.36 (3.48)	1	4.03 (3.29)		4.80 (3.81)
EQ-5D-3L health state today	3	78.37 (16.63)		76.24 (19.28)	1	78.13 (16.84)		76.45 (16.93)		78.63 (17.09)		76.58 (16.90)
EQ-5D-3L calculated utility value	1	0.83 (0.20)		0.81 (0.21)	1	0.82 (0.20)		0.79 (0.22)	2	0.82 (0.21)		0.75 (0.25)
RS-14	2	83.39 (10.98)	1	83.63 (10.43)		83.27 (11.14)		83.49 (10.47)	1	83.44 (10.86)		81.83 (12.90)
NPI (carer distress)		3.15 (2.67)		3.23 (2.59)	2	3.13 (2.48)		3.18 (2.39)	1	3.11 (2.65)	1	3.25 (2.41)
QCPR total	3	59.21 (6.67)	3	58.21 (6.63)	8	60.12 (6.33)	4	59.73 (6.67)	9	60.14 (6.54)	4	59.76 (6.77)
QCPR (warmth)	3	34.94 (3.77)	3	34.59 (3.64)	8	35.20 (3.66)	4	35.69 (3.45)	8	35.25 (3.57)	4	34.95 (3.51)
QCPR (criticism and conflict)	3	24.26 (3.63)	2	23.63 (3.81)	8	24.92 (3.57)	4	24.04 (4.41)	9	24.90 (3.66)	4	24.81 (4.01)

Mis., number of missing cases after pro-rating within items; NPI, Neuropsychiatric Inventory; [P], proxy rated measure; RS-14 Resilience Scale-14 items.

TABLE 17 Comparison of the iCST and TAU groups for person with dementia outcomes at week 26 after adjusting for the baseline outcome measures (complete case data are presented owing to little difference between this and imputed data results)

Outcome measure	Missing	iCST ($n = 134$)	TAU ($n = 139$)	MD	95% CI of MD	p-value
ADAS-Cog	11	20.03	20.58	–0.55	–2.00 to 0.90	0.45
QoL-AD	6	37.90	37.92	–0.02	–1.04 to 1.00	0.97
DEMQOL	9	94.45	94.14	0.31	–1.62 to 2.22	0.79
NPI [P]	2	8.10	8.42	–0.32	–2.78 to 2.12	0.79
GDS-15	11	3.29	3.31	–0.02	–0.51 to 0.47	0.94
QCPR (total)[a]	4	57.42	55.65	1.77	0.26 to 3.28	0.02
QCPR (warmth)	1	33.74	32.93	0.81	–0.11 to 1.73	0.09
QCPR (criticism and conflict)		23.51	22.65	0.86	–1.74 to 0.02	0.06
MMSE	5	19.63	20.10	–0.47	–1.26 to 0.30	0.23
BADLS [P]	4	11.91	12.57	–0.66	–2.07 to 0.75	0.36
QoL-AD [P]	1	32.45	32.00	0.45	–0.71 to 1.60	0.45
DEMQOL [P]	2	99.67	97.94	1.73	–0.61 to 4.07	0.15

MD, mean difference; Missing, number of cases with missing data; NPI, Nueropsychiatric Inventory; [P], proxy rated measure.
a Significant difference at 5% level.

TABLE 18 Comparison of the iCST and TAU groups for person with dementia outcomes at week 13 after adjusting for the baseline outcome measures (complete case data are presented owing to little difference between this and imputed data results)

Outcome measure	Missing	iCST ($n = 142$)	TAU ($n = 146$)	MD	95% CI of MD	p-value
ADAS-Cog	10	22.00	21.71	0.29	–1.10 to 1.68	0.68
QoL-AD	4	38.40	38.54	–0.14	–1.12 to 0.84	0.78
DEMQOL	11	91.72	92.05	–0.33	–2.31 to 1.65	0.74
NPI [P]	2	12.27	13.72	–1.46	–3.68 to 0.76	0.20
GDS-15	12	3.27	3.36	–0.09	–0.56 to 0.38	0.71
QCPR (total)	7	56.62	55.52	1.10	–0.15 to 2.35	0.09
QCPR (warmth)	1	34.04	33.65	0.39	–0.43 to 1.21	0.36
QCPR (criticism and conflict)	1	22.49	21.85	0.63	–0.10 to 1.36	0.09
MMSE	3	20.32	20.16	0.16	–0.60 to 0.92	0.69
BADLS [P]	1	12.73	12.93	–0.20	–1.44 to 1.04	0.75
QoL-AD [P]	3	32.66	31.91	0.75	–0.27 to 1.77	0.15
DEMQOL [P]	3	99.28	98.73	0.55	–1.70 to 2.80	0.64

MD, mean difference; Missing, number of cases with missing data; NPI, Neuropsychiatric Inventory; [P], Proxy rated measure.

TABLE 19 Comparison of the iCST and TAU groups for carer outcomes at week 26 after adjusting for the baseline outcome measures (complete case data are presented owing to little difference between this and imputed data results)

Outcome measure	Missing	iCST (*n* = 134)	TAU (*n* = 139)	MD	95% CI of MD	*p*-value
SF-12 PCS	1	49.57	49.11	0.46	–1.21 to 2.13	0.59
SF-12 MCS	0	48.44	48.31	0.13	–1.65 to 1.91	0.89
HADS total	1	10.27	10.96	–0.70	–1.85 to 0.46	0.24
HADS (anxiety)	1	6.09	6.30	–0.21	–0.94 to 0.52	0.57
HADS (depression)	1	4.16	4.67	–0.51	–1.09 to 0.08	0.09
EQ-5D-3L health state today	0	78.20	76.99	1.21	–2.14 to 4.57	0.48
EQ-5D-3L calculated utility value[a]	2	0.82	0.76	0.06	0.01 to 0.10	0.01
RS-14	1	83.42	81.85	1.58	–0.37 to 3.52	0.11
NPI (carer distress)	2	3.13	3.22	–0.09	–0.55 to 0.37	0.70
QCPR total	13	59.65	60.21	–0.56	–1.93 to 0.82	0.43
QCPR (warmth)	12	35.05	35.13	–0.08	–0.84 to 0.68	0.83
QCPR (criticism and conflict)	13	24.65	25.05	–0.40	–1.19 to 0.39	0.32

MD, mean difference; Missing, number of cases with missing data; NPI, Neuropsychiatric Inventory; RS-14, Resilience Scale-14 items.
a Significant difference at 5% level.

TABLE 20 Comparison of the iCST and TAU groups for carer outcomes at week 13 after adjusting for the baseline outcome measures (complete case data are presented owing to little difference between this and imputed data results)

Outcome measure	Missing	iCST (*n* = 134)	TAU (*n* = 139)	MD	95% CI of MD	*p*-value
SF-12 PCS	0	50.51	50.57	–0.06	–1.45 to 1.33	0.93
SF-12 MCS	0	47.59	48.30	–0.71	–2.34 to 0.92	0.39
HADS total	1	10.47	10.31	0.16	–0.81 to 1.15	0.74
HADS (anxiety)	1	6.34	6.05	0.29	–0.35 to 0.91	0.37
HADS (depression)	1	4.13	4.27	–0.14	–0.67 to 0.39	0.60
EQ-5D health state today	1	77.55	77.00	0.55	–2.59 to 3.69	0.73
EQ-5D calculated utility value	1	0.81	0.79	0.02	–0.02 to 0.06	0.19
RS-14	0	83.35	83.41	–0.06	–1.63 to 1.51	0.94
NPI (carer distress)	2	3.16	3.15	0.01	–0.43 to 0.43	0.99
QCPR total	12	59.90	59.94	–0.04	–1.45 to 1.37	0.95
QCPR (warmth)	12	35.10	35.78	–0.68	–1.44 to 0.08	0.09
QCPR (criticism and conflict)	12	24.80	24.16	0.64	–0.23 to 1.53	0.15

MD, mean difference; Missing, number of cases with missing data; NPI, Neuropsychiatric Inventory; RS-14, Resilience Scale-14 items.

Person with dementia outcomes

The ADAS-Cog primary outcome for people with dementia was not statistically significant between the iCST and TAU groups either at week 13 or at the primary time point of week 26. However, between week 13 and week 26, the estimated adjusted marginal means decreased more in the iCST group than in the TAU group, with a lower ADAS-Cog score being an improvement. For QoL-AD, there was no significant difference between the groups. Similarly, there were no differences between the groups for most secondary outcomes. There was a significant improvement for the iCST group relative to the TAU group for QCPR total score with a mean difference of 1.77 (95% CI 0.26 to 3.28; *p*-value = 0.02) at week 26. There was no evidence of significant differences for primary outcomes or secondary outcomes at week 13.

Carer outcome measures

There was no statistically significant difference in the primary outcome of SF-12 for carers between iCST and TAU at either week 26 or week 13. At week 26, the EQ-5D calculated utility value for the carer was significantly better for the iCST group with a mean difference of 0.06 (95% CI 0.01 to 0.10; *p*-value = 0.014). At week 26 there was an indication that the HADS depression subscale was lower in the iCST than in the TAU group, with decreases in depressive symptoms of –0.51 (95% CI –1.09 to 0.08; *p*-value = 0.090), but this did not reach significance.

At week 13 there were no significant differences between the two groups for any of the secondary outcome measures. The QCPR warmth subscale was close to significance between the iCST and TAU groups, with a mean difference of –0.68 (95% CI –1.44 to 0.08; *p*-value = 0.09) (see *Table 19*). In view of these results, and the fact that the QCPR measure for carers had the most missing data, we have also presented the results for the imputed analysis. *Table 21* shows the imputation analyses, with the final two columns showing the range of *F*-values for the five imputed data sets. The suggestion from the observed data that the QCPR warmth subscale may have an effect was not substantiated by the imputed data sets with a pooled mean difference of –0.65 (*F*-range 2.35–3.66; *p*-range 0.06–0.13).

Adherence analysis

The number of sessions completed by people with dementia and their carers ranged from 0 to 75 over the 26 weeks. *Table 22* shows the number of sessions completed by the 180 participants randomised to receive iCST available for analysis. Overall, 22% of participants did not complete any sessions, whereas 51% completed more than 30 sessions.

TABLE 21 Results of the imputation analyses for the QCPR scores where there are more than five missing values

QCPR outcome and subscales	iCST, *n* = 142; TAU, *n* = 146	Mis., *n*	Pooled mean	Pooled SE	Pooled mean difference (iCST–TAU)	Pooled SE	Median *F*-value		Low *F*-value		High *F*-value	
							F	*p*-value	*F*	*p*-value	*F*	*p*-value
Carer												
QCPR total	iCST	8	59.73	0.51	–0.087	0.708	0.017	0.897	0.005	0.944	0.097	0.756
	TAU	4	59.81	0.50								
QCPR (warmth)	iCST	8	35.05	0.28	–0.650	0.392	2.900	0.090	2.353	0.126	3.660	0.057
	TAU	4	35.70	0.27								
QCPR (criticism and conflict)	iCST	8	24.68	0.32	0.565	0.441	1.681	0.196	1.257	0.263	2.115	0.147
	TAU	4	24.11	0.31								

Mis., missing number of participants with missing data.

TABLE 22 Number of sessions completed by those randomised to receive iCST

Number of sessions completed	0	1–10	11–20	21–30	31–40	41–50	51–60	61–70	71–75
n (%)	39 (22)	23 (13)	10 (5)	17 (9)	19 (11)	20 (11)	14 (8)	18 (10)	20 (11)
Number of sessions completed, mean (SD)	31.68 (26.81)								

A number of options were explored in terms of the best way to consider analyses for adherence. The analysis methods for beginning to understand the 'dose' relationship were considered exploratory in nature. These options included whether or not an average of 1.5 or 2 sessions per week had been completed up to week 13 and week 26. The most efficient approach was considered to be to model the total number of sessions attended at each time point. Linear regression was used to assess the relationship between the follow-up outcome measures and the number of iCST sessions attended after adjusting for baseline outcome measures. *Appendix 7* reports observed data with values of coefficients, SEs, *F*-values and *p*-values, and pooled data showing pooled coefficients, SEs, median *F*-values, with *F*-values and *p*-values for both the person with dementia and carer, respectively, at each time point.

Outcomes for person with dementia

There was no statistical relationship between the number of sessions completed by the person with dementia and the ADAS-Cog primary outcome at any time point (see *Appendix 7*). However, the total number of sessions completed from baseline to week 26 was significant, with an improvement for both the QCPR total (p-value = 0.003) and QCPR criticism subscale (p-value = 0.001) for the iCST group. This result was consistent for the QCPR total after regression analysis with imputed data. The imputation was not conducted for QCPR (criticism) at week 26 as no data were missing. At week 13, only QCPR (criticism) had a significant association with the number of sessions (p-value = 0.004). However, several measures were close to significance, suggesting a potential pattern of improvement for people with dementia undertaking iCST. This included the QCPR total (p-value = 0.06; imputed values: p-range 0.06–0.06), the MMSE (p-value = 0.10; imputed values: p-range 0.09–0.12) and the QoL-AD (p-value = 0.08: imputed values; p-range 0.08–0.10).

Outcomes for carer

There were no significant associations between the SF-12 primary outcome and the number of sessions completed by carers at either week 13 and week 26. At week 26, HADS (depression) showed a significant reduction in the iCST group (p-value = 0.02), suggesting that a higher number of iCST sessions was associated with a decrease in depression scores (see *Appendix 7*). This was supported by the imputation analysis (p-range 0.01–0.02). Imputation suggested that the HADS total (p-range 0.03–0.05) was also associated with numbers of sessions completed. The EQ-5D utility showed a trend in favour of iCST (p-value = 0.09; imputed values: p-range 0.08–0.10). At week 13, there were no significant associations between the secondary outcomes and the number of sessions completed; however, there was borderline significance for carer EQ-5D health state being associated with higher adherence (p-value 0.06; imputed values: p-range 0.05–0.06).

Adverse events

Individual cognitive stimulation therapy was not a Clinical Trial of an Investigational Medicinal Product, so there were no associated risks to participants by taking part. However, qualitative interviews indicated that for some people with dementia, taking part in iCST was a difficult process, which for a small number of participants resulted in feelings of frustration, especially when the activities were judged by the person with dementia to be very easy or not challenging enough.

Economic evaluation

Data on service use and unpaid care were collected using the CSRI at each assessment point. The rates of completion of the CSRI were high at each point. At baseline, one iCST participant/carer dyad did not complete the CSRI. At week 13, of 142 iCST dyads completing outcome assessments, 141 completed a CSRI; of 146 TAU dyads completing outcome assessments, 145 completed a CSRI. At week 26, of 134 iCST dyads completing outcome assessments, 133 completed a CSRI; of 139 TAU dyads completing outcome assessments, 138 completed a CSRI. Thirteen dyads in the TAU group and 16 dyads in the iCST group completed only one follow-up CSRI. Information was available at all three time points for 129 iCST dyads and for 135 TAU dyads. There was a difference of nine dyads in the complete case information available for the costs analyses relative to the 26-week outcomes analyses (264 vs. 273). Owing to a protocol violation (see *Appendix 9*), one participant who should have been assigned to the control group received the intervention. For the cost-effectiveness analyses, costs of all participants have been retained and the analysis carried out according to the intended allocation.

Care and support services and costs

Professional time spent in supporting the carers of participants receiving iCST is presented in *Table 23*. The amount of time (including travel) spent in delivering the set-up visit was about 2 hours. The time spent in monitoring visits and telephone calls was similar between week 13 and week 26. Carers spent 16.8 hours, on average, delivering the intervention at week 13, and 13.1 hours at week 26 (*Table 24*). Resources used by both groups are given in *Tables 25–27*. Use of health and social care services was very similar between groups during the period prior to baseline, and during the two follow-up periods (*Tables 28–30*).

TABLE 23 Professionals' time (hours) spent in supporting carers to deliver the intervention, per participant, at week 13 and week 26

Type of contact	Intervention, mean (SE)[a]	Valid, *n*
Week 13		
Set-up visit[b]	2 (0)	126
Monitoring visits[b]	1.3 (0)	124
Telephone calls	0.6 (0)	118
Week 26		
Monitoring visits[b]	1.2 (0)	121
Telephone calls[b]	0.4 (0)	97

a Data from treatment adherence collection.
b Includes travel time.

TABLE 24 Carers' time (hours) spent in delivering the intervention, per participant, at week 13 and week 26

Hours of carers' time	Intervention, mean (SE)[a]	Valid, *n*
Week 13, hours	16.8 (0.8)	118
Week 26, hours	13.1 (1.2)	91

a Data from treatment adherence collection.
b Includes preparation time.

