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Effectiveness of cognitive stimulation therapy (CST) for mild to moderate dementia: A systematic literature review and meta-analysis of randomised control trials using the original CST protocol

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Abstract

Aims:

We aimed to conduct a systematic literature review and meta-analysis to evaluate the efficacy of the original 14 session Cognitive Stimulation Therapy (CST) protocol in improving cognitive function and related outcomes in people with mild to moderate dementia.

Methods:

Four databases were searched, up to May 2023, for randomized controlled trials of CST using the original protocol. Pre- and post-test means and measures of dispersion for intervention and control groups were extracted for each reported outcome and used to calculate effect sizes. Effect sizes were grouped by outcome and pooled in inverse variance weighted random effects models.

Results:

Twelve studies were identified as meeting inclusion criteria. Of these, ten were given either a 'high' or 'medium' quality rating. The pooled results indicated that CST had a significant beneficial impact on global cognition, language, working memory, depression, neuropsychiatric symptoms, communication, self-reported quality of life and severity of dementia.

Conclusions:

CST as delivered in adherence to the original 14-session protocol is an efficacious treatment for mild to moderate dementia with improvements in cognition, affective symptoms and quality of life demonstrated from global trials.

Keywords:

Mild to moderate dementia, Cognitive Stimulation Therapy, Psycho-social Interventions, Cognitive function, Quality of Life

1. Introduction

Dementia is an umbrella term for a group of neurodegenerative diseases which result in cognitive impairment and impact on the ability to engage in activities of daily life and ultimately quality of life. Dementia is regarded as a pressing global public health challenge as the population ages. Globally, nearly ten million new cases of dementia are diagnosed each year, with numbers of people living with dementia (PLWD) projected to be 78 million by 2030 and 139 million by 2050 (WHO, 2021). In line with these increased numbers in PLWD is also a projected exponential rise in dementia care costs, which was estimated at 1 trillion USD in 2018 and estimated to reach 2 trillion USD by 2030 (Patterson, 2018). These figures underscore the urgency for implementing effective evidence-based interventions.

However, progress in developing pharmaceutical interventions aimed at modifying or halting disease processes have thus far been slow. In the absence of effective pharmaceutical interventions, psychosocial interventions; including those using physical, cognitive and social methods, have been found to be effective at improving global physical and cognitive functioning, social interaction, activities of daily life and quality of life (McDermott et al., 2019).

One such psychosocial intervention is Cognitive Stimulation Therapy (CST). CST is a well-established, manualized intervention developed by Spector et al., (2003). The original CST protocol was comprised of 14 group sessions, each of 45-minute duration, delivered twice a week. over a seven-week period. Each session focused on a different theme, with the programme aiming to enhance the cognitive functioning and overall well-being of individuals with mild to moderate dementia. The original CST protocol was designed to provide structured and stimulating activities in supportive group environments. The primary goal of CST is to engage PLWD in mentally stimulating activities to preserve existing skills. The protocol includes topical discussions such as discussing a current news story; reminiscence, for example, by listening to music or singing; problem-solving tasks, such as playing a word game; creative exercises, such as baking; and multisensory experiences. Tasks engage various cognitive domains, such as memory, attention, language and executive functions. CST also aims to have a broader impact on dementia-related symptoms, such as behavioral symptoms, affective symptoms, and impaired communication. By encompassing cognitive components along with psychosocial and relational elements, CST seeks to promote a comprehensive enhancement of overall quality of life and well-being for individuals with dementia.

Since its inception, CST has been found to be effective (Lobbia et al., 2019), acceptable (Toh, Ghazali, & Subramaniam, 2016) and cost-effective (Comas-Herrera & Knapp, 2019). In the latest UK's National Institute for Health and Care Excellence guidelines (NICE-SCIE, 2018), group CST is the only non-pharmacological intervention specifically recommended to improve cognition, independence and well-being. The success of CST has further resulted it being widely adapted or modified; including cross-cultural adaptations (Aguirre, Spector, & Orrell, 2014), individual delivery (Orrell et al., 2015), introduction of additional elements such as exercise (Binns, Kerse, Peri, Cheung, & Taylor, 2020)), adapted for on-line delivery (Perkins et al., 2022), and the length and frequency of sessions are also variable from study to study (Woods et al., 2023).

The effectiveness of 'Cognitive Stimulation' has been well established in a number of systematic reviews, including a recent Cochrane review (Woods et al., 2023), showing its benefits for overall cognitive function and mixed results with other outcomes including depression, activities of daily living, quality of life (self and proxy report) and behaviors that challenge.

One reason for these mixed results is the heterogeneity introduced into the meta-analytic models from the inclusion of CST protocols which differ significantly from the original 14 session protocol as developed by Spector (2003). The Cochrane review included 37 RCTs of which only 16 used this protocol – other studies varied in programme length and content. In light of this, the aim of the current review is to conduct a systematic literature review and meta-analysis to establish the efficacy of the original CST protocol, updating a previous review conducted by Lobbia et al., (2019). Of note, Lobbia et al., (2019) included all study designs using the 14-session protocol whereas this review aims to only include RCTs studies.

2. Method

2.1 Systematic search and study selection

A systematic literature search was conducted based on the search terms from a previously published systematic literature review (Lobbia et al., 2019) examining the efficacy of CST for people living with dementia. In brief, keywords were used to identify the target sample i.e. 'Alzheimer's disease', 'dementia', and 'people with dementia' and were combined with descriptions of the intervention i.e., 'non-pharmacological therapy', 'Cognitive Stimulation Therapy', 'CST' and 'psychosocial intervention'. Four databases were searched including, PubMed, Web of Science, PsycINFO and SCOPUS from the end date (March 2017) of the review conducted by Lobbia et al., (2019) to May 2023. After de-duplicating the search hits, a title and abstract screen was completed, followed by full text inspection of the remaining articles to assess eligibility for inclusion in the current review. In addition, the 14 studies included in the Lobbia et al., (2019) review were re-evaluated to assess eligibility for inclusion in the current review. Reference lists of all studies meeting inclusion criteria as well as all relevant review articles were subjected to forwards and backwards citation searching. The study adhered to the updated Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021).

Studies were deemed as meeting inclusion criteria if they were: RCTs adhering to the original CST protocol as described by Spector et al., (2001; 2003) (or a cultural adaptation to the original protocol); participants had a diagnosis of mild to moderate dementia; published in a peer-reviewed journal in English; and reported data on cognitive outcomes, psychological outcomes or outcomes related to quality of life (either self or proxy reports), disability, and severity of dementia symptoms.

2.2 Methodological quality assessment

The Jadad Scale (Jadad et al., 1996) was used to assess the overall methodological quality of each study. In brief, this scale allows the assessment of the following: whether the study was (1) randomized and/or (2) blinded, (3) whether details were provided regarding the randomisation and (4) double-blinding methods and (5) attrition. Each study can score a maximum of five points, where scores from three to five are considered 'high quality', a score of two is 'medium quality' and scores of zero or one are considered to be of 'low quality'. Unlike the quality assessments used in the Lobbia et al., (2019) review, the SPREAD method (Inzitari & Carlucci, 2006) was not utilized in this review, as the inverse variance-weighted meta-analysis method inherently incorporates the confidence intervals of each estimate, assigning greater weight to studies with narrower confidence intervals, rendering the SPREAD method redundant in this context. Two reviewers independently rated each study with consensus reached through discussion when disagreements arose.

2.3 Data extraction

Two reviewers (RD and CF) independently extracted all the data on study characteristics and outcome measures. Disagreements were resolved through consensus meetings. The pre and post intervention mean (*M*) and standard deviation (*SD*) was extracted for each outcome for both the treatment and control groups. Where baseline and change scores were reported, the change score was used to calculate the post intervention mean. In situations where the standard error (*SE*) rather than the *SD* was reported, the *SE* was extracted and transformed to the *SD*. In cases where a study did not report the full set of data required for meta-analysis, the authors were contacted to request the raw data.

Where a study reported the pre-post correlation (*r*) this was extracted and where raw data was available *r* was calculated directly.

2.4 Meta-analysis

Studies were grouped for meta-analysis based on reported outcomes. There were several studies which reported data from overlapping samples. Only one study per sample was included in a particular meta-analysis to avoid bias from overlapping samples. Where one or more paper used the same participant pool the study reporting the largest sample size was included in the analysis. Where a study reported multiple measures for the same domain (e.g. MMSE and ADAS-Cog) only one measure was included from each study in a particular model to avoid artificially inflating the overall estimate. A meta-analysis was run where two or more non-overlapping studies reported data to calculate an effect size for an outcome. A standardised pre-post effect size (*d*) was calculated using the formula as recommended by Morris (2008). This method provides a bias corrected estimate of the effect size and as such it is considered the best approach to analysing pretest-posttest-control group designs, to calculate effect sizes for inclusion in meta-analyses. As most studies did not provide the pre-post correlation required to calculate the effect size, a conservative value of 0.70 was imputed and sensitivity analyses using the values of 0.5 and 0.9 were also conducted; which broadly represents the range of correlations found in applied settings (Becker, 1988). The effect sizes were pooled in a random effects model using the inverse variance weighted method. The heterogeneity of each model was assessed using the I^2 and the *Q*-statistic. Where I^2 quantifies the proportion of total variation across studies due to between study differences and the *Q*-statistic quantifies the differences between effect sizes. As none of the individual meta-analyses contained ten or more

studies, estimates of publication bias or further sub-group analysis could not be calculated (Higgins et al., 2022). The effect size for the ADAS-Cog was reversed so that a higher score represented improvement in cognition to keep the direction of effect aligned with other measures and thereby to facilitate comparison between measures.

The analyses were performed using RStudio software version 2023.12.0+369 and the metafor package for R (Viechtbauer, 2010).

3. Results

3.1 Study Selection

A total of 332 papers were identified from the initial database search. After removal of duplicates and an initial title and abstract screen 217 titles were identified for full text inspection. This number was combined with 14 studies included in the previous review conducted by Lobbia et al., (2019) leaving a total of 231 that were subject to full text examination. This resulted in 12 studies meeting inclusion criteria for the current review; seven from the previous review and five newly identified, which were published in the intervening period. The flow diagram of study selection is presented in Figure 1.