TABLE 25 Resource use over the prior 3 months, at baseline assessment

Baseline	Unit	iCST (SE) ($n = 129$)	TAU (SE) ($n = 135$)	Mean difference (95% CI)[a]
A&E department	Attendances	0.0 (0.0)	0.1 (0.0)	–0.1 (–0.2 to 0.0)
Inpatient services	Admissions	0.0 (0.0)	0.0 (0.0)	0.0 (0.0 to 0.1)
Inpatient services	Days	0.2 (0.1)	0.1 (0.1)	0.1 (–0.1 to 0.3)
Day services	Days	0.0 (0.0)	0.0 (0.0)	0.0 (0.0 to 0.1)
Days in inpatient and day services	Days	0.2 (0.1)	0.1 (0.1)	0.1 (–0.1 to 0.4)
Outpatient services	Visits	0.7 (0.1)	1.0 (0.1)	–0.3 (–0.7 to 0.1)
GP	Visits	1.7 (0.2)	1.6 (0.1)	0.1 (–0.3 to 0.5)
Practice nurse	Visits	0.9 (0.2)	0.7 (0.1)	0.2 (–0.3 to 0.7)
Community/district nurse	Visits	0.3 (0.1)	0.5 (0.3)	–0.2 (–0.8 to 0.5)
Physiotherapist	Visits	0.2 (0.1)	0.2 (0.1)	0.0 (–0.2 to 0.2)
Occupational therapist	Visits	0.1 (0.0)	0.1 (0.0)	0.0 (–0.1 to 0.1)
Dietician	Visits	0.0 (0.0)	0.0 (0.0)	0.0 (0.0 to 0.0)
Specialist nurse	Visits	0.1 (0.0)	0.1 (0.0)	–0.1 (–0.2 to 0.1)
Optician	Contacts	0.2 (0.0)	0.3 (0.0)	0.0 (–0.1 to 0.1)
Chiropodist	Contacts	0.4 (0.1)	0.4 (0.1)	0.0 (–0.2 to 0.2)
Dentist	Contacts	0.5 (0.1)	0.5 (0.1)	0.0 (–0.2 to 0.2)
Mental health nurse	Contacts	0.5 (0.2)	0.5 (0.1)	–0.1 (–0.5 to 0.4)
Psychiatrist	Visits	0.3 (0.1)	0.4 (0.1)	–0.1 (–0.3 to 0.1)
Psychologist	Visits	0.1 (0.0)	0.1 (0.0)	0.0 (–0.1 to 0.1)
Counsellor	Visits	0.0 (0.0)	0.1 (0.1)	–0.1 (–0.3 to 0.1)
Mental health team worker	Visits	0.1 (0.0)	0.3 (0.1)	–0.1 (–0.3 to 0.1)
Social worker/care manager	Visits	0.1 (0.0)	0.4 (0.2)	–0.3 (–0.7 to 0.1)
Home care/home help	Visits	12.2 (4.3)	9.3 (2.9)	2.9 (–7.3 to 13.1)
Cleaner	Visits	3.9 (0.9)	2.8 (0.5)	1.1 (–0.9 to 3.0)
Meals on wheels	Meals	0.0 (0.0)	0.0 (0.0)	0.0 (0.0 to 0.0)
Laundry service	Contacts	0.8 (0.7)	0.3 (0.2)	0.5 (–0.8 to 1.8)
Sitting service (e.g. Crossroads)	Visits	0.5 (0.3)	0.9 (0.3)	–0.3 (–1.2 to 0.5)
Carer support worker	Visits	0.1 (0.0)	0.3 (0.3)	–0.3 (–1.0 to 0.4)
Daycentre	Attendances	2.0 (0.6)	4.5 (1.9)	–2.5 (–6.6 to 1.5)
Lunch club	Attendances	1.0 (0.5)	0.6 (0.3)	0.5 (–0.6 to 1.6)
Patient education classes	Attendances	0.2 (0.1)	0.5 (0.2)	–0.2 (–0.7 to 0.2)
Items of equipment	Items	1.1 (0.2)	0.9 (0.2)	0.2 (–0.3 to 0.8)
Medications[b]	Units	0.9 (0.1)	0.9 (0.1)	0.0 (–0.2 to 0.2)
Unpaid care by primary carer	Hours	646.3 (75.0)	652.5 (68.1)	–6.2 (–205.3 to 192.9)
Unpaid care by other friends/relatives	Hours	84.6 (23.0)	40.3 (7.4)	44.3 (–2.7 to 91.3)

A&E, accident and emergency; GP, general practitioner.
a Difference in group means, iCST–TAU.
b Drugs for dementia, antipsychotics and antidepressants.

TABLE 26 Resource use over the prior 3 months, at week 13

Week 13	Unit	iCST (SE) ($n = 129$)	TAU (SE) ($n = 135$)	Mean difference (95% CI)[a]
A&E department	Attendances	0.1 (0.0)	0.1 (0.0)	0.0 (–0.1 to 0.1)
Inpatient services	Admissions	0.0 (0.0)	0.0 (0.0)	0.0 (–0.1 to 0.0)
Inpatient services	Days	0.1 (0.1)	0.2 (0.1)	–0.1 (–0.4 to 0.2)
Day services	Days	0.0 (0.0)	0.0 (0.0)	0.0 (–0.1 to 0.0)
Days in inpatient and day services	Days	0.1 (0.1)	0.3 (0.1)	–0.1 (–0.4 to 0.2)
Outpatient services	Visits	0.8 (0.1)	0.7 (0.1)	0.1 (–0.2 to 0.4)
GP	Visits	1.4 (0.2)	1.6 (0.2)	–0.2 (–0.6 to 0.3)
Practice nurse	Visits	0.8 (0.1)	0.7 (0.1)	0.2 (–0.1 to 0.5)
Community/district nurse	Visits	0.2 (0.1)	1.2 (0.9)	–1.0 (–2.8 to 0.8)
Physiotherapist	Visits	0.1 (0.0)	0.3 (0.1)	–0.2 (–0.4 to 0.1)
Occupational therapist	Visits	0.1 (0.0)	0.1 (0.0)	0.0 (–0.1 to 0.1)
Dietician	Visits	0.0 (0.0)	0.0 (0.0)	0.0 (–0.1 to 0.0)
Specialist nurse	Visits	0.1 (0.1)	0.1 (0.1)	–0.1 (–0.2 to 0.1)
Optician	Contacts	0.2 (0.0)	0.2 (0.0)	0.0 (–0.2 to 0.1)
Chiropodist	Contacts	0.4 (0.1)	0.5 (0.1)	–0.2 (–0.3 to 0.0)
Dentist	Contacts	0.4 (0.1)	0.4 (0.1)	–0.1 (–0.2 to 0.1)
Mental health nurse	Contacts	0.2 (0.1)	0.3 (0.1)	–0.1 (–0.3 to 0.1)
Psychiatrist	Visits	0.2 (0.0)	0.3 (0.0)	–0.1 (–0.2 to 0.0)
Psychologist	Visits	0.0 (0.0)	0.0 (0.0)	0.0 (0.0 to 0.0)
Counsellor	Visits	0.0 (0.0)	0.2 (0.1)	–0.2 (–0.5 to 0.1)
Mental health team worker	Visits	0.1 (0.1)	0.3 (0.1)	–0.1 (–0.4 to 0.1)
Social worker/care manager	Visits	0.2 (0.1)	0.3 (0.2)	–0.1 (–0.6 to 0.3)
Home care/home help	Visits	10.3 (3.8)	11.6 (3.4)	–1.4 (–11.4 to 8.7)
Cleaner	Visits	3.4 (0.6)	2.8 (0.6)	0.6 (–1.0 to 2.3)
Meals on wheels	Meals	1.2 (0.8)	0.0 (0.0)	1.2 (–0.3 to 2.8)
Laundry service	Contacts	0.3 (0.1)	0.5 (0.3)	–0.2 (–0.9 to 0.5)
Sitting service (e.g. Crossroads)	Visits	0.4 (0.2)	0.3 (0.2)	0.0 (–0.4 to 0.5)
Carer support worker	Visits	0.1 (0.0)	0.4 (0.2)	–0.3 (–0.8 to 0.1)
Daycentre	Attendances	2.7 (0.7)	3.1 (0.8)	–0.5 (–2.5 to 1.5)
Lunch club	Attendances	1.2 (0.5)	0.2 (0.1)	1.0 (–0.1 to 2.0)
Patient education classes	Attendances	0.4 (0.1)	0.9 (0.3)	–0.4 (–1.0 to 0.2)
Items of equipment	Items	1.1 (0.2)	0.9 (0.2)	0.3 (–0.2 to 0.8)
Medications[b]	Units	0.8 (0.1)	0.9 (0.1)	–0.1 (–0.2 to 0.1)
Unpaid care by primary carer	Hours	705.6 (71.9)	732.7 (71.8)	–27.1 (–227.3 to 173.0)
Unpaid care by other friends/relatives	Hours	87.7 (22.9)	40.9 (8.6)	46.8 (–0.7 to 94.4)
Intervention: professional support[c]	Contacts	4.9 (0.2)	0.04 (0.0)	4.9 (4.5 to 52)

A&E, accident and emergency; GP, general practitioner.
a Difference in group means, iCST–TAU.
b Drugs for dementia, antipsychotics and antidepressants.
c contacts of unblinded researchers providing iCST support to dyads (telephone and face-to-face visits) – contacts for set-up, monitoring and telephone support are summed and any missing values here treated as zero; TAU includes the mean contacts with TAU carer delivering the intervention (protocol violation)

TABLE 27 Resource use over the prior 3 months, at week 26

Week 26	Unit	iCST (SE) ($n = 129$)	TAU (SE) ($n = 135$)	Mean difference (95% CI)[a]
A&E department	Attendances	0.2 (0.1)	0.1 (0.0)	0.1 (–0.1 to 0.3)
Inpatient services	Admissions	0.1 (0.0)	0.1 (0.0)	0.0 (–0.1 to 0.0)
Inpatient services	Days	0.4 (0.2)	0.6 (0.3)	–0.3 (–0.9 to 0.4)
Day services	Days	0.0 (0.0)	0.0 (0.0)	0.0 (0.0 to 0.0)
Days in inpatient and day services	Days	0.4 (0.2)	0.6 (0.3)	–0.3 (–0.9 to 0.4)
Outpatient services	Visits	0.8 (0.2)	0.5 (0.1)	0.3 (–0.1 to 0.6)
GP	Visits	1.2 (0.1)	1.4 (0.1)	–0.2 (–0.5 to 0.2)
Practice nurse	Visits	0.7 (0.1)	0.6 (0.1)	0.1 (–0.2 to 0.4)
Community/district nurse	Visits	0.6 (0.3)	0.4 (0.2)	0.2 (–0.5 to 0.8)
Physiotherapist	Visits	0.2 (0.1)	0.2 (0.1)	0.0 (–0.4 to 0.3)
Occupational therapist	Visits	0.1 (0.0)	0.3 (0.2)	–0.2 (–0.6 to 0.2)
Dietician	Visits	0.0 (0.0)	0.0 (0.0)	0.0 (–0.1 to 0.0)
Specialist nurse	Visits	0.1 (0.0)	0.2 (0.1)	–0.1 (–0.2 to 0.1)
Optician	Contacts	0.2 (0.0)	0.2 (0.0)	0.0 (–0.1 to 0.1)
Chiropodist	Contacts	0.4 (0.1)	0.5 (0.1)	–0.1 (–0.3 to 0.1)
Dentist	Contacts	0.4 (0.1)	0.4 (0.1)	0.0 (–0.1 to 0.2)
Mental health nurse	Contacts	0.2 (0.0)	0.1 (0.0)	0.1 (0.0 to 0.2)
Psychiatrist	Visits	0.1 (0.0)	0.2 (0.0)	0.0 (–0.1 to 0.1)
Psychologist	Visits	0.0 (0.0)	0.0 (0.0)	0.0 (–0.1 to 0.1)
Counsellor	Visits	0.0 (0.0)	0.1 (0.1)	–0.1 (–0.3 to 0.1)
Mental health team worker	Visits	0.2 (0.0)	0.2 (0.1)	0.0 (–0.3 to 0.2)
Social worker/care manager	Visits	0.1 (0.0)	0.2 (0.1)	–0.1 (–0.3 to 0.0)
Home care/home help	Visits	14.0 (4.9)	14.5 (4.0)	–0.5 (–12.9 to 11.9)
Cleaner	Visits	3.2 (0.6)	4.3 (0.8)	–1.1 (–3.1 to 0.9)
Meals on wheels	Meals	1.2 (0.8)	0.0 (0.0)	1.2 (–0.3 to 2.7)
Laundry service	Contacts	0.1 (0.1)	0.2 (0.1)	–0.1 (–0.4 to 0.2)
Sitting service (e.g. Crossroads)	Visits	1.0 (0.4)	0.9 (0.3)	0.1 (–0.8 to 1.1)
Carer support worker	Visits	0.6 (0.5)	0.2 (0.2)	0.4 (–0.6 to 1.4)
Daycentre	Attendances	2.0 (0.6)	3.4 (0.8)	–1.4 (–3.3 to 0.5)
Lunch club	Attendances	1.4 (0.5)	0.7 (0.3)	0.7 (–0.5 to 1.9)
Patient education classes	Attendances	0.7 (0.3)	1.2 (0.4)	–0.5 (–1.4 to 0.3)
Items of equipment	Items	1.0 (0.2)	0.5 (0.1)	0.5 (–0.0 to 0.9)
Medications[b]	Units	0.8 (0.1)	0.9 (0.1)	0.0 (–0.2 to 0.1)
Unpaid care by primary carer	Hours	720.5 (72.5)	912.8 (79.0)	–192.4 (–403.9 to 19.1)
Unpaid care by other friends/relatives	Hours	69.0 (15.4)	51.9 (12.2)	17.2 (–21.3 to 55.7)
Intervention: professional support[c]	Contact	2.6 (0.14)	0.0 (0.0)	2.5 (2.3 to 2.8)

A&E, accident and emergency; GP, general practitioner.
a Difference in group means, iCST–TAU.
b Drugs for dementia, antipsychotics and antidepressants.
c Contacts of unblinded researchers providing iCST support to dyads (telephone and face-to-face visits): contacts for set-up, monitoring and telephone support are summed and any missing values here treated as zero; TAU includes the mean contacts with TAU carer delivering the intervention (protocol violation).

TABLE 28 Mean (raw) costs of dyad: person with dementia's health and social care, unpaid carer costs, intervention costs, and total health and social care and societal costs over prior 3 months, at baseline assessment (£), 2012–13

Baseline	iCST, mean (SE) ($n = 129$)	TAU, mean (SE) ($n = 135$)	Mean difference (95% CI)[a]
Hospital	233 (62)	297 (69)	–64 (–248 to 121)
Primary and community health	150 (13)	144 (10)	6 (–26 to 38)
Respite in residential/nursing home	0 (0)	13 (9)	–13 (–32 to 6)
Community-based social care	901 (243)	817 (175)	84 (–502 to 670)
Community mental health	126 (31)	118 (18)	8 (–62 to 78)
Daycare (any provider)	685 (176)	1012 (227)	–327 (–897 to 243)
Equipment and adaptations	4 (1)	3 (1)	1 (–3 to 5)
Medications[b]	172 (15)	176 (14)	–4 (–45 to 36)
Health and social care[c]	2271 (312)	2581 (317)	–309 (–1186 to 567)
Unpaid care and support[d]	4535 (477)	4282 (414)	253 (–988 to 1493)

a Difference in group means, iCST–TAU.
b Drugs for dementia, antipsychotics and antidepressants.
c Person with dementia's health and social care costs.
d Costs of unpaid carers' time in providing care and support to participant with dementia, lost production and out-of-pocket expenditure, time valued at minimum wage.

TABLE 29 Mean (raw) costs of dyad: person with dementia's health and social care, unpaid carer costs, intervention costs, and total health and social care and societal costs over prior 3 months, week 13 (£), 2012–13

Week 13	iCST, mean (SE) ($n = 129$)	TAU, mean (SE) ($n = 135$)	Mean difference (95% CI)[a]
Hospital	253 (57)	198 (46)	55 (–89 to 199)
Primary and community health	125 (13)	142 (12)	–17 (–51 to 17)
Respite in residential/nursing home	31 (22)	0 (0)	31 (–11 to 73)
Community-based social care	845 (245)	1072 (235)	–227 (–895 to 441)
Community mental health	36 (7)	76 (12)	–40 (–68 to –12)
Daycare (any provider)	327 (69)	439 (75)	–112 (–314 to 89)
Equipment and adaptations	4 (2)	2 (1)	2 (–2 to 6)
Medications[b]	188 (17)	217 (15)	–29 (–72 to 15)
Health and social care excluding intervention[c]	1809 (268)	2146 (279)	–337 (–1099 to 426)
Intervention: professional support[d]	249 (4)	1 (1)	249 (240 to 257)
Health and social care including intervention (professional)[e]	2058 (267)	2147 (278)	–88 (–849 to 673)
Unpaid care and support[f]	4930 (448)	4770 (444)	159 (–1083 to 1401)
Intervention: carer delivered[g]	101 (5)	1 (1)	100 (90 to 110)
Intervention: professional support and carer delivered[h]	350 (8)	2 (2)	348 (333 to 363)
Societal excluding intervention[i]	6739 (540)	6916 (587)	–177 (–1751 to 1396)
Societal including intervention (professional and carer)[j]	7089 (539)	6918 (586)	171 (–1402 to 1744)

a Difference in group means, iCST–TAU.
b Drugs for dementia, antipsychotics and antidepressants.
c Person with dementia's health and social care costs.
d Paid/professional support to carers delivering the intervention (includes costs of training and toolkit).
e Person with dementia's health and social care costs and paid/professional support to carers delivering the intervention (includes costs of training and toolkit).
f Costs of unpaid carers' time in providing care and support to participant with dementia, lost production and out-of-pocket expenditure, time valued at minimum wage.
g Time spent by carers in delivering the intervention valued at minimum wage.
h Paid/professional support to carers delivering the intervention (includes costs of training and toolkit) and time spent by carers in delivering the intervention, valued at minimum wage.
i Person with dementia's health and social care costs and costs of unpaid carers' time in care and support, lost production and out-of-pocket expenditure, time valued at minimum wage.
j Person with dementia's health and social care costs and costs of unpaid carers' time in care and support, lost production and out-of-pocket expenditure, time valued at minimum wage. Paid/professional support to carers delivering the intervention (includes costs of training and toolkit) and time spent by carers in delivering the intervention, valued at minimum wage.

TABLE 30 Mean (raw) costs of dyad: person with dementia's health and social care, unpaid carer costs, intervention costs, and total health and social care and societal costs over prior 3 months, week 26 (£), 2012–13

Week 26	iCST, mean (SE) ($n = 129$)	TAU, mean (SE) ($n = 135$)	Mean difference (95% CI)[a]
Hospital	364 (106)	377 (111)	–12 (–316 to 291)
Primary and community health	122 (12)	138 (14)	–16 (–53 to 21)
Respite in residential/nursing home	34 (24)	0 (0)	34 (–12 to 81)
Community-based social care	1010 (281)	1142 (227)	–131 (–840 to 577)
Community mental health	37 (8)	40 (8)	–3 (–25 to 19)
Daycare (any provider)	505 (109)	783 (130)	–278 (–613 to 58)
Equipment and adaptations	5 (2)	1 (1)	4 (0 to 8)
Medications[b]	200 (16)	207 (14)	–7 (–49 to 35)
Health and social care excluding intervention[c]	2279 (360)	2688 (344)	–409 (–1389 to 571)
Intervention: professional support[d]	231 (4)	1 (1)	231 (223 to 239)
Health and social care including intervention (professional)[e]	2510 (360)	2688 (344)	–178 (–1158 to 801)
Unpaid care and support[f]	4902 (448)	5941 (481)	–1039 (–2336 to 258)
Intervention: carer delivered[g]	71 (6)	1 (1)	70 (58 to 82)
Intervention: professional support and carer delivered[h]	302 (8)	1 (1)	301 (285 to 317)
Societal excluding intervention[i]	7181 (605)	8629 (630)	–1448 (–3171 to 274)
Societal including intervention (professional and carer)[j]	7483 (604)	8630 (630)	–1147 (–2869 to 574)

a Difference in group means, iCST–TAU.
b Drugs for dementia, antipsychotics and antidepressants.
c Person with dementia's health and social care costs.
d Paid/professional support to carers delivering the intervention (includes costs of training and toolkit).
e Person with dementia's health and social care costs and paid/professional support to carers delivering the intervention (includes costs of training and toolkit)
f Costs of unpaid carers' time in providing care and support to participant with dementia, lost production and out-of-pocket expenditure, time valued at minimum wage.
g Time spent by carers in delivering the intervention, valued at minimum wage.
h Paid/professional support to carers delivering the intervention (includes costs of training and toolkit) and time spent by carers in delivering the intervention, valued at minimum wage.
i Person with dementia's health and social care costs and costs of unpaid carers' time in care and support, lost production and out-of-pocket expenditure, time valued at minimum wage.
j Person with dementia's health and social care costs and costs of unpaid carers' time in care and support, lost production and out-of-pocket expenditure, time valued at minimum wage. Paid/professional support to carers delivering the intervention (includes costs of training and toolkit) and time spent by carers in delivering the intervention, valued at minimum wage.

Carers were asked to report which types of care and support activities they typically engaged in (see *Appendix 4*). The proportions of carers reporting each type of activity did not vary significantly between groups. The majority reported assisting with supervision, helping the person with dementia with finances and medication, and taking them to appointments. At week 26, approximately 40% of carers across the groups were assisting the person with dementia with personal care.

The (imputed) costs of health and social care and unpaid carer inputs, including the costs of delivering the intervention, are given in *Tables 28–30*. The costs of delivering the intervention were estimated from the health and social care perspective, including the costs of paid/professional staff, training and materials, and also from the broader perspective of the time costs to carers (see *Tables 29–30*). The paid staff costs of delivering the intervention were slightly higher and the unpaid carer costs were approximately 40% higher at the week-13 follow-up compared with the week-26 follow-up period. The mean cost of the intervention, taking paid staff time into account, was £481 over the period of the study; the mean cost of delivering the intervention, if carer time was valued at the minimum wage, was £171. It cost £652 to deliver the intervention, considering both paid staff and unpaid carer inputs. Costs of other health and social care and carer costs were similar between the groups at baseline and, for the most part, did not significantly differ (at the 5% level) between the groups during the follow-up period. The total raw mean costs of health and social care and costs to carers at week 26 were somewhat, but not significantly, less for the intervention than the control group (7483 iCST vs. 8631 TAU; $t = 1.312$; p-value = 0.191).

Cost-effectiveness analyses

The primary outcomes and costs for the person with dementia and their carers are presented in *Tables 31–34*. Only primary outcomes (ADAS-Cog, QoL-AD, QALY) and secondary outcomes (QCPR, person with dementia) with significant between-group differences at the 5% level are presented here.

TABLE 31 Person with dementia: outcome scores at 6 months

Outcomes	iCST ($n = 129$) (95% CI)	TAU ($n = 135$) (95% CI)	Difference ($n = 264$) (95% CI)[a]
ADAS-Cog	20.53 (19.19 to 21.87)	21.19 (19.78 to 22.61)	–0.66 (–2.25 to 0.92)
QoL-AD	37.96 (37.09 to 38.84)	37.71 (36.86 to 38.57)	0.25 (–0.81 to 1.3)
QCPR	56.95 (55.63 to 58.27)	55.24 (53.74 to 56.75)	1.71 (0.15 to 3.27)

a Estimates from outcome equation: adjusted for site, whether or not person with dementia is taking anticholinesterase, categories of coresidents (spouse/partner and other family and/or others; other family/other; no-one), treatment allocation, baseline outcome.

TABLE 32 Person with dementia: mean costs at 6 months

Costs	iCST ($n = 129$) (95% CI)	TAU ($n = 135$) (95% CI)	Difference ($n = 264$) (95% CI)
Health and social care (£)[a,b]	4740 (3790 to 5700)	4670 (3680 to 5660)	70 (–1050 to 1190)
Societal (£)[a,c]	9770 (8410 to 11140)	10630 (9140 to 12120)	–860 (–2750 to 1040)

a Estimates from costs equation: adjusted for site, whether or not person with dementia is taking anticholinesterase, categories of coresidents (spouse/partner and other family and/or others; other family/other; no-one), treatment allocation, costs in 3 months pre-baseline. Results rounded to nearest £10.
b Person with dementia's health and social care costs and paid/professional support to carers delivering the intervention (includes costs of training and toolkit).
c Person with dementia's health and social care costs and costs of unpaid carers' time in care and support, lost production and out-of-pocket expenditure, time valued at minimum wage. Paid/professional support to carers delivering the intervention (includes costs of training and toolkit) and time spent by carers in delivering the intervention, valued at minimum wage.

TABLE 33 Carers: QALY

Outcomes	iCST ($n = 129$) (95% CI)	TAU ($n = 135$) (95% CI)	Difference ($n = 264$) (95% CI)
QALY[a,b]	0.82 (0.78 to 0.85)	0.77 (0.74 to 0.80)	0.05 (0.01 to 0.09)

a Estimates from outcome equation: adjusted for site, whether or not person with dementia is taking anticholinesterase, categories of carer coresidents (spouse/partner and other family and/or others; other family/other; no-one), treatment allocation, baseline outcome, carer sex, carer age.
b QALY calculated using the area-under-the-curve method with linear interpolation between assessment points, and the last value carried forward from the final assessment to 12 months post-baseline.

TABLE 34 Carers: mean costs

Costs	iCST ($n = 129$) (95% CI)	TAU ($n = 135$) (95% CI)	Difference ($n = 264$) (95% CI)
Annual equivalent: health and social care (£)[a,b]	9480 (7370 to 11,600)	9340 (7300 to 11,390)	140 (–2360 to 2640)
Annual equivalent: societal (£)[a,c]	19,550 (16,730 to 22,370)	21270 (18,170 to 24,350)	–1710 (–5570 to 2150)

a Estimates from costs equation: adjusted for site, whether or not person with dementia is taking anticholinesterase, categories of coresidents (spouse/partner and other family and/or others; other family/other; no-one), treatment allocation, costs in 3 months pre-baseline. Results rounded to nearest £10.
b Person with dementia's health and social care costs and paid/professional support to carers delivering the intervention (includes costs of training and toolkit).
c Person with dementia's health and social care costs and costs of unpaid carers' time in care and support, lost production and out-of-pocket expenditure, time valued at minimum wage. Paid/professional support to carers delivering the intervention (includes costs of training and toolkit) and time spent by carers in delivering the intervention, valued at minimum wage.

Outcomes and costs for the person with dementia

The SUR analyses produced very similar estimates of between-group differences on these outcomes at week 26 to the ANCOVA approach used in the main analysis (see *Primary analyses of outcomes*). On the primary outcomes for the person with dementia (see *Table 31*), the groups' mean outcome scores did not differ significantly. The mean (adjusted) difference in ADAS-Cog scores was –0.66 (95% CI –2.25 to 0.92). On the QoL-AD, the intervention group scores were marginally, but not significantly, higher than those of the intervention (difference of 0.25, 95% CI –0.81 to 1.3). On the secondary outcomes, the mean between-group difference in the QCPR was 1.71 (95% CI 0.15 to 3.27).

For the costs for the person with dementia (see *Table 32*), the groups' (adjusted) mean health and social care costs did not differ significantly. The (adjusted) mean week-26 health and social care costs were slightly, but not significantly, higher in the intervention group, giving a between-group difference of £70 (95% CI –£1050 to £1190). In terms of societal costs, however, the control group's (adjusted) mean week-26 costs were £860 (95% CI –£2750 to £1040) higher than those in the intervention group (but not significantly so).

Outcomes and costs for carers

Mean QALYs (see *Table 33*) for the carers in the intervention group were significantly higher than for carers in the control group [0.82 (95% CI 0.78 to 0.85) vs. 0.77 (95% CI 0.74 to 0.8), respectively, a difference of 0.05, 95% CI 0.01 to 0.09]. The annual-equivalent health and social costs in the intervention group were slightly higher than in the control group (see *Table 34*). From the broader societal perspective, the annual equivalent costs in the intervention group were somewhat lower than in the control, by £1710 (95% CI –£5570 to £2150).

Incremental cost-effectiveness ratios

The ICERs for people with dementia and for carers are presented in *Table 35*.

Person with dementia

The incremental health and social care cost of a difference of 2.4 points in the ADAS-Cog score at week 26 was £300. The probability of cost-effectiveness on the ADAS-Cog from the health and social care perspective rises from 45% at a WTP of £0 to approximately 80% at a WTP of £20,000 (see *Figure 2*). As the control group's mean (adjusted) 6-month societal costs were greater than those in the intervention group, which constitutes a cost-saving (not significant at the 5% level), the ICER produced is negative. The probability of cost-effectiveness by reference to ADAS-Cog (see *Figure 2*) from the broader societal perspective rises from 80% at a WTP of £0 and then falls to approximately the same level as given by the health and social care perspective. This is a pattern that can occur when the joint density of incremental outcomes and costs crosses all quadrants of the cost-effectiveness plane.[67]

The incremental health and social care cost of a difference of 1.7 points in QoL-AD score at week 26 was £600. The ICER from the societal perspective was negative (–£7100). The probabilities of cost-effectiveness follow a fairly similar pattern as in the case of the ADAS-Cog measure (see *Figure 3*).

Going beyond the ICER point estimates and taking sampling uncertainty into account, on both ADAS-Cog and QoL-AD measures, and from either the health and social care or the societal perspective, the CEACs and the (absence of) confidence limits of the ICERs indicate that there is no positive WTP where we can be 95% confident that the two interventions differ in terms of cost-effectiveness.[68]

On the secondary outcomes, the incremental cost to achieve a difference of 3.1 points in the QCPR was £100 from the health and social care perspective, whereas the ICER from the societal perspective was negative. Taking sampling uncertainty into account, we can be confident that the intervention is cost-saving at a WTP of

TABLE 35 Person with dementia and carer: ICER for intervention over control, from health and social care and societal perspectives

Cost perspective[a]	ADAS-Cog (95% CI)[b]	QoL-AD (95% CI)[c]	QCPR (95% CI)[d]	QALY (95% CI)[e]
Person with dementia, 6 months				
Health and social care[f]	300 (unbounded to unbounded)	600 (unbounded to unbounded)	100 (–3200 to 5400)	NA
Societal[g]	–3300 (unbounded to unbounded)	–7100 (unbounded to unbounded)	–1600 (–13,300 to 2400)	NA
Carer, annual equivalent costs and outcomes				
Health and social care[f]	NA	NA	NA	3100 (–71,000 to 84,200)
Societal[g]	NA	NA	NA	–38,400 (–236,000 to 47,300)

NA, not applicable.
a Results rounded to nearest £100.
b Cost of achieving a 2.4-point difference between groups at week 26.
c Cost of achieving a 1.7-point difference between groups at week 26.
d Cost of achieving a 3.1-point difference between groups at week 26.
e Cost of achieving a QALY gain.
f Person with dementia's health and social care costs and paid/professional support to carers delivering the intervention (includes costs of training and toolkit).
g Person with dementia's health and social care costs and costs of unpaid carers' time in care and support, lost production and out-of-pocket expenditure, time valued at minimum wage. Paid/professional support to carers delivering the intervention (includes costs of training and toolkit) and time spent by carers in delivering the intervention, valued at minimum wage.

over £5400 considering health and social care costs, or at a lower WTP of over £2400 considering societal costs. The CEAC (see *Figure 4*) indicates that the probability of cost-effectiveness exceeds 97.5% over these WTP thresholds.

Carers

The incremental cost per QALY gained was £3100 (95% CI –£71,000 to £84,200). Given the 95% CIs of the ICER, we cannot be certain that the iCST and TAU alternatives are different in terms of cost-effectiveness at a WTP below the upper limit of about £84,200, but we can be confident that the intervention is cost-effective above this upper limit.[68] The probability of iCST being cost-effective from this perspective was 72% at a WTP per QALY of £20,000 and 81% at a WTP per QALY of £30,000.

From the broader societal perspective, as costs were lower and QALYs gained were higher in the intervention group, the ICER point-estimate was negative. The probability of iCST being cost-effective from this perspective was 90% at a WTP per QALY of £20,000 and 93% at a WTP per QALY of £30,000 (see *Figure 5*). There is a > 97.5% probability of cost-effectiveness at WTP values over £47,300 per QALY, given the upper confidence limit of the ICER, and we can be confident that the intervention is cost-effective above this upper limit.

Sensitivity analyses

The estimates of societal costs were tested by varying the valuation of time spent by carers in providing assistance with care and delivering the intervention using a replacement cost approach (*Tables 36* and *37*). This approximately doubled ICERs for all outcomes (*Table 38*). As measured by achieving a difference of 3.1 points in the QCPR and seen from this cost perspective, we can be confident that the intervention is cost-saving at a WTP of over £11,700, in light of sampling uncertainty. The probability of achieving a QALY gain at a WTP of £30,000 was lower than in the main analysis, at 73% (see *Figure 5*). The upper confidence limit for the ICER is much higher than in the main estimates, at £244,500 (see *Table 38*).

TABLE 36 Sensitivity analyses: person with dementia – mean costs at 6 months

Costs	iCST ($n = 129$) (95% CI)	TAU ($n = 135$) (95% CI)	Difference ($n = 264$) (95% CI)[a]
Societal: replacement cost (£)[b]	35,510 (30,900 to 40,120)	37,250 (32,470 to 42,030)	–1740 (–7920 to 4430)

a Costs equation: adjusted for site, whether or not person with dementia is taking anticholinesterase, categories of coresidents (spouse/partner and other family and/or others; other family/other; no-one), treatment allocation, costs in 3 months pre-baseline. Results rounded to nearest £10.
b Person with dementia's health and social care costs and costs of unpaid carers' time in care and support, lost production and out-of-pocket expenditure, time valued at the cost per hour of a home care worker, paid/professional support to carers delivering the intervention (includes costs of training and toolkit) and time spent by carers in delivering the intervention, valued at the cost per hour of a home care worker.

TABLE 37 Sensitivity analyses: carers – mean costs

Costs	iCST ($n = 129$) (95% CI)	TAU ($n = 135$) (95% CI)	Difference ($n = 264$) (95% CI)[a]
Annual equivalent (societal: replacement cost) (£)[b]	71,010 (61,420 to 80,600)	74,520 (64,020 to 85,020)	–3510 (–16,170 to 9140)

a Estimates from costs equation: adjusted for site, whether or not person with dementia is taking anticholinesterase, categories of coresidents (spouse/partner and other family and/or others; other family/other; no-one), treatment allocation, costs in 3 months pre-baseline. Results rounded to nearest £10.
b Person with dementia's health and social care costs and costs of unpaid carers' time in care and support, lost production and out-of-pocket expenditure, time valued at the cost per hour of a home care worker, paid/professional support to carers delivering the intervention (includes costs of training and toolkit) and time spent by carers in delivering the intervention, valued at the cost per hour of a home care worker.