3.2 Characteristics of studies

The characteristics of included studies are presented in Table 1. The included studies were published during the 21-year period between 2001 to 2022. Sample sizes in the studies ranged from 27 to 225 with a total of 1025 across all the included studies. Three studies were conducted in the UK, three in Italy, two in Portugal, one in Ireland, one in Malaysia, one in Brazil and one in Japan. All the participants were aged 60 years and older, with the oldest reported mean age being 88.3 (*SD*=5.2). Six studies recruited participants from

residential or care homes (Alvares-Pereira, Silva-Nunes, & Spector, 2021; Carbone et al., 2021; Spector et al., 2001; Spector et al., 2003; Spector et al., 2010), five studies recruited participants from mixed community and residential care settings (Apóstolo, Cardoso, Rosa, & Paúl, 2014; Capotosto et al., 2017; Coen et al., 2011; Dahlan et al., 2022; Piras et al., 2017; Yamanka et al., 2013) and one study recruited participants from an outpatient setting (Marinho et al., 2021). All the included studies recruited participants that comprised a greater female proportion (51.9% to 86.7%). A total of 15 different outcomes were reported across the studies falling into three broad categories of cognition (global cognition, language, working memory, orientation), affective symptoms (anxiety, depression, neuropsychiatric symptoms, loneliness) and other outcomes(communication, behaviour, severity of symptoms, quality of life, carer burden, functional ability and health. Seven (Alvares-Pereira, Silva-Nunes, & Spector, 2021; Apóstolo, Cardoso, Rosa, & Paúl, 2014; Carbone et al., 2021; Dahlan, Ungku Mohd Zam, Kandayah, & Nurhidayah, 2022; Marinho et al., 2021; A. Spector et al., 2001; Yamanaka et al., 2013) of the 12 studies were given a 'high' quality rating, three (Capotosto et al., 2017; A Spector, Orrell, & Woods, 2010; A Spector et al., 2003) a 'medium' quality rating and two (Coen et al., 2011; Piras et al., 2017) were rated as 'low' quality.

3.3 Meta-analyses

Eleven studies reported outcomes which could be combined in a meta-analysis. One study (Dahlan et al., 2022) met inclusion criteria for the current review but did not report the pre and post-test *M* and *SD* and therefore it could not be included in a meta-analysis. Seventeen separate meta-analyses were conducted falling into the three broad categories

of (1) cognition: global cognition: Mini Mental State Examination (MMSE) (*k*=7) and Montreal Cognitive Assessment (MoCA) (*k*=1); global cognition: Alzheimer's Disease Assessment Scale -Cognitive Subscale ADAS-Cog (*k*=8); working memory (*k*=2); language (*k*=3) and orientation (*k*=3); (2) affective symptoms: anxiety (*k*=5); depression (*k*=9); neuropsychiatric symptoms (*k*=2); social loneliness (*k*=2); emotional loneliness (*k*=2); and (3) other outcomes: quality of life: self (*k*=7); quality of life: proxy (*k*=4); behaviour (*k*=4); communication (*k*=3); functional ability (*k*=3); severity of symptoms (*k*=3) and carer burden (*k*=2).

The results of the meta-analyses for the cognitive outcomes are depicted in Figure 2, affective and neuropsychiatric symptoms are depicted in Figure 3 for all other outcomes in Figure 4.

Cognition: CST was found to have a significant beneficial impact on global cognition as measured by the MMSE and MoCA (*d*=0.45, 95%CI:0.33;0.56) and the ADAS-Cog (*d*=0.31, 95%CI:0.21;). The levels of heterogeneity were non-significant for both the global cognition models, MMSE/MoCA model (*Q*=4.23, df=7, *p*=.75, I^2=0%), ADAS model (*Q*=6.14, df=7, *p*=.52, I^2=0%). CST was found to have a beneficial impact on language (*d*=0.51, 95%CI:0.34;0.69) with non-significant levels of heterogeneity (*Q*=0.30, df=2, *p*=.86, I^2=0%) and also found to increase working memory as measured by the BDS (*d*=0.87, 95%CI:0.35;1.39) with significant levels of heterogeneity in the model (*Q*=10.57, df=1, *p*<.01, I^2=90.53%). CST did not have a significant impact on orientation.

Affective and neuropsychiatric symptoms: CST was found to significantly reduce depression symptoms (*d*=-0.26, 95%CI:-0.37;-0.15) and neuropsychiatric symptoms (*d*=-0.36,

95%CI:-0.54;-0.17). There were significant levels of heterogeneity in the depression model (Q=43.17, df=8, p<.01, I^2=81.47%) and non-significant levels of heterogeneity in the neuropsychiatric symptoms model (Q=1.53, df=1, p=.22, I^2=34.69%). CST did not have a significant impact on anxiety symptoms, social loneliness, or emotional loneliness.

Other outcomes: CST was found to have a significant beneficial impact on communication (d=0.38, 95%CI:0.21;0.55), symptom severity (d=-0.34, 95%CI:-0.53;-0.16) and quality of life as measured by self-report (d=0.24, 95%CI:0.13;0.35). There were significant levels of heterogeneity in the communication (Q=21.73, df=2, p<.01, I^2=90.79%) and dementia severity (Q=13.07, df=2, p<.01, I^2=84.70%) models and with non-significant levels in the quality-of-life model. Quality of life as measured by proxy report, functional ability, carer burden and behaviour were not found to be significantly impacted by CST.

Sensitivity analyses using the two additional r values (0.5, 0.9) representing the range of typical correlations did not change the direction of effect or significance of the main findings. Additional sensitivity analyses were conducted removing the two studies (Coen et al., 2011; Piras et al., 2017) rated as 'low' quality. Removal of these two studies did not change the direction of effect or significance, of the main findings. However, two of the meta-analyses (NPI and BDS), each initially containing two studies, could not be run after removal the 'low' quality studies.