TABLE 38 Sensitivity analyses: person with dementia and carer – ICER for intervention over control, from health and social care and societal perspectives

Cost perspective[a]	ADAS-Cog (95% CI)[b]	QoL-AD (95% CI)[c]	QCPR (95% CI)[d]	QALY (95% CI)[e]
Person with dementia, 6 months				
Societal: replacement cost[f]	–6600 (unbounded to unbounded)	–14,500 (unbounded to unbounded)	–3200 (–35,600 to 11,700)	NA
Carer, annual equivalent costs and outcomes				
Societal: replacement cost[f]	NA	NA	NA	–78,300 (–595,100 to 244,500)

NA, not applicable.
a Results rounded to nearest £100.
b Cost of achieving a 2.4-point difference between groups at week 26.
c Cost of achieving a 1.7-point difference between groups at week 26.
d Cost of achieving a 3.1-point difference between groups at week 26.
e Cost of achieving a QALY gain.
f Person with dementia's health and social care costs and costs of unpaid carers' time in care and support, lost production and out-of-pocket expenditure, time valued at the cost per hour of a home care worker, paid/professional support to carers delivering the intervention (includes costs of training and toolkit) and time spent by carers in delivering the intervention, valued at the cost per hour of a home care worker.

Chapter 6 Qualitative study

Background

Despite the increasing number of RCTs evaluating cognitive-based interventions for people with dementia, little is known about the experiences of people with dementia taking part. This is the first RCT to conduct an embedded qualitative study exploring experiences of people with dementia taking part in a cognitive stimulation intervention alongside their family carers. In this study we used qualitative methods to explore the views of people with dementia taking part in the iCST programme. Given that qualitative data from the development phase of the trial indicated that interpersonal aspects of the caregiving relationship may be particularly relevant within the context of a home-based, carer-led individual cognitive stimulation approach, we additionally explored whether or not taking part in iCST was associated with any changes in interpersonal aspects of quality of life such as the relationship between the person with dementia and their family carer.

Aims

To explore the experiences of people with dementia and family carers taking part in the iCST programme.

Methods

Sampling and recruitment to the qualitative study

This was a qualitative study using semistructured in-depth interviews, using a convenience sub-sample of participants allocated in the treatment group, regardless of how many sessions they completed. During the baseline assessments participants were informed about the iCST qualitative study and were invited to consent to the possibility of participating in the qualitative interview if they were assigned to the intervention group. Unblinded researchers made contact with the participants to discuss the qualitative component of the trial after they completed the intervention (at week 25). The contact was usually at monitoring visit 2, via telephone and, occasionally, via e-mail. The unblinded researcher asked participants if they would be willing to take part in an individual interview about their experiences of taking part in the iCST programme. If participants agreed to be interviewed, a confirmation letter and Participant Information Sheet were sent to them.

A subsample of 23 dyads of the group allocated to receive iCST took part, consisting of 22 people with dementia (one participant refused to participate) and 23 family carers. Demographic characteristics of the sample can be seen in *Table 39*. The mean age was 74.73 years for participants and 65.87 for family carers. People with dementia taking part in the qualitative study had a mean baseline MMSE score of 22.5, indicative of mild dementia. There were 17 spousal carers, 5 adult–child carers and 1 sibling carer. The minimum number of sessions completed was 18 and the maximum was 75, with 61% of the sample completing more than 38 sessions.

Data collection

The researcher undertaking the individual interviews was not involved in recruiting or providing the intervention to participants. Semistructured, in-depth interviews took place at the participants' homes, with each interview fully audio-recorded and transcribed. The interview questions were established by focusing mainly on non-directive questions, with overall interview duration ranging from 30 to 45 minutes. People with dementia and their carers were asked separately to describe their experiences in taking part in the iCST programme using initially open-ended questions, followed by questions focusing on specific domains, presented in *Box 3*. All interviews started with an informal conversation while the dyad welcomed the

TABLE 39 Demographic characteristics of people with dementia and family carers taking part in the qualitative study

Characteristics	People with dementia, $n = 22$ Mean (%)	Carers, $n = 23$ Mean (%)
Age	74.73 (6.00)	65.87 (13.68)
Sex		
Male	16 (73)	4 (17)
Female	6 (27)	19 (83)
Ethnicity		
White British	15 (68)	20 (87)
Other white	4 (18)	2 (8)
Caribbean	3 (14)	1 (4)
Education		
School leaver (14–16 years)	12 (54)	10 (43)
School leaver (18 years of age)	4 (18)	2 (8)
Higher education	4 (18)	6 (26)
Further education	2 (9)	4 (17)
Postgraduate	0	1 (4)
MMSE	22.5 (3.38)	
Number of iCST sessions completed	49.41 (18.38)	

BOX 3 Key topic areas explored during interviews with people with dementia and their carers about their experiences of taking part in iCST

Key topic area questions

How would you describe your experiences of taking part in the iCST programme?

How did you find the iCST programme?

How would you describe taking part in iCST to someone else?

Have you experienced any changes as a result of your participation in iCST?

Have you experienced any changes in your everyday life?

Have you experienced any changes in your relationship with your relative?

interviewer into their home, in order to build up optimal rapport and increase the reliability of the interview.[69] In the second part the interviewer went through the Participant Information Sheets with the person with dementia and their carer and explained topic areas of the questions.

Data analysis

Interviews were analysed using Framework Analysis,[70] which is considered to be a suitable and reliable method of qualitative analysis providing a systematic model for managing and mapping the data.[71] Framework Analysis consists of stages of familiarisation, identifying a thematic framework, indexing, charting, mapping and interpretation. The interviews were transcribed verbatim, checked for accuracy and read thoroughly by two independent researchers. After several readings of the interviews, a coding frame was developed using Nvivo 10 software (QSR International, Warrington, UK). Initial codes were refined and modified during the analytic process. A coding scheme was created to organise the data to interpretations. A spreadsheet was used to generate a matrix with data 'charted' into the matrix. Researchers compared and contrasted styles of summarising in the early stages of the analysis process to ensure consistency.[70] Quotations were tagged automatically by using Nvivo10.

Results

A total of 22 people with dementia and 23 carers were interviewed. Ten dyads were recruited from London, four dyads from Manchester, five dyads from Norfolk and Suffolk and four dyads from Dorset. The analyses identified five main themes in relation to participation in iCST which were common across transcripts for both people with dementia and their carers. These themes were the following: (1) iCST was described as providing opportunities for both general and specific intellectual stimulation; (2) iCST was of value and useful for both the person with dementia and carer; (3) iCST offered opportunities for enjoyment and allowed the person to take part in pleasant activities; (4) iCST promoted being active in everyday life; and (5) iCST brought the carer and person with dementia closer. An additional theme identified in the carer data was that iCST provided opportunities for carers to become more aware of the 'needs' of the person with dementia and the experience of 'living with dementia' from their perspective.

Opportunities for stimulation

A total of 73% of people with dementia and 65% of carers reported that iCST provided opportunities for general mental stimulation and non-specific memory improvement. Some participants described their experience of mental stimulation as being alert and noted that the intervention helped in terms of both raising general 'awareness of what is happening' and enabling them to 'think better'. A number of carers noticed changes in their relative's alertness, orientation and likelihood of engaging, and being active, in discussions. Non-specific memory changes were reported by both people with dementia and their carers.

> *It helped to try and get my memory back and look at different things.*
>
> *Participant (Manchester)*

> *The course has re-stimulated me to think.*
>
> *Participant (London)*

> *I found it interesting, looking at the different things and trying to remember some of the logos and different things from the past . . . It keeps the mind active and it is a good thing . . . how I would describe it . . . really it was good.*
>
> *Participant (Dorset)*

> *. . . It varied the awareness of what is happening I think, otherwise just carry on not thinking about things but then get aware of what it is all about and start thinking a little bit more about it.*
>
> *Participant (Norfolk and Suffolk)*

> *Made my relative more alert.*
>
> *Carer (London)*

He became a little more active, more willing to participate in discussions, activities that we did together outside of the activities in the book. He tended to snooze a lot before.

Carer (London)

It does sharpen up what you are doing.

Participant (Norfolk and Suffolk)

It does obviously get your mind focused on trying to think of the past as well, very interesting.

Participant (Dorset)

The activities motivate you to think better.

Participant (Norfolk and Suffolk)

However, 20% of the people with dementia did not find iCST stimulating or not stimulating enough as the activities were too easy. Although some participants and carers found that the activities were not challenging enough, they were aware of, and emphasised, the fact that the intervention was probably designed to meet the different 'needs' of a wide range of people. Carers commented that the effectiveness of the activities can vary and that this possibly depends on the topics, levels of interest and issues around level of 'difficulty' of cognitive impairment. Some participants were not quite sure about iCST when they first started the programme but later found the activities to be worthwhile.

I didn't honestly find the material all that stimulating for me.

Participant (London)

I would say there was much of it I enjoyed but I didn't gain much from it, because a lot of it wasn't appropriate for my particular stage of difficulty . . . you must have so many people at different stages, with different needs.

Participant (London)

Sometimes it is difficult, depending on the topic on the subject, the reaction is quite different sometimes.

Carer (London)

Well I wasn't quite sure, but now I have started to appreciate it.

Participant (Manchester)

Most of the things were mind stretching in the actual books but some of the things weren't, but then of course you have got a whole range of people to actually hit the book with haven't you and I thought it was worthwhile.

Participant (Norfolk and Suffolk)

Individual cognitive stimulation therapy was useful and of value for the person with dementia and carer in terms of communication

Most people with dementia and their carers found that the programme was very useful and important. Although most described iCST as a useful programme, one participant valued it as a 'learning course'. Both people with dementia and carers found the design and structure of the programme easy to adjust to and remember overall, thus providing a focus. Carers mentioned that engaging their relative in conversation can be difficult and that doing the iCST activities not only helped to stimulate thinking but helped to frame a conversation.

It was useful for us and perhaps even for other people at some time . . . it was all worthwhile in my opinion, I found it extremely good.

Participant (Norfolk and Suffolk)

It is mostly about the course, about learning and recalling . . . it has re-stimulated me to think that maybe I should talk a bit more.

Participant (London)

It does give a structure and a focus on something that you can do together and just sharpen things up and I would guess if you are bit further along it would be even more important.

Carer (London)

I would just describe it as a pack with activities to help stimulate the mind of the person with dementia and help the carer find new ways of communicating and talking to that person.

Carer (Manchester)

Opportunities for enjoyment and allowing the person with dementia to increase pleasant activities

A total of 82% of people with dementia found iCST to be enjoyable. They described the activities as pleasurable, entertaining and interesting. Carers found the activities to be enjoyable for both their relative and for themselves. Some participants mentioned that they did not remember the activities, but they were able to reflect on the enjoyment related to taking part. For one participant, the feelings of enjoyment and achievement outweighed any experience of remembering the activities.

I enjoyed the whole programme . . . if I didn't enjoy it, then there is something wrong with me and there is something wrong all together.

Participant (London)

I think we both really enjoyed it and I think some work better than others, but it was a good way of sitting down having some time dedicated to actually talking about our particular subject or something specific, and I think that was helpful and it was fun as well.

Carer (London)

I don't remember the activities, but I enjoyed what we were doing.

Participant (London)

Yeah even though like things might not stay with me . . . but it's brilliant.

Participant (Manchester)

I have felt I have done something when it is time to pack up, and put the things away . . . I enjoy doing them . . . feel you've accomplished something.

Participant (London)

Individual cognitive stimulation therapy promotes being active in everyday life

People with dementia and their carers reported that being involved in the iCST programme added value to their daily experience in terms of taking up new activities, feeling motivated and raising awareness of 'things around'. Some participants applied iCST sessions to everyday life. One couple made a journey to their home town to compare the old town with new changes. For some participants, taking part in iCST was an 'obligation', which has helped them not only to 'think better' but also to engage in other activities. A few people with dementia found that some of the activities helped them to revisit activities/hobbies that they enjoyed in the past or to look for new activities and interests. Some carers experienced changes in their everyday life, such as having 'more of a focus' or looking for further information related to cognitive stimulation activities for their relative.

It makes you aware of what is going on . . . It just keeps you going otherwise you would slump away and sleep the day away.

Participant (Norfolk and Suffolk)

It gives you a point of reference to do something and not just sit.

Participant (London)

Makes me more inquisitive and enlightens me about things.

Participant (Norfolk and Suffolk)

We were going through the street of that town, trying to remember each shop.

Participant (Norfolk and Suffolk)

I think having the obligation as we did here, to sit down in a particular day of the week or whenever it was, to actually do that, and it does make you think and work what's left of my brain, and things like that, and yes I think it did well, it did well.

Participant (Norfolk and Suffolk)

It's made me start thinking about doing what I used to do which was painting . . . over there there's about two or three paintings over there, that I've done on that table and I think I could do more painting and that might make me better, you know and I can get up and do things more easily.

Participant (London)

It gives you a break from everyday life because while you're doing this, you're concentrating on doing that, therefore your mind relaxes from other problems . . . with this it makes him think and I've noticed a difference. When he was doing that, you see, that helped him think of normal ordinary day living things.

Carer (Norfolk and Suffolk)

Individual cognitive stimulation therapy gets the carer and person with dementia 'together'

Most people with dementia and carers reported that iCST activities brought them closer, kept their 'relationship going' and helped people with dementia to 'build up confidence'. A carer emphasised that spending time doing iCST together with her relative gave her the opportunity to 'listen'.

It brings you together in a very nice way and it is good . . . we ought to continue them because it does get you together.

Participant (Norfolk and Suffolk)

It has really brought us closer . . . through it . . . because we were doing things together instead of things apart . . . If he's left alone to his own devices he loses confidence, but through doing these sort of things that helps to build them up.

Carer (Norfolk and Suffolk)

I think if it involves you in something, and particularly if you can get a laugh out of it, the barriers come down . . . We enjoyed that time together.

Participant (Norfolk and Suffolk)

. . . Just opening topics of conversation, maybe listening to her, encouraging her to express herself and talk about things rather than just getting on with the business of how are we going to sort out the mess in this flat, what shopping do we need or what bills need to be dealt with. All that kind of stuff that is quite tedious and I think it is nice to just have the time to sit down and spend half an hour just looking through some photos or looking at a book together.

Carer (Manchester)

Carers were made aware of the 'needs' of the person with dementia and 'understanding dementia in everyday life'

The final theme emerging from the carer data only was that engaging in the iCST activities with the person with dementia allowed carers to have a better understanding of their needs and to become more aware of situations their relative is likely to encounter in everyday life.

> *On the whole the experience has been really good . . . It disciplined us . . . so I think it raised an awareness of the need.*
>
> *Carer (London)*

> *I did not really notice any drastic changes . . . but the main changes were in how I was probably relating to her and thinking about how she would understand things, and how that could be in everyday situations . . . The change is probably more about me that I noticed about her.*
>
> *Carer (Manchester)*

> *My understanding of my relative's needs that have changed a lot.*
>
> *Carer (London)*

Discussion

The study aimed to explore experiences of people with dementia and their carers taking part in the iCST programme through semistructured qualitative interviews. Major themes emerging from the qualitative data were opportunities for stimulation, changes in everyday life, interpersonal issues, such as the caregiving relationship, and understanding dementia in everyday life. The study findings suggested that taking part in the iCST programme provided opportunities for both general and intellectual stimulation, helping people with dementia to 'think better' and increase their alertness and awareness.[72] Some participants perceived the design and structure of the iCST programme as a tool which helped them to open up conversations and provided a frame for communication. A large number of participants and carers found that iCST offered opportunities to be involved in enjoyable and pleasant activities, revisiting or focusing on new interests and hobbies. In line with previous qualitative findings, although a few people with dementia expressed that they could not remember all of the activities they have completed during the intervention, they were able to reflect on moments of enjoyment and their feelings.[73]

Interestingly, reports were consistent with the observation that iCST provided opportunities for people with dementia and their carers to 'come closer' and further strengthen their relationship. This is in line with results of the secondary analyses of more positive perceptions of relationship quality by people with dementia. As most people with dementia are cared for at home by family carers, it will be important for future research to understand better the factors that are likely to influence the caregiving relationship within the context of a carer-led, cognitive-based intervention. A considerable number of carers emphasised that iCST provided a framework for gaining a better understanding of the needs of the person with dementia, possibly by making carers more aware of the nature of the difficulties encountered by people with dementia and the experience of dementia in everyday life from the perspective of the person with dementia.

There are several limitations in this qualitative study, especially in relation to the fact that this was a convenience subsample. Most participants interviewed have done well with the intervention and reported higher than average compliance, which may have biased findings towards reporting positive changes related to the intervention. We did not interview dyads that did not complete any sessions or reported poor compliance (i.e. 10 sessions or fewer). In addition, data could have been affected by social desirability bias and participants thinking that the intervention has worked. Most people with dementia and their carers found the iCST programme to be interesting, useful and of value; however, a few reported that the programme was too easy and did not help them in terms of stimulating their thinking, judging the

programme overall as not suitable for them. Future research should investigate issues of suitability of cognitive-based interventions and the importance of matching activities to personal preferences and 'level of stimulation'.

This study reflected the experiences of people with dementia and their carers taking part in iCST and provided further insight into the perspectives of people with dementia and their feelings relating to engaging in a home-based cognitive stimulation programme. Some participants did not remember details of the activities but they were able to reflect on feelings of enjoyment and expressed the importance and value of taking part, its impact on their everyday life and their relationship with their family carer. The results indicate that many carers and people with dementia found iCST to be of great value in promoting mental stimulation and communication, and enhancing their relationship. These findings indicate that it will be important for future studies to include qualitative data in the design and evaluation of cognitive-based interventions for people with dementia and their carers.

Chapter 7 Discussion

Main findings

The iCST trial was a pragmatic, multicentre, RCT of a complex, individual, carer-led cognitive stimulation intervention. The trial was designed to evaluate the effects of iCST on cognition and quality of life for people with dementia and their family carers. We recruited a total of 356 caregiving dyads, making this study the largest in the current literature on CST-based approaches.

Primary outcomes

For people with dementia, the primary outcomes did not indicate any specific benefit for those allocated to receive iCST, given that there was no clinically significant improvement in cognition or quality of life compared with people with dementia receiving usual care. Carers' physical and mental health was not significantly different between the intervention and control groups.

Secondary outcomes

We found no evidence that iCST reduced behavioural and psychological symptoms or depressive symptoms for people with dementia. There was also no evidence of change in activities of daily living. Although no effects were observed on most of the secondary outcomes, analyses indicated that people with dementia allocated to receive the intervention reported improvements in relationship quality with their family carer. iCST did not improve secondary outcomes such as carers' mood, resilience or relationship quality with the person with dementia. Despite no differences in most secondary outcomes, health-related quality of life ratings for family carers allocated to the intervention group improved at the primary end point. This, however, was in contrast to no evidence of improvement on carers' SF-12 component scores. This discrepancy in findings between the two generic instruments (SF-12 and EQ-5D-3L) may reflect intrinsic differences between these two instruments or differences in terms of each instrument's sensitivity to change.

This is the first economic analysis of an iCST intervention for people with dementia and their family carers. Although costs from either the health and social care or the societal perspective did not differ substantially between the groups at either follow-up time point, there was a consistent pattern of lower costs in the iCST group over the 26-week period. In terms of the primary outcomes for people with dementia, it appears that iCST is not more cost-effective than TAU from either cost perspective, when we take sampling uncertainty into account. There are no established societal WTP thresholds for improvements in ADAS-Cog, QoL-AD or QCPR. In terms of QALY gain for carers, iCST was more effective than TAU. Taking carers' costs into account, costs in the iCST group were lower, but not significantly lower, than in the TAU group. Taking sampling uncertainty into account, and assuming no further change in utility or costs in either group for the following 6 months, the probability that iCST is cost-effective was 93% at a societal WTP per QALY of £30,000. Under the same assumptions, we can be confident that iCST is cost-effective at a societal WTP of approximately £47,300 to gain a QALY, and, excluding costs to carers from this calculation, we can be confident that iCST is cost-effective at approximately £84,200 per QALY. The intervention can be considered to be cost-effective in improving unpaid carers' health-related quality of life only at a societal WTP well above the NICE threshold of £20,000–30,000. However, societal decision-makers may be willing to accept somewhat lower levels of certainty to achieve this outcome. Given the results of the sensitivity analysis, this conclusion is dependent on a relatively low valuation of carer time.

When considering the number of sessions received, as opposed to allocation, some improvements were observed. People with dementia completing more sessions were more likely to experience gains in terms of the caregiving relationship at 26 weeks. Reports of improvements in the caregiving relationship by people with dementia are consistent with previous studies indicating that meaningful activities conducted alongside family carers can preserve and enhance the caregiving relationship.[74] Improvements were observed for carers completing more sessions with their relative, expressed by a reduction in depressive symptoms. These findings are consistent with previous research, in which a home-based cognitive stimulation programme was associated with lower depressive affects in carers.[11]

Overall, however, findings are in contrast to previous studies demonstrating that group short-term CST benefits cognition and quality of life for people with dementia,[6] and maintains quality of life improvements when provided long term.[19] These results also contrast with previous RCTs reporting benefits in cognition for people with dementia associated with home-based individual RO/cognitive stimulation.[12] In relation to effects on cognition, not replicating results of group CST approaches may be attributable to the lack of a group setting when CST sessions are provided. In addition, although we tried to use similar activities to those provided in group CST, it is unlikely that the activities were the same, indicating that differences may relate to differences on group versus individual CST approaches. In relation to effects of quality of life, this is the first study to include a measure of quality of life for a home-based approach for people with dementia. Our results therefore indicate that the benefits in quality of life are more likely to be associated with interventions that combine or use CST approaches within a social setting. Our findings may be of importance in relation to updating the Cochrane review. This may indicate the need for separate analyses of group and individual approaches to cognitive stimulation.

Treatment implementation is an important parameter when evaluating psychosocial interventions. In order to ensure that iCST was 'delivered as intended', we used a treatment protocol that specified all components of the intervention in detail, in order to ensure that the intervention was delivered as planned. Each unblinded researcher received training in iCST, and there were frequent opportunities for researchers supporting carers in the delivery of iCST to receive supervision and feedback. Furthermore, there were a number of challenges associated with implementing iCST, particularly with regard to carers fitting iCST into a busy timetable, the lack of 'stimulation' for some participants and difficulties reported by carers in engaging in the intervention with their relative. Compliance will be, therefore, an important component to consider in order to optimise similar psychosocial interventions for people with dementia and their carers. At this stage, it is not clear if there are any specific characteristics that would identify the very low compliance group who completed no sessions at all, but we plan to look at further analyses on this topic in due course.

In line with our projections in relation to sample size, a total of 81% of the sample completed the 13-week assessments and 71% completed the 26-week assessments. The most common reason for not being available to complete follow-up appointments was reporting problems with engaging in iCST, indicating that, although the intervention may have a high uptake, it still may be difficult or not suitable for some carers and people with dementia. Although most carers were able to engage in iCST with their relative, there were frequent reports by carers of struggling to engage with their relative in the sessions and, often, this was a common reason of loss to follow-up. A total of 22% of dyads allocated to receive iCST did not complete any sessions and 13% completed fewer than 10. A threshold of completing over 38 sessions was set on the basis of number of sessions completed by the whole of the sample, as indicative of compliance to the intervention. We did not find any evidence of differential attrition, and analyses exploring differences between completers versus non-completers did not suggest any differences between the two groups in terms of baseline characteristics.

In terms of cognition and quality of life, our findings do not provide support for the use of home-based cognitive stimulation programmes for people with dementia, which is contrary to previous work on home-based memory rehabilitation[10] and RO for people with dementia.[12] It is unclear which factors could account for the differential efficacy. It is likely that in some studies participants are highly selected,

resulting in different patient groups recruited and, therefore, different levels of dementia severity and cognitive function. For example, in our study most of the sample had mild dementia in comparison to previous studies. Other factors could reflect differences between studies in terms of power or chance variation, given that previous studies are of varying quality with small samples overall.[2] Importantly, although treatment compliance is not reported in detail across studies, the 'dose' received in each of the studies may be an important determinant of efficacy.

Despite generally negative findings, people with dementia reported better relationship quality with their carer, indicating that individual cognitive stimulation interventions have the potential to improve inter-relationship outcomes for people with dementia. Relationship quality, rated by the person with dementia, has been shown to be an important contributor to quality of life for people with dementia and is the cornerstone of relationship-centred care.[75] We also found that health-related quality of life for family carers significantly increased, indicating that carer involvement in cognitive-based interventions may increase carer well-being. This may be related to the fact that, although iCST was developed largely as a home-based, carer-led, individual cognitive stimulation approach, the intervention incorporated additional psychoeducational elements such as communication, opportunities to increase pleasant events for both carers and people with dementia, which are components less likely to be incorporated in group CST-based approaches. This is consistent with the findings of the qualitative study where carers reported that iCST provided opportunities to understand dementia, its impact on communication and confidence for the person with dementia, and to increase pleasant activities both for themselves and their relative. Interventions that therefore target communication between people with dementia and their carers may reduce the strain on the caregiving relationship and may potentially improve general well-being outcomes for both.

A further variable of interest is unblinded researchers' level of expertise and experience, which is an important factor to consider in the development of psychosocial interventions. Consultation groups with unblinded researchers indicated that they were generally well received by carers and people with dementia, although dyads differed widely in their level of engagement with the intervention. The level of expertise was judged as sufficient, and training and background in dementia care was considered to be important in supporting carers in delivering the sessions.

Implications for health care

It was expected that iCST may be beneficial for people with dementia in terms of cognition; however, this was based on smaller studies using both cognitive stimulation and RO techniques and using less well-defined methods. However, it is notable that participants in this study had better cognition (mean baseline MMSE score of 21) than those in the original group CST study (mean baseline MMSE score of 14), which was also limited to people with dementia scoring between 10 and 24 on the MMSE. This suggests that in the current study there was less scope for improvement, and some participants may have had cognitive function that was too high to benefit from iCST.

Most of the evidence on effects on cognition for cognitive stimulation is based on group approaches, so future research will need to focus on understanding the mechanisms that are more likely to be associated with the reported effects and differential effects of outcomes between group versus individual approaches. There was evidence in this trial that some people with dementia and their family carers will not be able to engage successfully in iCST, as 34% of the sample allocated to receive the intervention completed 0 or fewer than 10 sessions. Our qualitative findings indicated that, although most people with dementia and carers enjoyed the sessions, there were also a few comments that the iCST sessions were not challenging enough, indicating that the type of carer-led, cognitive-based intervention may be key in terms of producing a therapeutic effect. Despite overall negative findings, improvements on the carer–patient relationship and carers' health-related quality of life suggest that iCST may have a key role in improving communication for people with dementia and their carers.

Limitations

Participants dropping out will have introduced bias if they had a different response to the intervention or TAU conditions compared with those that completed the trial. However, there was no evidence from demographic variables or baseline outcome scores that those who did complete the study were different from those who did not.

Although significant efforts were made to obtain outcome data, the trial may have been underpowered to detect significant differences for the primary outcome measure owing to the attrition rate and low levels of compliance in the overall number of sessions completed. Nevertheless, this is the largest RCT of a cognitive stimulation intervention in which carers lead the sessions and which shows no effect on cognition and quality of life for people with dementia compared with usual care.

An important limitation is that the observed differences of improvement in the caregiving relationship for people with dementia and health-related quality of life for carers may be attributable to incidental findings, driven by the multiple comparisons tested, and may, therefore, be attributable to chance. Despite people with dementia and carers expressing interest in the intervention, compliance was low overall, indicating that cognitive stimulation interventions delivered by carers may not be the ideal mode of delivery for many, thereby limiting wider applicability and generalisability of this approach, and indicating that better methods of monitoring and support for adherence are needed. Identifying subgroups of caregiving dyads that are more likely to benefit from this intervention is likely to be an important aim for future research.

Recommendations for future research

The null effect reported in this study leaves unanswered the question of whether or not carer-led cognitive stimulation interventions are effective. Despite the appeal of home-based programmes led by carers, cognitive stimulation approaches may be better provided on a group basis unless further evidence becomes available.

1. If carer-led interventions are to be further pursued, future research should identify which factors are more likely to make the intervention most successful and adaptable to the needs of people with dementia. As feedback from people with dementia in the qualitative interviews indicated that some sessions were not stimulating enough, future studies should consider that people earlier in the disease trajectory may have different cognitive stimulation needs from those with moderate dementia.
2. Given that less than half of the iCST group completed at least two sessions per week this reduced the power of the study to identify potential differences with the control group and indicates limitations in relation to the applicability of the intervention. Future work is needed to investigate the characteristics of caregiving dyads that are most likely to adhere to and benefit from carer-led individual cognitive stimulation interventions and methods to improve adherence. The involvement of paid domiciliary care workers or volunteer befrienders in delivering sessions should be explored further, as this may increase adherence by placing less responsibility on family carers.
3. Given that carer-led, cognitive-based approaches are relatively new treatments, research designs that address their efficacy are more relevant than designs addressing mechanisms at this point. Therefore, comparisons of group versus individual approaches are likely to be premature at this stage.
4. It is important that future research and different research groups evaluate further the effects of individual cognitive stimulation interventions. This work will help to ensure the reliability and robustness of the effects reported in this trial, in relation to benefits of relationship quality for people with dementia and health-related quality of life for carers.

Conclusions

The evidence from this trial suggests that taking part in iCST sessions does not result in improvements on cognition or quality of life for people with dementia. There was no evidence of improvements for carers' mental and physical health. There was no evidence that iCST improved secondary outcomes for people with dementia, such as activities of daily living, mood or behavioural and psychological symptoms. Analyses indicated that iCST did not confer any benefit for carers' mood, resilience or relationship quality with the person with dementia. Although people with dementia receiving iCST reported better relationship quality with their carer (in itself, an important component of quality of life for people with dementia) and carers reported improved health-related quality of life, these findings need to be interpreted with caution given limitations owing to multiple testing. Despite efforts to minimise loss to follow-up, the study may have still been underpowered to detect significant differences for the primary outcome. Given that iCST did not achieve the expected change, it is unlikely to lead to clinical benefit in improving cognition and quality of life for people with dementia.

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Contributions of authors

Vasiliki Orgeta (Senior Research Associate) supervised and planned the development of iCST, contributed to the development of iCST materials, planned and conducted one of the development studies, was responsible for the day-to-day operation and management of the study in all centres, contributed to the study design and drafted most of the final report.

Phuong Leung (PhD researcher) contributed to the development of iCST materials, trial management and data collection, planned and conducted the qualitative study, and wrote sections of this report.

Lauren Yates (PhD researcher) contributed to the development of iCST materials, recruitment and data collection, planned and conducted two of the development studies, and wrote sections of this report.

Sujin Kang (Research Officer, Statistics) was a trial statistician, undertook the statistical analyses and drafted sections of the report.

Zoe Hoare (Research Fellow, Statistics) was a trial statistician, developed the statistical analysis plan, undertook the statistical analyses and drafted sections of the report.

Catherine Henderson (Research Fellow, Health Economics) advised on the supervision of data collection of health economics, undertook the health economic analyses and drafted the health economic section of the report.

Chris Whitaker (Senior Statistician) was trial statistician, advised on the statistical analysis plan, the statistical analyses and statistical input in sections of the report.

Alistair Burns (Professor of Old Age Psychiatry, Honorary Consultant Old Age Psychiatrist) was principal investigator of the Manchester site.

Martin Knapp (Professor of Health Economics) oversaw the health economics of the study.

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Aimee Spector (Senior Lecturer in Dementia) contributed to the planning and design of the study and provided expertise in CST.

Steven Roberts (Head of Dementia Services) was principal investigator of the Lincolnshire site.

Ian T Russell (Professor of Clinical Trials) contributed to the planning and design of the study and oversaw the methodological aspects of the trial.

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Robert T Woods (Professor of Clinical Psychology of Older People) contributed to the planning and design of the study, provided expertise in CST and was principal investigator of the Bangor site.

Martin Orrell (Professor of Ageing and Mental Health) was the chief investigator, conceived, designed and planned the study, and supervised its conduct. He was the principal investigator for the London sites and contributed to all sections of this report.

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Data sharing statement

All available data can be obtained by contacting the corresponding author.