4. Discussion

4.1 Summary of findings

We aimed to examine the effects of CST, using the original protocol as described by Spector (2003), on various cognitive, affective and quality of life related outcomes in people

with mild to moderate dementia. The findings from this study indicate there are significant beneficial effects of the original protocol CST on global cognition, language, working memory, depression, neuropsychiatric symptoms, communication, quality of life (as measured by self-report) and severity of symptoms. The current study further aimed to build upon a previous review conducted by Lobbia et al., (2019) by incorporating an additional four RCTs. Notably, our study expands upon the methodology of the earlier review by employing meta-analyses. This is in contrast with the qualitative synthesis utilised by Lobbia et al., (2019). This methodological shift allows for more precise estimations of the treatment effect of CST and facilitates the estimation of effect sizes. In addition, a similar review conducted by Woods et al., (2023) included data from 37 CST trials. However, the approach taken in that study combined trials utilising the original 14-session protocol with those employing variations thereof, precluding a focused assessment of the efficacy of the original protocol.

4.2 Discussion of findings

The findings of the current study align to those reported in previous reviews (Lobbia et al., 2019; Woods et al., 2023) which have found beneficial effects of CST on global cognition. There were significant improvements in two other domains of cognition: namely language and working memory. Although the evidence for these two domains is not as strong as the evidence for global cognition, a potential mechanism for the effects of CST could be via improving cognitive flexibility in these two domains. However, it should be noted that studies did not routinely report or measure data for other specific domains such as memory, attention and processing speed.

In terms of affective symptoms, there was a significant reduction in depression and, neuropsychiatric symptoms but not anxiety. This finding is in keeping with previous work (Woods et al., 2023) suggesting that CST is possibly effective for reducing depressive symptoms (with a small effect) but does not have an effect on anxiety. It should also be noted that there were high and significant levels of heterogeneity in the depression model and only two studies in the neuropsychiatric symptoms model.

Another robust finding of this review is that of improvements in self-reported quality of life. This improvement was not mirrored in the proxy-reported measure. However, it is a well reported phenomena in dementia research, that PLWD often rate their subjective experience of quality of life higher than proxy reports (Spector & Orrell, 2006) Again, this is a similar finding to previous reviews (Lobbia et al., 2019; Woods et al., 2023).

Overall, there were small but significant improvements in a number of outcomes. It is important to note that there was significant heterogeneity in some of these models indicating potential variation between studies. If we only consider models with non-significant levels of heterogeneity and 'high' or 'medium' quality studies, the observed effects of global cognition (as measured by the MMSE), language and self-reported quality of life can be regarded as robust evidence of the beneficial treatment effects of original protocol CST. In addition, given the inclusion of studies from a range of countries and settings including; community, inpatient and care home residents, these findings are generalisable to a range of clinical settings and populations.

4.3 Limitations and future research

A strength of the current study is in its use of inclusion criteria of RCTs using a standardised CST protocol. This stringent inclusion criteria, in combination with the

calculation of bias corrected effect sizes suggests that the effects reported in this study are robust and causal inferences can be made in terms of the efficacy of CST. There were, however, significant levels of heterogeneity reported in some of the models, which suggests potential variation across different studies. Differences due to variations in settings could influence the delivery and outcomes of CST interventions. Furthermore, discrepancies in measurement tools and outcome assessments across studies may have contributed to heterogeneity as well as adherence to the CST protocol, including fidelity to session content and duration, could also impact intervention effectiveness and introduce variability across studies. As each individual meta-analysis contained fewer than ten studies it was not possible to systematically explore this heterogeneity further but in time when there are more studies available reporting data using cultural adaptations it may be possible to explore this further in sub-group analysis.

4.4 Conclusions

These results add to the body of literature that evidences the efficacy of CST. In particular, this review further extends previous research to establish the evidence base for efficacy of the original 14-session protocol and provides strong evidence of positive CST treatment effects for: global cognition, language and quality of life. These results have clinical implications for the use of CST in routine practice for the treatment of mild to moderate dementia. Where possible, CST using the original protocol, should be delivered routinely to individuals with mild to moderate dementia.

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Table 1: Demographic and characteristics of included studies

Study	Location	Setting	Age/years *M* (*SD*)	Women (%)	Outcomes assessed	N in the analysis	Quality rating
Alvares-Pereira et al., (2021)	Portugal	Eight organisations representing a mix of community and inpatient/residential care settings	Treatment: 83.0 (6.7) Control: 84.2 (8.7)	86.7	Anxiety: RAID Behaviour: CAPE Cognition: ADAS -Cog Communication: Holden Depression: CSDD Orientation: ADAS-Cog orientation subscale Quality of Life: QoL-AD Severity: CDR	Total N = 105 Treatment = 50 Control = 55	High
Apóstolo et al., (2014)	Portugal	Four residential care homes	Treatment: 82.0 (5.9)	68.8	Cognition: MoCA	Total N = 48	High