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Appendix 1 Development study 1: service users' views about the intervention

TABLE 40 Demographic characteristics of people with dementia and family carers: Development study 1

Characteristics	Focus groups	Individual interviews
People with dementia	***n* = 18**	***n* = 10**
Sex, *n* (%)		
Male	7 (39)	5 (50)
Female	11 (61)	5 (50)
Mean age (years), *n* (SD)	80.50 (5.80)	84.44 (4.10)
Ethnicity, *n* (%)		
White	18 (100)	10 (100)
Living status, *n* (%)		
With spouse	6 (33)	6 (60)
With adult child	2 (11)	3 (30)
Alone	4 (22)	1 (10)
In care	2 (12)	–
Unknown	4 (22)	–
Family carers	***n* = 14**	***n* = 10**
Gender, *n* (%)		
Male	6 (43)	3 (30)
Female	8 (57)	7 (70)
Mean age (years), *n* (SD)	65.23 (9.65)	67.67 (14.35)
Ethnicity, *n* (%)		
White	11 (79)	10 (100)
Relationship, *n* (%)		
Spouse	7 (50)	6 (60)
Adult child	7 (50)	4 (40)
Cohabiting, *n* (%)		
Yes	8 (57)	9 (90)
Years caring, *n* (range, SD)	5.61 (1–16, 4.03)	2.89 (1.5–7, 1.78)

TABLE 41 Discussion guide themes for focus groups and individual interviews with people with dementia and family carers: Development study 1

		Focus group		Interview		
Themes	**Discussion points**	**Carer**	**Participant**	**Combined**	**Carer**	**Participant**
Mental stimulation	Importance of mental stimulation	✗	✗	✗	✗	✗
	Characteristics/types of mentally stimulating activities	✗	✗	✗	✗	✗
iCST manual						
Content	Additional information required	✗		✗	✗	
	Additional information required	✗		✗	✗	
Layout	Size of text/images and quality	✗		✗	✗	
	Layout and format	✗		✗	✗	
General	Positive/negative comments	✗		✗	✗	
	Ease of use	✗		✗	✗	
iCST activity workbook						
Content	Clarity of instructions	✗		✗	✗	
	Activities	✗		✗	✗	
Layout	Layout and format	✗		✗	✗	
	Quality of images	✗		✗	✗	
Activities	Level of difficulty		✗	✗		✗
	Level of engagement/enjoyment		✗	✗		✗
	Issues around improving activities		✗	✗		✗
Feasibility of iCST	Acceptability/iCST schedule (30 minutes/three times weekly)	✗	✗	✗	✗	✗
	Anticipated difficulties	✗		✗	✗	
	Support needed	✗		✗	✗	
	Group- vs. home-based training	✗		✗	✗	

TABLE 42 Results of qualitative analyses of focus groups and individuals interviews with people with dementia and family carers: Development study 1

Themes of qualitative analyses	Person with dementia	Family carer
Mental stimulation		
Importance of mental stimulation	'Keep up to date' and improve thoughts	Important for person with dementia
	Keeps from 'going backwards'	Person is dependent on carer for stimulation
	Keeps mind and body active	Improves mood, alertness and quality of life
Mentally stimulating activities	Newspapers, watching TV, sports/exercise	Playing cards/quizzes, attending clubs/ social events/trips, keeping fit, well-being activities
	Puzzles/quizzes, household tasks	
iCST manual/activity workbook		
Content/language/terminology	Awakens thoughts/ideas, 'opens the mind'	Provides ideas to stimulate discussion
	Include more images as 'words are a problem'	Easy to understand, instructions clear
Layout/format/size of text/images	Ring-bound hard-copy material preferred	Increase size of text/images
	Increase size of text	Layout should discourage feeling 'being tested'
	Good, pleasing to the eye, bright and happy, putting you 'in a good mood'	Ring-bound and hard-copy material preferred
		Outstanding, great colours, nicely done
iCST activities	Reduce difficulty level	Reduce difficulty level and avoid 'deep' questions
	Include factual information	Use activities that trigger memories
Feasibility	Limited time of family carers	Professionals delivering better suited
	Important for carers to assist	Sessions feel 'formal'
	Household duties may be a barrier	Useful for winter months
	Person with dementia has plenty of time	Accommodate everyday events/personal needs
	Carer will not need a lot of support	Sessions in chunks would feel less like 'therapy'
		Mental/physical challenges of caring
		Training would be necessary
Resources/training		Resources forum/'iCST expert' carers
		Phone support preferred over visits
		Group training encourages peer learning
		Individual training personal/easier to ask questions and not require arranging care

Appendix 2 Development study 2: expert feedback

TABLE 43 Results of the online survey for the evaluation of the iCST manual: expert knowledge in dementia – Development study 2

Statement	Response options, *n* (%)					
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Conclusion
Language is easy to understand	0	2 (8)	2 (8)	6 (24)	15 (60)	High agreement
Size of font is appropriate	0	2 (8)	1 (4)	12 (48)	10 (40)	Moderate agreement
Manual is stimulating/ engaging	0	1 (4)	4 (16)	16 (64)	4 (16)	Moderate agreement
Amount of information is appropriate	1 (4)	1 (4)	4 (16)	14 (56)	5 (20)	Moderate agreement
Activities are clearly presented	0	0	2 (8)	12 (48)	11 (44)	Moderate agreement
Layout is appropriate	0	0	2 (8)	11 (44)	12 (48)	Moderate agreement
Adequate variety in activities	0	0	4 (16)	15 (60)	6 (24)	Moderate agreement
Participant/carer will enjoy the activities	0	0	6 (24)	16 (64)	3 (12)	Moderate agreement

TABLE 44 Results of the online survey for the evaluation of the iCST workbook: expert knowledge in dementia – Development study 2

Statement	Response options, *n* (%)					
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Conclusion
Language is easy to understand	0	0	1 (4)	11 (44)	13 (52)	High agreement
Size of font is appropriate	0	0	1 (4)	14 (56)	10 (40)	Moderate agreement
Workbook is stimulating/ engaging	0	0	3 (12)	16 (64)	6 (24)	Moderate agreement
Amount of information is appropriate	0	0	1 (4)	16 (64)	8 (32)	Moderate agreement
Activities are clearly presented	0	0	1 (4)	13 (52)	11 (44)	Moderate agreement
Layout is appropriate	0	0	0	14 (56)	11 (44)	Moderate agreement
Adequate variety in activities	0	0	3 (12)	15 (60)	7 (28)	Moderate agreement
Participant/carer will enjoy the activities	0	0	5 (20)	14 (56)	6 (24)	Moderate agreement

Appendix 3 Development study 3: field testing of the intervention for final refinement prior to the main trial

TABLE 45 Demographic characteristics of people with dementia and carers taking part in field testing: Development study 3

Demographic characteristics, *N* = 25	
Family caregiving dyads,* n = *19	
People with dementia	
Age, mean (SD)	80.60 (5.15)
Sex, %	
Male	47.4
Female	52.6
Ethnicity, %	
White	78.9
Black	5.3
Unknown	15.8
Living status, %	
Living with spouse	42.1
Living with adult child	15.8
Living alone	26.3
Unknown	15.8
Carers	
Age, mean (SD)	65.00 (10.52)
Sex, %	
Male	21.1
Female	78.9
Ethnicity, %	
White	84.2
Mixed	5.3
Unknown	10.5
Relationship, %	
Spouse	57.9
Adult child	42.1
Years caring, mean (SD)	4.32 (1.87)

continued

TABLE 45 Demographic characteristics of people with dementia and carers taking part in field testing: Development study 3 (*continued*)

Demographic characteristics, *N* = 25	
Paid caregiving dyads, **n = 6**	
People with dementia	
Age, mean (SD)	83.25 (8.22)
Sex, %	
Male	50.0
Female	50.0
Ethnicity, %	
White	83.3
Unknown	16.7
Living status, %	
Living alone	83.3
Living with paid carer	16.7
Carers	
Age, mean (SD)	42.6 (16.13)
Sex, %	
Male	16.7
Female	83.3
Ethnicity,%	
White	33.3
Black	33.3
Mixed	33.3
Years caring, mean (SD)	1.75 (1.50)

TABLE 46 Number of sessions completed by participants during field testing: Development study 3

Sessions completed (range 4–24) (*N* = 9)	
0–6, *n* (%)	1 (11)
7–11, *n* (%)	5 (56)
12–16, *n* (%)	2 (22)
17–24, *n* (%)	1 (11)
Mean number of sessions, *n* (SD)	11.56 (5.59)

TABLE 47 Evaluation ratings of iCST sessions during the field-testing phase: Development study 3

Evaluation ratings of iCST sessions, ($n = 9$)					
		Frequency			
iCST theme		Interest	Communication	Enjoyment	Difficulty level
My life sessions (6 ratings)	Not at all (1)	0	0	0	0
	A little (2)	0	0	0	4
	Moderately (3)	6	1	4	2
	Quite a lot (4)	0	5	2	0
	Extremely (5)	0	0	0	0
Mean ratings (SD)		3.00 (0.00)	3.83 (0.41)	3.33 (0.52)	2.33 (0.52)
Current affairs (4 ratings)	Not at all (1)	1	0	1	1
	A little (2)	0	2	1	1
	Moderately (3)	1	0	2	2
	Quite a lot (4)	2	2	0	0
	Extremely (5)	0	0	0	0
Mean ratings (SD)		3.00 (1.41)	3.00 (1.15)	2.25 (0.95)	2.25 (0.96)
Food (6 ratings)	Not at all (1)	1	0	2	1
	A little (2)	3	2	2	0
	Moderately (3)	0	0	0	2
	Quite a lot (4)	2	4	2	1
	Extremely (5)	0	0	0	2
Mean ratings (SD)		2.50 (1.22)	3.33 (1.03)	2.33 (1.37)	3.50 (1.51)
Being creative (5 ratings)	Not at all (1)	2	2	2	4
	A little (2)	0	1	0	1
	Moderately (3)	1	0	1	0
	Quite a lot (4)	2	2	2	0
	Extremely (5)	0	0	0	0
Mean ratings (SD)		2.50 (1.22)	3.33 (1.03)	2.33 (1.37)	3.50 (1.51)
Number games (4 ratings)	Not at all (1)	0	0	0	2
	A little (2)	1	0	2	1
	Moderately (3)	1	2	2	1
	Quite a lot (4)	2	2	0	0
	Extremely (5)	0	0	0	0
Mean ratings (SD)		3.25 (0.96)	3.50 (0.58)	2.50 (0.58)	1.75 (0.96)
Quiz games (2 ratings)	Not at all (1)	0	0	0	2
	A little (2)	0	0	0	0
	Moderately (3)	0	0	0	0
	Quite a lot (4)	2	1	1	0
	Extremely (5)	0	1	1	0

continued

TABLE 47 Evaluation ratings of iCST sessions during the field-testing phase: Development study 3 (*continued*)

Evaluation ratings of iCST sessions, ($n = 9$)					
		Frequency			
iCST theme		Interest	Communication	Enjoyment	Difficulty level
Mean ratings (SD)		3.25 (0.96)	3.50 (0.58)	2.50 (0.58)	1.75 (0.96)
Sounds (3 ratings)	Not at all (1)	0	0	2	0
	A little (2)	0	0	0	1
	Moderately (3)	0	0	1	0
	Quite a lot (4)	3	3	0	2
	Extremely (5)	0	0	0	0
Mean ratings (SD)		4.00 (0.00)	4.00 (0.00)	1.67 (1.15)	3.33 (1.15)
Physical games (6 ratings)	Not at all (1)	0	0	0	4
	A little (2)	0	0	0	0
	Moderately (3)	2	2	2	2
	Quite a lot (4)	2	0	2	0
	Extremely (5)	2	4	2	0
Mean ratings (SD)		4.00 (0.89)	4.33 (1.03)	4.00 (0.89)	1.67 (1.03)
Categorising objects (6 ratings)	Not at all (1)	0	0	0	2
	A little (2)	0	0	0	4
	Moderately (3)	4	4	2	0
	Quite a lot (4)	2	2	4	0
	Extremely (5)	0	0	0	0
Mean ratings (SD)		3.33 (0.52)	3.33 (0.52)	3.67 (0.52)	1.67 (0.52)
Household treasures (6 ratings)	Not at all (1)	0	0	0	2
	A little (2)	0	0	0	4
	Moderately (3)	4	2	6	0
	Quite a lot (4)	2	4	0	0
	Extremely (5)	0	0	0	0
Mean ratings (SD)		3.33 (0.52)	3.67 (0.52)	3.00 (0.00)	1.67 (0.52)
Useful tips (5 ratings)	Not at all (1)	0	0	1	2
	A little (2)	0	0	0	2
	Moderately (3)	3	1	2	1
	Quite a lot (4)	2	4	2	0
	Extremely (5)	0	0	0	0
Mean ratings (SD)		3.40 (0.55)	3.80 (0.44)	3.00 (1.22)	1.80 (0.84)
Thinking cards (2 ratings)	Not at all (1)	0	0	0	0
	A little (2)	0	0	0	2
	Moderately (3)	0	0	0	0
	Quite a lot (4)	2	2	2	0
	Extremely (5)	0	0	0	0
Mean ratings (SD)		4.00 (0.00)	4.00 (0.00)	4.00 (0.00)	4.00 (0.00)

TABLE 47 Evaluation ratings of iCST sessions during the field-testing phase: Development study 3 (*continued*)

Evaluation ratings of iCST sessions, ($n = 9$)					
		Frequency			
iCST theme		Interest	Communication	Enjoyment	Difficulty level
Art discussion (4 ratings)	Not at all (1)	0	0	0	4
	A little (2)	0	0	0	0
	Moderately (3)	2	0	0	0
	Quite a lot (4)	0	2	2	0
	Extremely (5)	2	2	2	0
Mean ratings (SD)		4.00 (1.15)	4.50 (0.58)	4.50 (0.58)	1.00 (0.00)
Faces/scenes (4 ratings)	Not at all (1)	0	0	0	2
	A little (2)	0	0	0	0
	Moderately (3)	0	0	2	2
	Quite a lot (4)	4	4	2	0
	Extremely (5)	0	0	0	0
Mean ratings (SD)		4.00 (0.00)	4.00 (0.00)	3.50 (0.58)	2.00 (1.15)
Word games (14 ratings)	Not at all (1)	0	0	0	8
	A little (2)	0	0	0	2
	Moderately (3)	0	2	2	4
	Quite a lot (4)	12	8	4	0
	Extremely (5)	2	4	8	0
Mean ratings (SD)		4.14 (0.36)	4.14 (0.66)	4.43 (0.75)	1.71 (0.91)
Slogans and visual clips (4 ratings)	Not at all (1)	0	0	2	2
	A little (2)	0	0	0	0
	Moderately (3)	2	2	0	0
	Quite a lot (4)	2	2	2	2
	Extremely (5)	0	0	0	0
Mean ratings (SD)		3.50 (0.58)	3.50 (0.58)	2.50 (1.73)	2.50 (1.73)
Orientation (7 ratings)	Not at all (1)	0	0	2	2
	A little (2)	2	2	2	2
	Moderately (3)	5	4	1	1
	Quite a lot (4)	0	1	2	0
	Extremely (5)	0	0	0	2
Mean ratings (SD)		2.71 (0.48)	2.86 (0.69)	2.43 (1.27)	2.71 (1.70)
Using money (6 ratings)	Not at all (1)	0	0	0	4
	A little (2)	2	0	0	0
	Moderately (3)	2	4	4	2
	Quite a lot (4)	0	0	0	0
	Extremely (5)	2	2	2	0

continued

TABLE 47 Evaluation ratings of iCST sessions during the field-testing phase: Development study 3 (*continued*)

Evaluation ratings of iCST sessions, ($n = 9$)					
		Frequency			
iCST theme		Interest	Communication	Enjoyment	Difficulty level
Mean ratings (SD)		3.33 (1.37)	3.67 (1.03)	3.67 (1.03)	1.67 (1.03)
Childhood (4 ratings)	Not at all (1)	0	0	0	2
	A little (2)	0	0	0	0
	Moderately (3)	0	0	0	2
	Quite a lot (4)	4	2	2	0
	Extremely (5)	0	2	2	0
Mean ratings (SD)		4.00 (0.00)	4.50 (0.58)	4.50 (0.58)	2.00 (1.54)

TABLE 48 Information collected during set-up visits to inform main trial: Development study 3 ($n = 22$; family carers only)

Carer ratings			Researcher ratings		
	%	Mean (SD)		%	Mean (SD)
iCST knowledge		***3.04 (1.00)***	***Success of set-up visit***		***3.77 (0.75)***
Poor (1)	0		Poor (1)	0	
Fair (2)	31.8		Fair (2)	0	
Good (3)	45.5		Good (3)	41.2	
Very good (4)	9.1		Very good (4)	41.2	
Excellent (5)	13.6		Excellent (5)	17.6	
Confidence in iCST		***3.95 (0.78)***	***Successful engagement***		***3.70 (0.47)***
Very little (1)	0				
Some (2)	0		Not at all (1)	0	
Fair (3)	31.8		A little (2)	0	
Good (4)	40.9		Quite a bit (3)	29.4	
Very confident (5)	27.3		A lot (4)	70.6	
Support required		***2.10 (0.55)***	***Support required***		***1.52 (0.51)***
Not at all (1)	5.0		Not at all (1)	47.1	
A little (2)	85.0		A little (2)	52.9	
Quite a lot (3)	5.0		Quite a bit (3)	0	
A lot (4)	5.0		A lot (4)	0	
Training arrangement					
Own home	54.5				
In groups	22.7				
Either	22.7				

TABLE 49 Qualitative findings of the field-testing phase using standardised telephone interviews: Development study 3 ($n = 22$)

Themes	Family carers	Paid carers
Barriers in iCST delivery	Time/availability	Carer on annual leave
	Health of person with dementia/carer	Difficulties motivating/engaging person with dementia
	Job/family commitments	Life events
	Difficulties motivating/engaging person with dementia	Health of the person with dementia
	Life events	Visits suspended or person with dementia on holiday
Barriers specific to iCST activities/programme	Using opinion rather than facts	Person with dementia demotivated if activity is too easy
	Person with dementia finds activities difficult	
	Locating resources to use	
iCST programme/structure	Doing sessions in 'chunks'	Make sessions feel 'informal'
	Make sessions feel 'informal'	Completing sessions out of order helpful
	Separate orientation with current affairs	
	Skip orientation discussion	
	Repeating sessions out of order helpful	
Frequency/duration of iCST sessions	Difficult to complete three sessions weekly	Feasible to complete three sessions weekly
	Sessions last longer than 30 minutes	
iCST manual	Easy to use	Easy to use
	Promotes discussion/ideas	Important to adjust ratings of difficulty
	Provides variation in difficulty of activities	Remove reference to 'person with dementia'
iCST resources	Feasible to use own resources when prompted	Feasible to use own resources when prompted
Response to the iCST activities from the person with dementia	Enjoying activities	Enjoying activities
	Asking questions can make person nervous	Mood is lifted
	Mood is lifted, sense of achievement	Person interested/engaged in activities
	Improvements in conversation	
Caregiving relationship	Gives carer a sense of purpose	
	Brings dyad 'closer together'	
	Activities help dyad to communicate	
	Opportunities to laugh together	
	Carer is giving person more of their time	
Support in delivering iCST	None needed	None needed
	Friends and family help with sessions	Family members help with sessions
	Family is often too busy to help	

Appendix 4 Economic evaluation: unit costs and types of care and support tasks carried out by carers

TABLE 50 Unit costs

Service use item	Unit cost (£)	Sources
Costs of professional support (intervention)		
iCST training costs	17,288	Project team
Per-participant (total divided by 180 intervention participants)	96	
iCST manual and materials, per participant	94	Project team
Weighted cost of professional support, per hour	49	Project data collection; Health and Social Care Information Centre 2012[76]
Mileage costs per one-way journey (per site)	Range: 4–32	Project data collection; NHS Employers[77]
Carer costs (value of time)		
Replacement cost: average cost of independent sector, local authority-purchased home worker, per hour	19	Curtis 2013[55]
Opportunity cost: minimum wage, per hour	6	UK Government[78]
Hospital costs		
Inpatient bed-day, per specialty	Range: 344–1495	Department of Health[54]
Inpatient bed-day, weighted average across adult specialties	577	Department of Health[54]
Day attendances	Range: 540–817	Department of Health[54]
Day case, weighted average across specialties	693	Department of Health[54]
Outpatient attendances	Range: 27–468	Department of Health[54]
Outpatient, weighted average of follow-up attendances across adult specialties	98	Department of Health[54]
Average cost of memory clinic contact	465	Curtis 2013[55]
A&E attendances, admitted and non-admitted	Range: 115–160	Department of Health[54]
Primary and community health services		
District nursing time: average cost of direct contact, per contact	38	Department of Health[54]
District nursing time: average cost of an hour of home visit, per minute	1	Curtis 2013[55]
District nursing visit: average cost of an hour of nurse time, per minute	0.7	Curtis 2013[55]
Practice nurse visit: average cost of an hour of direct contact time, per minute	0.7	Curtis 2013[55]
Practice nurse visit: per consultation, per consultation	11	Curtis 2013[55]
Specialist nursing; adult, face to face, per contact	Range: 45–90	Department of Health[54]
Weighted average of specialist nursing across adult specialities, per contact	59	Department of Health[54]
NHS community occupational therapy, per minute	0.5	Curtis 2013[55]
NHS community occupational therapy, per visit	73	Curtis 2013[55]
NHS community physiotherapy, per visit	50	Department of Health[54]

continued

TABLE 50 Unit costs (*continued*)

Service use item	Unit cost (£)	Sources
NHS community physiotherapy average cost of an hour of home visit, per minute	0.5	Curtis 2013[55]
GP time: average cost per minute of home visit, excluding direct staff and qualification, per minute	4	Curtis 2013[55]
GP time: per home visit lasting 23.4 minutes (including travel), per visit	85	Curtis 2013[55]
GP time: average cost per minute in clinic, excluding direct staff and qualification, per minute	3	Curtis 2013[55]
GP time: average cost of surgery visit of 11.7 minutes, excluding direct staff and qualification, per consultation	34	Curtis 2013[55]
Chiropodist (NHS): reference (average) cost of visit for community podiatry, episode/contact	41	Curtis 2013[55]
Dentist (NHS): reference (average) cost of visit for community dentistry, per contact	115	Department of Health[54]
Dentist (private): average price of check-up, per contact[a]	26	Office of Fair Trading[79]
NHS sight test: paid for sight test to optometrists, per test	21	Department of Health[80]
Private sight test: average charge to patients for a private sight test, excluding discounts and special offers, per test	22	Optics at a glance[81]
Social care		
Private residential care, mean cost per day	76	Curtis 2013[55]
Local authority residential care, mean cost per day	143	Curtis 2013[55]
Private nursing home care, mean cost per day	107	Curtis 2013[55]
Social work: average cost per hour of face-to-face contact, per minute	3	Curtis 2013[55]
Independent home carer weekday face-to-face, per minute	0.4	Curtis 2013[55]
Meals on wheels: average cost per meal on wheels, per meal	4	Curtis 2013[55]
Community mental health services		Curtis 2013[55]
Consultant psychiatrist: face-face contact, per minute	4	Curtis 2013[55]
Mental health nurse: face-to-face contact, per minute	1	Curtis 2013[55]
Counselling services in primary care: per surgery consultation	58	Curtis 2013[55]
Community psychologist: per hour of client contact per minute	2	Curtis 2013[55]
Day services		
Day services: per session	38	Curtis 2013[55]
Day services: per day, weighted average over all services (stroke, elderly, other)	155	Department of Health[54]
Lunch club: per session	8	Banerjee *et al.* 2013[82]
Social club: per session	5	Banerjee *et al.* 2013[82]
'Other'		
Medications: standard quantity units	Range: 0.1–6.0	Health and Social Care Information Centre 2013[83]
Equipment and adaptations, cost over 3 months[a]	Range: 0.1–104.0	Curtis 2012,[56] Curtis 2013[55]

A&E, accident and emergency; GP, general practitioner.
a Uprated using Hospital and community health services prices inflator.

TABLE 51 Types of care and support tasks carried out by carers

Type of care	iCST (SE) ($n = 129$)	TAU (SE) ($n = 135$)	Mean difference[a]
Baseline			
Personal care	43%	36%	6%
Helping with finances	82%	76%	7%
Practical help	78%	77%	1%
Taking the person to appointments	91%	86%	6%
Medications	78%	79%	–1%
Keeping the person company	89%	91%	–2%
Making sure the person is safe (supervision)	68%	76%	–7%
Helping person to organise schedule[b]	2%	2%	–1%
Helping person's mental state: morale[b]	1%	2%	–1%
Week 13			
Personal care	40%	30%	11%
Helping with finances	82%	81%	1%
Practical help	81%	80%	1%
Taking the person to appointments	87%	89%	–2%
Medications	81%	80%	1%
Keeping the person company	91%	91%	0%
Making sure the person is safe (supervision)	75%	79%	–3%
Helping person to organise schedule[b]	2%	1%	0%
Helping person's mental state: morale[b]	2%	2%	–1%
Week 26			
Personal care	43%	40%	3%
Helping with finances	84%	82%	1%
Practical help	84%	85%	–1%
Taking the person to appointments	89%	90%	0%
Medications	82%	81%	1%
Keeping the person company	92%	96%	–3%
Making sure the person is safe (supervision)	79%	81%	–2%
Helping person to organise schedule[b]	2%	4%	–3%
Helping person's mental state: morale[b]	1%	1%	0%

a iCST–TAU.
b Derived from 'other' tasks, free-text descriptions.

Appendix 5 Cost-effectiveness acceptability curves

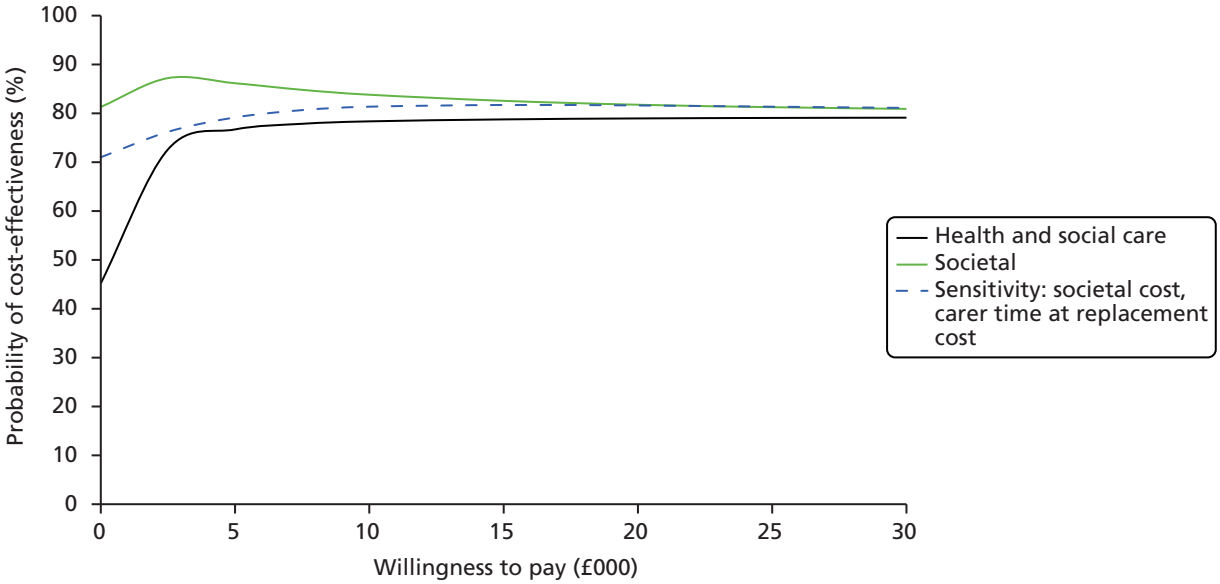

FIGURE 2 Cost-effectiveness acceptability curve: ADAS-Cog.

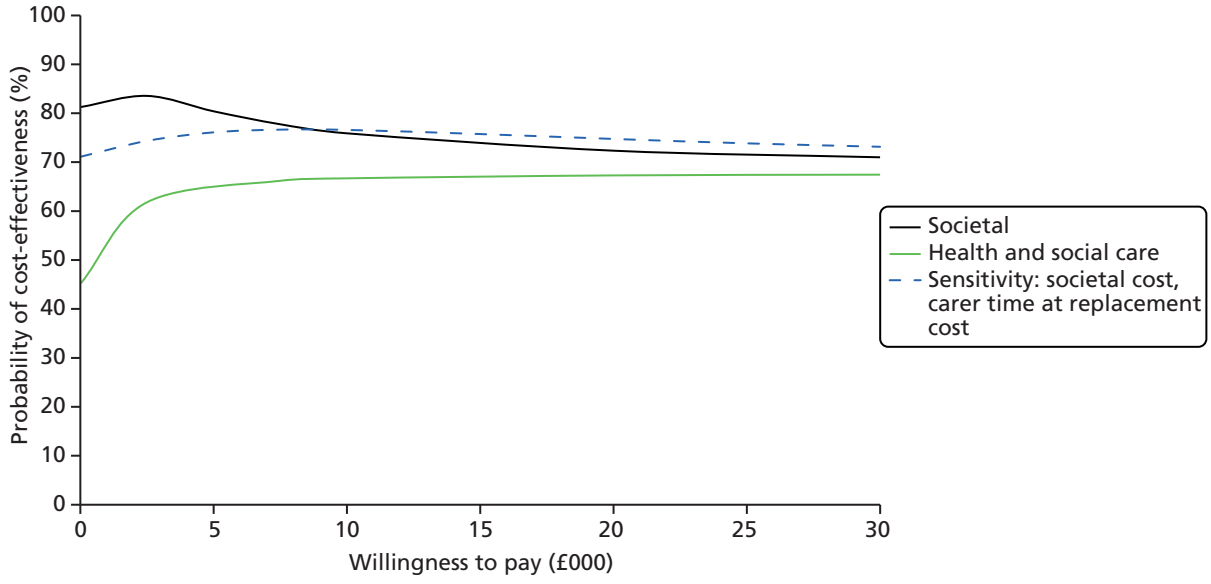

FIGURE 3 Cost-effectiveness acceptability curve: QoL-AD.

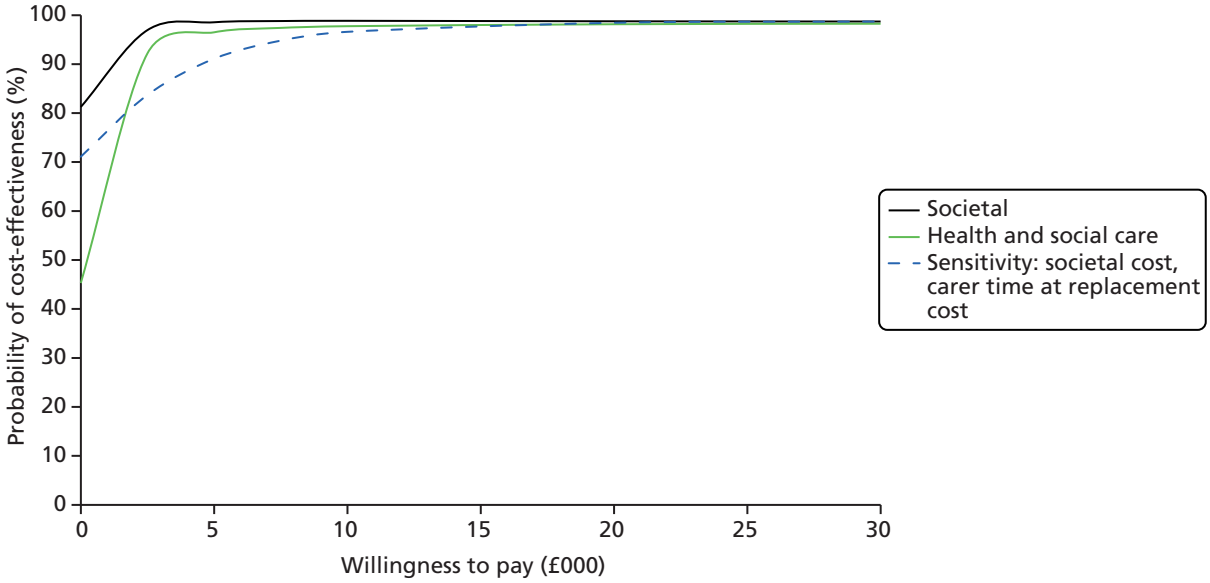

FIGURE 4 Cost-effectiveness acceptability curve: QCPR, person with dementia.

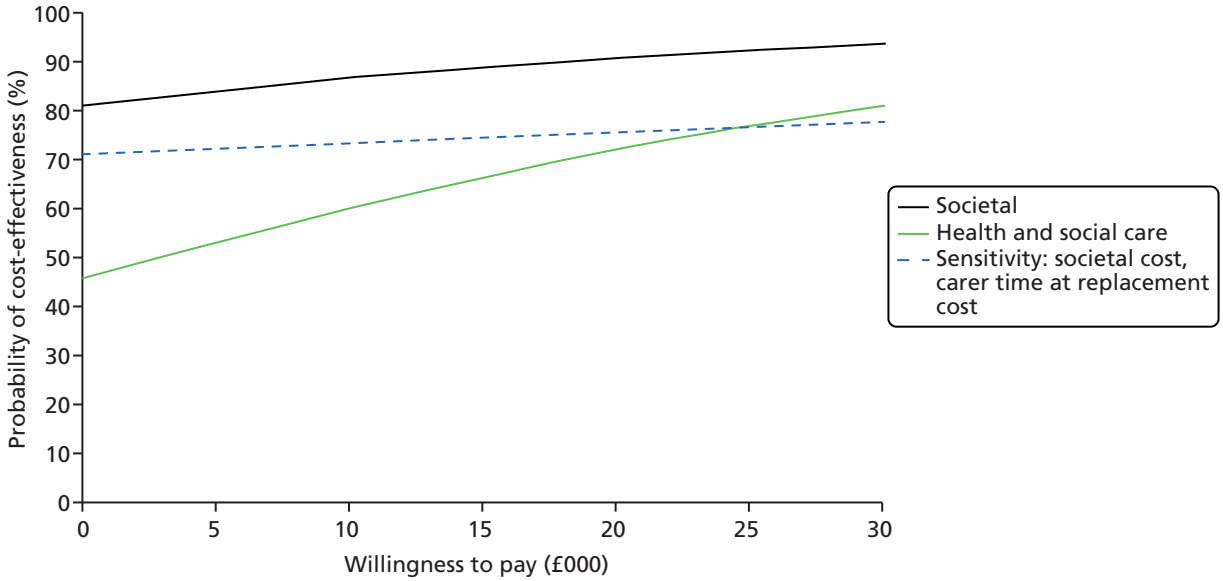

FIGURE 5 Cost-effectiveness acceptability curve: QALY, carers.

Appendix 6 Full imputation data set

The tables presented here indicate the results for the data if the multiple imputation model had been used to impute the data for all 356 participants at each time point. Various methodologies for different types of missing data (e.g. death vs. ill health) have not been taken into account as the number of each of these circumstances was minimal and would have limited impact on the results of any imputation method. Ten imputation sets were created to establish a robust adjustment to the data missing from each time point.

TABLE 52 The pooled means (and 95% CIs) of the multiple imputations comparing the iCST and TAU for person with dementia outcomes at week 26 after adjusting for the baseline outcome measures

Person with dementia outcome measure	iCST ($N = 180$)	TAU ($N = 176$)	Pooled MD	95% CI of pooled MD	*p*-value
ADAS-Cog	22.16	22.61	–0.45	–1.95 to 1.05	0.56
QoL-AD	37.74	37.71	0.03	–1.94 to 2.00	0.98
DEMQOL	93.23	93.57	–0.34	–2.48 to 1.80	0.76
NPI [P]	10.52	9.80	0.72	–1.85 to 3.29	0.58
GDS-15	3.45	3.33	0.12	–0.34 to 0.58	0.61
QCPR total	56.59	55.21	1.38	–0.16 to 2.92	0.08
QCPR (warmth)	33.48	32.83	0.65	–0.31 to 1.61	0.18
QCPR (criticism and conflict)	23.06	22.43	0.63	–0.26 to 1.52	0.17
MMSE	18.98	19.68	–0.7	–1.44 to 0.04	0.07
BADLS [P]	13.38	13.47	–0.09	–1.40 to 1.22	0.89
QoL-AD [P]	31.27	31.03	0.26	–0.91 to 1.38	0.69
DEMQOL [P]	99.05	97.94	1.11	–1.16 to 3.38	0.34

MD, mean difference; NPI, Neuropsychiatric Inventory; [P], Proxy rated measure.