Study	Location	Setting	Age/years *M* (*SD*)	Women (%)	Outcomes assessed	N in the analysis	Quality rating
			Control: 81.3 (5.5)		Depression: GDS-15	Treatment = 23 Control = 25	
Capotosto et al., (2017)	Italy	Two residential care homes	Treatment: 88.3 (5.2) Control: 86.5 (5.6)	69.2	Cognition: MMSE; ADAS-Cog; BDS Depression: CSDD Emotional Loneliness: ESLS Functional Ability: DAD Language: NLT Psychiatric symptoms: NPI Quality of Life: QoL-AD Social loneliness: ESLS	Total N = 39 Treatment = 20 Control = 19	Medium
Carbone et al., (2021)	Italy	16 residential care homes or day centres	Treatment: 82.6 (6.8) Control: 84.7 (6.2)	66.2	Cognition: MMSE; ADAS-Cog Depression: CSDD Functional Ability: DAD Language: NLT Psychiatric symptoms: NPI Quality of Life: QoL-AD	Total N = 225 Treatment = 123 Control = 102	High
Coen et al., (2011)	Ireland	Two residential care homes	Treatment: 78.4 (5.0) Control: 81.3 (6.2)	51.9	Anxiety: RAID Behaviour: BRS Cognition: MMSE; ADAS-Cog	Total N = 27 Treatment = 14 Control = 13	Low

Study	Location	Setting	Age/years *M* (*SD*)	Women (%)	Outcomes assessed	N in the analysis	Quality rating
					Depression: GDS-15 Quality of Life: QoL-AD Severity: CDR		
Dahlan et al., (2022)	Malaysia	Residential care homes	Treatment: 60-74yrs 66.7% Control: >75yrs 33.3%	60.4	Cognition: LOTCA-G	Total N = 48 Treatment = 24 Control = 24	High
Marinho et al., (2021)	Brazil	One outpatient department	Treatment: 78.3 (8.4) Control: 77.3 (8.4)	61.7	Caregiver burden: ZBI Cognition: ADAS-Cog Depression: CSDD Functional Ability: ADCS-ADL Orientation: ADAS-Cog orientation subscale Quality of Life: QoL-AD	Total N = 47 Treatment = 23 Control = 24	High
Piras et al., (2017)	Italy	Residential care homes	Treatment: 83.8 (10.9) Control: 85.4 (5.18)	80.0	Cognition: MMSE; ADAS-Cog; BDS Depression: CSDD Functional Ability: DAD Language: NLT Loneliness: ESLS Psychiatric Symptoms: NPI Quality of Life: QoL-AD	Total N = 35 Treatment = 21 Control = 14	Low

Study	Location	Setting	Age/years *M* (*SD*)	Women (%)	Outcomes assessed	N in the analysis	Quality rating
Spector et al., (2001)	UK	One day centre and three residential care homes	85.7 (6.7)	NR	Anxiety: RAID Behaviour: BRS Carer burden: RSS Cognition: MMSE; ADAS-Cog Communication: Holden Depression: CSDD Health: GHQ-12 Severity: CDR	Total N = 27 Treatment = 17 Control = 10	High
Spector et al., (2003)	UK	169 day centres and residential care homes	85.3 (7.0)	78.6	Anxiety: RAID Behaviour: CAPE Communication: Holden Depression CSDD Severity: SDR	Total N = 167 Treatment = 97 Control = 70	Medium
Spector et al., (2010)	UK	Day centres and residential care homes	Treatment: 85.7 (6.2) Control: 84.7 (7.9)	78.6	Cognition: MMSE; ADAS-Cog Orientation: ADAS-Cog orientation subscale	Total N = 201 Treatment = 115 Control = 86	Medium
Yamanaka et al., (2013)	Japan	Three residential homes and one nursing home	Treatment: 84.1 (5.5) Control: 83.7 (6.4)	78.6	Cognition: MMSE; COGNISTAT Quality of Life: QoL-AD; EQ-5D	Total N = 56 Treatment = 26 Control = 30	High

M: mean; *SD*: standard deviation; ADAS-Cog: Alzheimer's Disease Assessment Scale -Cognition; QoL-AD: Quality of Life - Alzheimer's Disease; Holden: Holden communication scale; RAID: Rating Anxiety in Dementia; CAPE: Clifton Assessment Procedures for the Elderly -Behaviour Rating Scale; CDR: Clinical Dementia Rating; MoCA: Montreal Cognitive Assessment; GDS-15: Geriatric Depression Scale; MMSE: Mini Mental State Examination; BDS: Backwards Digit Span; NLT: Narrative Language Test; CSDD: Cornell Scale for Depression in Dementia; SELS: Social and Emotional Loneliness Scale; NPI: Neuropsychiatric Inventory; DAD: Disability Assessment for Dementia; BRS: Behaviour Rating Scale; LOTCA-G: Lowenstein Occupational Therapy Cognitive Assessment -Geriatric Version; ASCS-ADL: Alzheimer's Disease Cooperative Study - Activities of Daily Living; ZBI: Zarit Burden Interview; ESLS: Emotional and Social Loneliness Scale; NR: Not Reported; GHQ-12: General Health Questionnaire; RSS: Relative's Stress Scale; COGNISTAT: Neurobehavioral Cognitive Status Examination; EQ-5D: EuroQol -5 Dimension

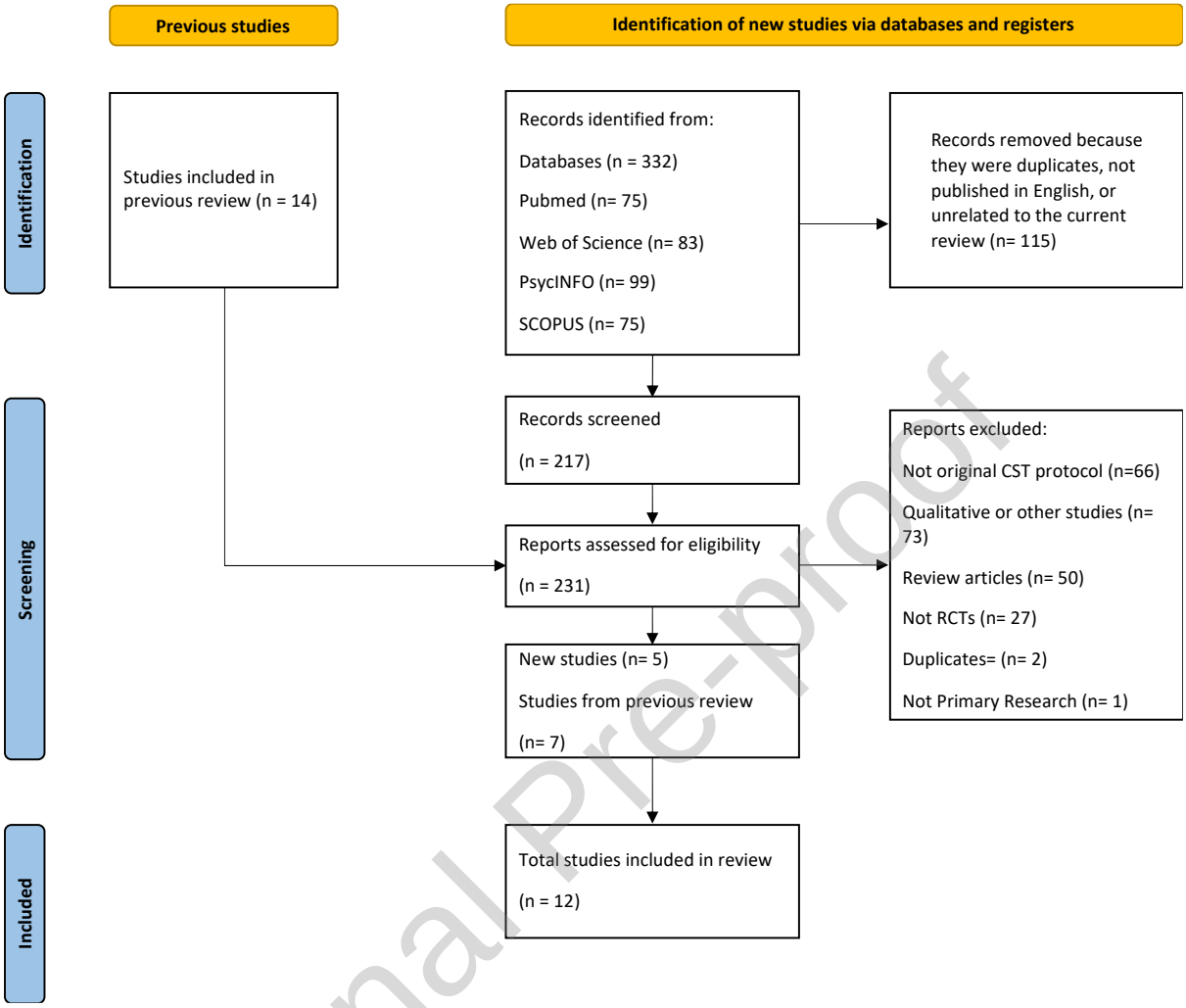

Figure 1. Flow diagram of study selection

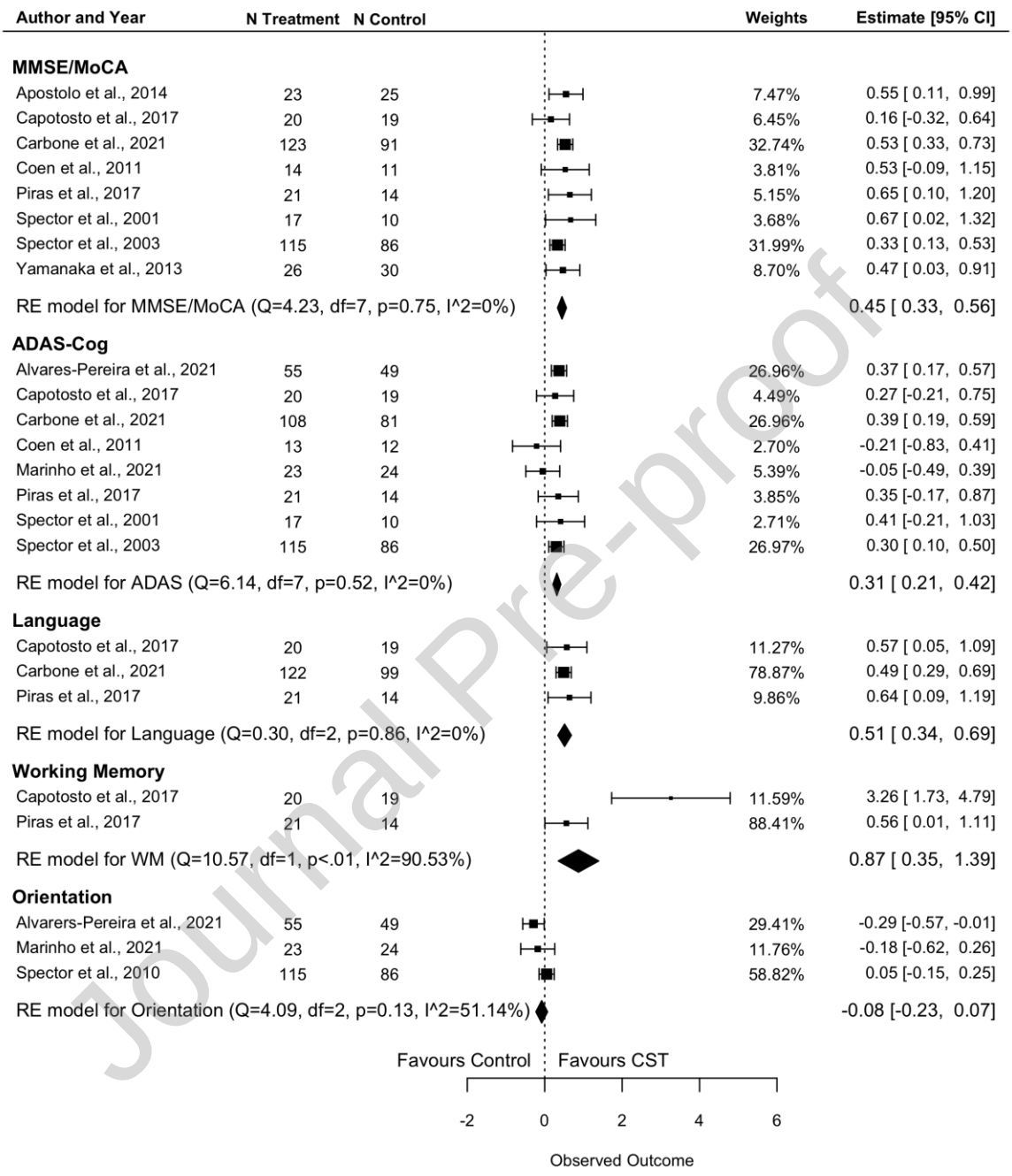

Figure 2. Forest plot for cognitive outcomes

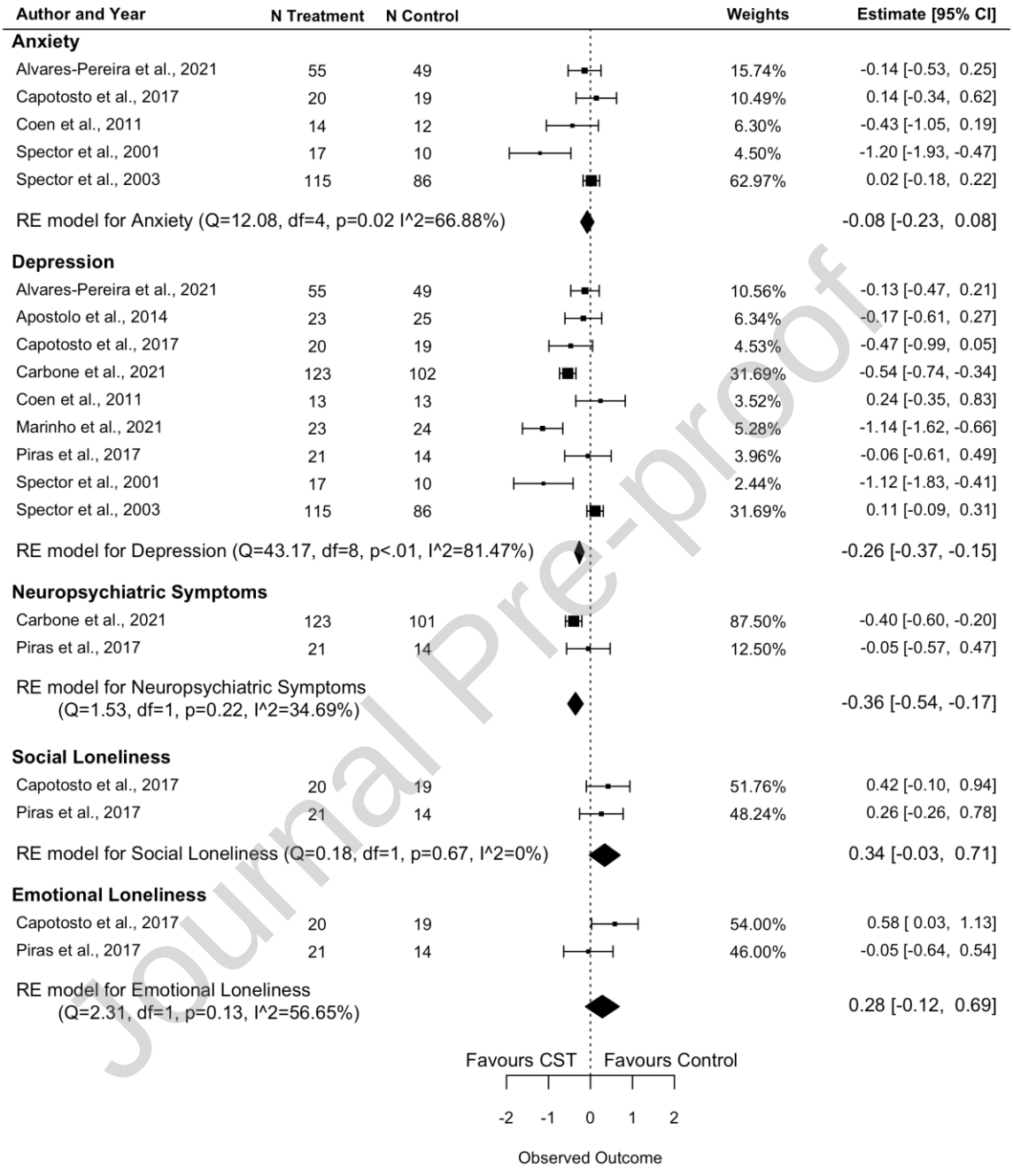

Figure 3. Forest plot for affective and neuropsychiatric symptoms *The NPI anxiety subscale score