TABLE 53 The pooled means (and 95% CIs) of the multiple imputations comparing the iCST and TAU for person with dementia outcomes at week 13 after adjusting for the baseline outcome measures

Carer outcome measure	iCST (*N* = 180)	TAU (*N* = 176)	Pooled MD	95% CI of pooled MD	*p*-value
ADAS-Cog	22.24	22.00	0.24	–1.37 to 1.85	0.77
QoL-AD	38.28	38.20	0.08	–0.85 to 1.01	0.86
DEMQOL	90.99	91.41	–0.42	–2.65 to 1.81	0.71
NPI [P]	13.41	14.52	–1.11	–3.24 to 1.02	0.31
GDS-15	3.43	3.42	0.01	–0.54 to 0.57	0.96
QCPR total	56.27	55.16	1.12	–0.13 to 2.36	0.08
QCPR (warmth)	33.72	33.43	0.29	–0.59 to 1.17	0.52
QCPR (criticism and conflict)	22.49	21.86	0.63	–0.06 to 1.32	0.08
MMSE	20.06	20.01	0.05	–0.70 to 0.80	0.89
BADLS [P]	12.96	13.18	–0.22	–1.45 to 1.01	0.73
QoL-AD [P]	32.56	31.76	0.80	–0.31 to 1.92	0.16
DEMQOL [P]	101.57	100.58	0.99	–1.22 to 3.2	0.38

MD, mean difference; NPI, Neuropsychiatric Inventory; [P], Proxy rated measure.

TABLE 54 The pooled means (and 95% CIs) of the multiple imputations comparing the iCST and TAU for carer outcomes at week 26 after adjusting for the baseline outcome measures

Carer outcome measure	iCST (*N* = 134)	TAU (*N* = 139)	MD	95% CI of MD	*p*-value
SF-12 PCS	47.80	46.99	0.81	–1.18 to 2.80	0.43
SF-12 MCS	46.84	47.52	–0.68	–2.82 to 1.47	0.54
HADS total	10.56	10.67	–0.12	–1.39 to 1.16	0.86
HADS (anxiety)	6.04	5.97	0.07	–0.74 to 0.88	0.87
HADS (depression)	4.63	4.83	–0.20	–0.83 to 0.43	0.53
EQ-5D health state today	75.33	74.90	0.42	–3.03 to 3.88	0.81
EQ-5D calculated utility value[a]	0.79	0.74	0.05	0.01 to 0.09	0.02
RS-14	82.83	82.05	0.78	–1.23 to 2.80	0.45
NPI (carer distress)	3.79	3.78	0.01	–0.45 to 0.47	0.97
QCPR total	58.20	58.67	–0.46	–1.79 to 0.87	0.50
QCPR (warmth)	34.38	34.44	–0.06	–0.74 to 0.62	0.87
QCPR (criticism and conflict)	23.88	24.25	–0.38	–1.21 to 0.46	0.38

MD, mean difference; NPI, Neuropsychiatric Inventory; RS-14, Resilience Scale-14 items.
a Significant difference at 5% level.

TABLE 55 The pooled means (and 95% CIs) of the multiple imputations comparing the iCST and TAU for carer outcomes at week 13 after adjusting for the baseline outcome measures

Carer outcome measure	iCST ($N = 180$)	TAU ($N = 176$)	MD	95% CI of MD	*p*-value
SF-12 PCS	49.95	50.14	–0.19	–1.59 to 1.22	0.80
SF-12 MCS	46.28	47.08	–0.80	–2.48 to 0.88	0.35
HADS total	11.27	11.01	0.26	–0.74 to 1.27	0.61
HADS (anxiety)	6.84	6.58	0.26	–0.41 to 0.92	0.45
HADS (depression)	4.58	4.60	–0.02	–0.51 to 0.47	0.93
EQ-5D health state today	74.91	74.56	0.35	–3.00 to 3.70	0.84
EQ-5D calculated utility value	0.80	0.78	0.02	–0.01 to 0.06	0.21
RS-14	81.37	81.75	–0.38	–2.00 to 1.25	0.65
NPI (carer distress)	3.14	3.04	0.10	–0.32 to 0.52	0.64
QCPR total	58.05	58.21	–0.16	–1.66 to 1.34	0.84
QCPR (warmth)	34.76	35.54	–0.77	–1.61 to 0.06	0.07
QCPR (criticism and conflict)	23.30	22.67	0.64	–0.26 to 1.53	0.16

MD, mean difference; NPI, Neuropsychiatric Inventory; RS-14, Resilience Scale-14 items.

Appendix 7 Compliance analysis

The model fitted uses linear regression to assess the relationship between outcome measure and number of iCST sessions attended at each outcome visit after adjusting for the baseline outcome measure.

TABLE 56 The regression coefficient (and SE) of the relationship between each person with dementia outcome measure and the number of sessions of iCST attended at week 26 after adjusting for the baseline outcome measures

Person with dementia outcome measure	Observed data				Imputed data							
Week 26							Median F		Low F		High F	
Participant with dementia	Coefficient	SE	*F*	*p*-value	Pooled coefficient	SE	*F*	*p*-value	*F*	*p*-value	*F*	*p*-value
ADAS-Cog	–0.013	0.014	0.837	0.361	–0.015	0.015	1.156	0.283	0.633	0.427	1.488	0.224
QoL-AD	0.008	0.010	0.703	0.402	0.009	0.010	0.659	0.418	0.601	0.439	1.260	0.263
DEMQOL	0.007	0.019	0.158	0.691	0.008	0.019	0.210	0.647	0.068	0.794	0.352	0.553
NPI total	–0.002	0.023	0.008	0.927	–0.003	0.023	0.018	0.892	0.004	0.952	0.029	0.865
GDS-15	0.001	0.005	0.055	0.815	0.002	0.005	0.091	0.763	0.019	0.889	0.270	0.604
QCPR total[a]	0.043	0.014	9.184	0.003	0.042	0.014	9.256	0.003	9.016	0.003	9.659	0.002
QCPR (warmth)	0.012	0.009	1.973	0.161	0.011	0.009	1.661	0.199	1.557	0.213	1.839	0.176
QCPR (criticism and conflict)[a,b]	0.029	0.008	12.633	0.001								
MMSE	0.006	0.008	0.559	0.455	0.006	0.008	0.447	0.504	0.383	0.536	0.846	0.359
BADLS [P]	–0.015	0.013	1.254	0.264	–0.015	0.013	1.272	0.260	1.230	0.268	1.413	0.236
QoL-AD [P]	0.012	0.011	1.225	0.269	0.012	0.011	1.225	0.269	1.225	0.269	1.225	0.269
DEMQOL [P]	0.013	0.023	0.344	0.558	0.013	0.023	0.326	0.569	0.312	0.577	0.421	0.517

NPI, Neuropsychiatric Inventory; [P], Proxy rated measure.
a Significant difference.
b When there are no missing data the imputed data columns are left blank.

TABLE 57 The regression coefficient (and SE) of the relationship between each person with dementia outcome measure and the number of sessions of iCST attended at week 13 after adjusting for the baseline outcome measures

Person with dementia outcome measure	Observed data				Imputed data							
Week 13					Pooled coefficient	SE	Median F		Low F		High F	
Person with dementia	Coefficient	SE	*F*	*p*-value			*F*	*p*-value	*F*	*p*-value	*F*	*p*-value
ADAS-Cog	0.006	0.030	0.042	0.838	0.002	0.030	0.038	0.846	0.005	0.946	0.071	0.790
QoL-AD	0.019	0.021	0.866	0.353	0.019	0.021	0.824	0.365	0.685	0.409	1.015	0.315
DEMQOL	–0.021	0.042	0.246	0.620	–0.020	0.042	0.190	0.663	0.122	0.727	0.408	0.524
NPI total	–0.045	0.048	0.880	0.349	–0.046	0.048	0.903	0.343	0.877	0.350	0.916	0.339
GDS-15	–0.003	0.010	0.076	0.783	–0.003	0.010	0.055	0.815	0.000	0.986	0.628	0.429
QCPR total	0.049	0.026	3.458	0.064	0.049	0.026	3.495	0.063	3.468	0.064	3.546	0.061
QCPR (warmth)	0.003	0.018	0.036	0.850	0.003	0.018	0.033	0.856	0.031	0.859	0.043	0.836
QCPR (criticism and conflict)[a]	0.043	0.015	8.268	0.004	0.043	0.015	8.383	0.004	8.377	0.004	8.386	0.004
MMSE	0.026	0.016	2.667	0.104	0.026	0.016	2.764	0.098	2.419	0.121	2.861	0.092
BADLS [P][b]	0.024	0.029	0.671	0.413								
QoL-AD [P]	0.038	0.022	3.015	0.084	0.037	0.022	2.833	0.093	2.782	0.096	3.181	0.076
DEMQOL [P]	0.019	0.048	0.155	0.694	0.019	0.048	0.160	0.689	0.137	0.711	0.195	0.659

NPI, Neuropsychiatric Inventory; [P], Proxy rated measure.
a Significant difference.
b When there is no missing data the imputed data columns are left blank.

TABLE 58 The regression coefficient (and SE) of the relationship between each carer outcome measure and the number of sessions of iCST attended at week 26 after adjusting for the baseline outcome measures

Carer outcome measure	Observed data				Imputed data							
Week 26							Median F		Low F		High F	
Carer	Coefficient	SE	*F*	*p*-value	Pooled coefficient	SE	*F*	*p*-value	*F*	*p*-value	*F*	*p*-value
SF-12 PCS	0.018	0.016	1.196	0.275	0.017	0.016	1.052	0.306	1.171	0.280	1.253	0.264
SF-12 MCS[a]	0.017	0.017	0.921	0.338	0.017	0.017						
HADS total[b]	–0.020	0.011	3.463	0.064	–0.022	0.011	4.085	0.044	3.850	0.051	4.815	0.029
HADS (anxiety)	–0.007	0.007	1.156	0.283	–0.009	0.007	1.655	0.199	1.279	0.259	2.091	0.149
HADS (depression)[b]	–0.013	0.006	5.684	0.018	–0.014	0.006	6.275	0.013	5.549	0.019	6.667	0.010
EQ-5D health state today[a]	0.020	0.032	0.406	0.525	0.020	0.032						
EQ-5D calculated utility value	0.0007	0.0004	2.888	0.090	0.0007	0.0004	2.992	0.085	2.691	0.102	3.006	0.084
RS-14	0.023	0.019	1.433	0.232	0.023	0.019	1.479	0.225	1.407	0.237	1.509	0.220
NPI (carer distress)	–0.005	0.004	1.461	0.228	–0.005	0.004	1.558	0.213	1.438	0.232	1.663	0.198
QCPR	–0.006	0.013	0.179	0.673	–0.004	0.013	0.065	0.798	0.010	0.919	0.184	0.669
QCPR (warmth)	–0.0001	0.007	0.0002	0.988	0.001	0.007	0.019	0.890	0.001	0.982	0.044	0.833
QCPR (criticism and conflict)	–0.004	0.008	0.273	0.602	–0.003	0.008	0.229	0.633	0.060	0.806	0.326	0.568

NPI, Neuropsychiatry Inventory; [P], Proxy rated measure; RS-14, Resilience Scale-14 items.
a When there are no missing data the imputed data columns are left blank.
b Significant difference.

TABLE 59 The regression coefficient (and SE) of the relationship between each carer outcome measure and the number of sessions of iCST attended at week 13 after adjusting for the baseline outcome measures

Carer outcome measure	Observed data				Imputed data							
Week 13							Median F		Low F		High F	
Carer	Coefficient	SE	*F*	*p*-value	Pooled coefficient	SE	*F*	*p*-value	*F*	*p*-value	*F*	*p*-value
SF-12 PCS[a]	0.015	0.030	0.270	0.604								
SF-12 MCS[a]	0.007	0.034	0.040	0.843								
HADS total	–0.024	0.021	1.271	0.260	–0.023	0.021	1.235	0.267	1.219	0.271	1.310	0.253
HADS (anxiety)	–0.012	0.013	0.806	0.370	–0.011	0.013	0.752	0.387	0.716	0.398	0.847	0.358
HADS (depression)	–0.014	0.011	1.519	0.219	–0.014	0.011	1.496	0.222	1.450	0.230	1.667	0.198
EQ-5D health state today	0.126	0.066	3.689	0.056	0.127	0.066	3.773	0.053	3.582	0.059	3.796	0.052
EQ-5D calculated utility value	0.001	0.001	2.573	0.110	0.001	0.001	2.566	0.110	2.558	0.111	2.607	0.108
RS-14[a]	–0.031	0.033	0.891	0.346								
NPI (carer distress)	–0.007	0.009	0.658	0.418	–0.007	0.009	0.646	0.422	0.598	0.440	0.746	0.389
QCPR total	–0.004	0.030	0.022	0.883	–0.003	0.030	0.033	0.855	0.002	0.968	0.088	0.766
QCPR (warmth)	–0.008	0.017	0.223	0.637	–0.006	0.017	0.074	0.786	0.020	0.888	0.466	0.495
QCPR (criticism and conflict)	0.005	0.019	0.061	0.806	0.004	0.019	0.070	0.792	0.001	0.980	0.206	0.650

NPI, Neuropsychiatry Inventory; [P], Proxy rated measure; RS-14, Resilience Scale-14 items.
a When there are no missing data the imputed data columns are left blank.

Appendix 8 Serious adverse events

Serious adverse events

In the iCST trial a SAE was defined as an untoward occurrence, experienced by the person with dementia or their carer, which:

(a) resulted in death
(b) was life-threatening
(c) required hospitalisation or prolongation of existing hospitalisation
(d) resulted in persistent or significant disability or incapacity
(e) is otherwise considered medically significant by the principal investigator.

In addition, any cases in which action was taken in line with the protocol with regard to alleged or suspected abuse/neglect that required protection of vulnerable adults was considered to be a SAE.

All iCST centres were asked to report any of the above instances either for the person with dementia or their carer by categorising them as below:

1. death
2. life-threatening
3. hospitalisation or prolongation of existing hospitalisation
4. persistent or significant disability or incapacity
5. otherwise considered medically significant by the investigator
6. alleged/suspected abuse/neglect, as detailed in protection of vulnerable adults protocol.

There were a total of 51 SAEs reported during the trial, all of which were reported directly to the Chief Investigator. There were 25 SAEs reported in the iCST group and 26 events reported in the TAU group. There were 10 deaths reported, of which nine were deaths of the person with dementia and one was a carer death. There were only eight deaths noted on the CONSORT flowchart as in the remaining cases participants were lost to follow-up prior to their death being reported. A total of 44 of the SAEs related to the person with dementia and the remaining seven involved the carer. None of the SAEs reported was related to the trial. Details of these events broken down by treatment allocation are provided below (*Table 60*). Details of types of SAEs are presented below (*Table 61*). For three people with dementia there were two SAEs reported, which included hospitalisation, followed by death.

TABLE 60 Serious adverse events reported by treatment allocation

SAE category	Total	iCST	TAU	Linked to the iCST trial
Death	10	2	8	0
Life-threatening	5	3	2	0
Hospitalisation	32	16	16	0
Disability	0	0	0	0
Medically significant	4	4	0	0
Protection of vulnerable adults	0	0	0	0

TABLE 61 Serious adverse events reported separately for people with dementia and carers

SAE category	Person with dementia	Carer
Angioplasty	0	1
Car accident	0	1
Chest infection	2	0
Diagnosis of cancer	1	2
Death	9	1
Fainting incident	2	0
Fall not requiring hospitalisation	2	0
Fall requiring hospitalisation	3	0
Fracture not requiring hospitalisation	1	0
Fracture of knee/arm/femoral shaft requiring hospitalisation	3	1
Heart attack	1	0
Heart operation	0	1
Irregular heart rhythm	1	0
Kidney stones/infection	2	0
Hospitalisation reason unknown	1	0
Oedema	1	0
Chronic obstructive pulmonary disease	1	0
Person with dementia missing/wandered away	1	0
Pneumonia	3	0
Psychiatric symptoms/confusion/delusions/suicidal thoughts/lethargy/loss of appetite	5	0
Seizure	1	0
Stroke	1	0
Urinary tract infection	3	0
Total	**44**	**7**

Appendix 9 Protocol violations

Protocol violations

There was one protocol violation in the iCST trial, which was reported to the DMEC meeting and was attributable to an administrative error.

The protocol violation involved two dyads being accidently randomised with the wrong identification numbers. The data entry was performed remotely under the original identification numbers and questionnaire codes (not the ones that were actually used in randomisation). The solution proposed in consultations with the clinical trials unit was to change the numbers for the two participants in the database.

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