was used as the anxiety measure for Capotosto et al., (2017)

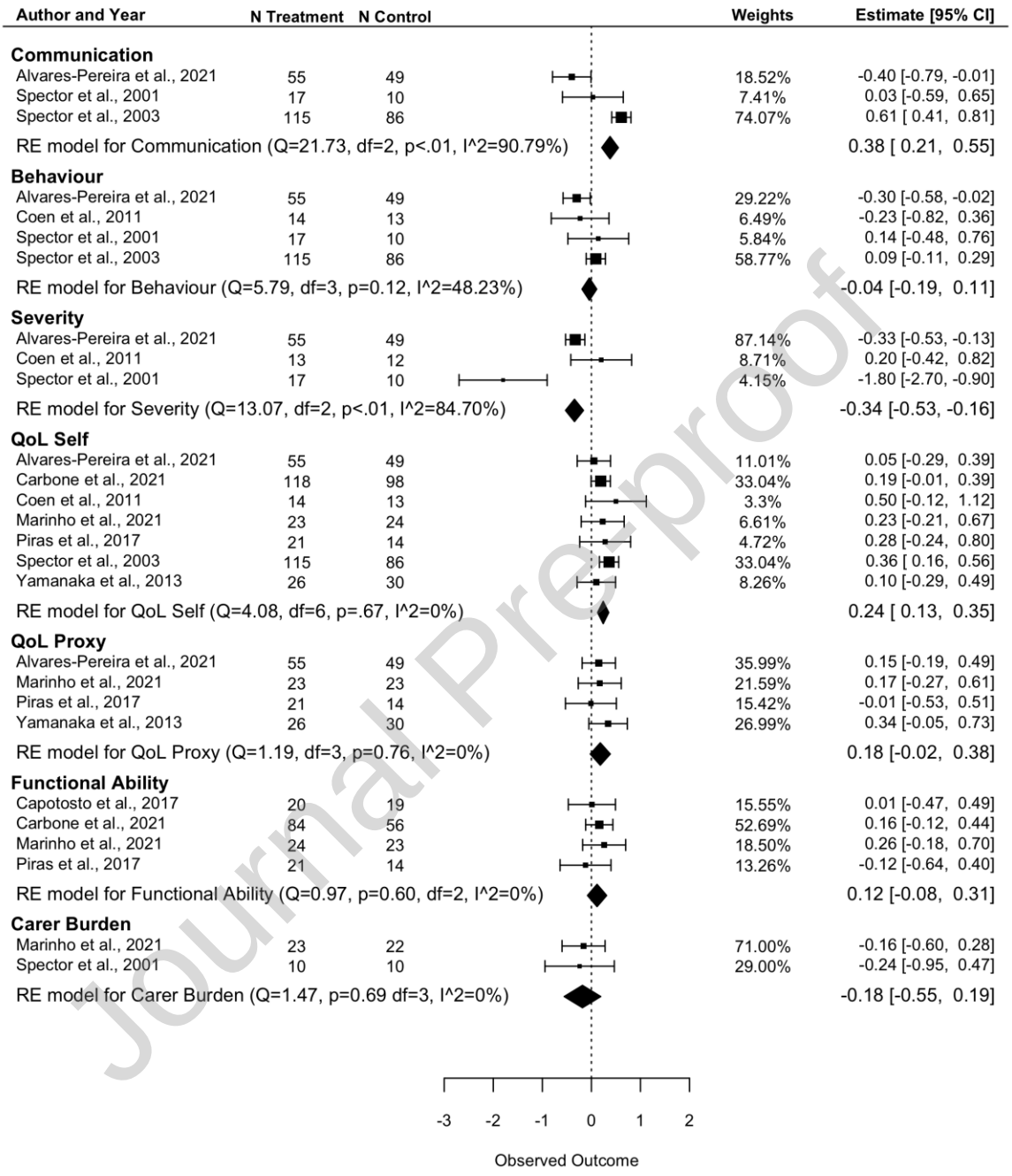

Figure 4. Forest plot for all other outcomes

Competing Interests:
None of the authors have competing interests to declare

Declarations of interest:

none

Highlights

- As yet there are no effective pharmaceutical treatments for dementia
- CST is a psychosocial intervention for people with mild to moderate dementia
- CST aims to improve cognitive functioning and overall well-being
- CST utilizing the original 14-session protocol is effective for improving cognition, depressive symptoms and quality of life outcomes