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Effects of an individual cognitive stimulation intervention on global cognition, memory, and executive function in older adults with mild to moderate Alzheimer's disease

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ABSTRACT

Objective: To determine the efficacy of a 12-week individual cognitive stimulation (iCS) intervention on global cognition, memory, and executive function of older adults with mild to moderate Alzheimer's disease (AD). Method: Protocolized analysis using data from a multicenter, single-blind, randomized, parallel two-arm RCT of iCS for older adults with probable AD. A sample of 142 people with probable Alzheimer's disease attending 13 Portuguese institutions providing care and support services for older adults were selected. Intervention group ($n=72$) received 24 iCS sessions, twice a week for 12 weeks. Control group ($n=70$) maintained their activities as usual. Outcomes included global cognitive function (Mini-Mental State Examination, and Alzheimer's Disease Assessment Scale—Cognitive Subscale), memory (Memory Alteration Test, and Free and Cued Selective Reminding Test), and executive functioning (Frontal Assessment Battery). All participants were assessed at baseline (T0), after the intervention (T1), and 12 weeks follow-up (T2). Results: The results showed significant improvements in memory performance at follow-up for the intervention group and greater stability in global cognition in the intervention relative to the control group. Conclusion: The current iCS protocol shows effectiveness in cognitive functioning in older adults with probable AD, particularly for memory upon completion of the intervention and at follow-up, adding further support to previous iCS studies showing similar results and to the effectiveness of the current intervention.

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Introduction

Neurocognitive Disorders (NCD) pose substantial public health consequences globally. The World Health Organization (WHO) estimated in 2019 that approximately 55 million people were affected by Major NCD (MNCD) with estimates reaching 70 million by 2030 and 139 million by 2050 (World Health Organization [WHO], 2021). Minor Neurocognitive Disorder (mNCD) presents with changes in cognitive functioning with preserved functional abilities and presents increased risk for progressive declines, while MNCD is characterized by changes in cognitive functioning as well as impairments in functional abilities (American Psychiatric Association [APA], 2022). With symptoms in NCD including cognitive, behavioral, and mood changes, it is paramount that interventions focused on treating the symptoms and deficits in NCD continue to be explored.

Promoting independence and improving quality of life are imperative goals in the treatment and management of persons with NCD. As such, there is ongoing emphasis on interventions to support persons with MNCD, including existing pharmacological options (Knight et al., 2018), though these can be costly and contraindicated for some persons. Behavioral options are viable, plentiful, and are sometimes preferred as separate or additive treatment to pharmacotherapeutic options for various reasons including cost, resources, access to medication, and side effects/tolerance (National Institute for Health and Care Excellence [NICE], 2018a). Some of the effective interventions include exercise (Groot et al., 2016), nutrition (Lourida et al., 2013), and cognitive therapy. Cognitive interventions for older adults with NCD, the focus of the current paper, are listed by WHO as a strategy to target cognition (World Health Organization [WHO], 2019) and NICE Guidelines (NICE, 2018a) and typically incorporate multiple activities and strategies with the goal of improving cognition, mood, behavior, and quality of life.

Cognitive stimulation therapies have been shown to be effective tools in the management of MNCD symptoms. One of the original subtypes is reality orientation therapy, which is part of the original framework for cognitive stimulation therapy. Reality orientation reviews temporal and spatial information and related activities, with primary emphasis on reviewing basic personal and current information (location, date, weather, current events) to all participants (Woods et al., 2023). A meta-analysis revealed that reality orientation therapy shows positive results in cognition in older adults with NCD (Chiu et al., 2018), and improved purpose in life in the treatment group relative to the control group in a clinical trial (Hsiao et al., 2018). Reminiscence therapy, another cognitive stimulation activity, guides participants through past experiences and events (often by using prompts such as photos, audio, or visual recordings) and has shown to improve cognition (Woods et al., 2018) as well as depression, functional activities, and QoL (Cuevas et al., 2020) in older adults with dementia. Most effective therapies were in small groups, lasting 45 min for 8–12 weeks, with notable benefits of the use of photographs, videos, and music associated with past experiences (Cuevas et al., 2020).

Cognitive stimulation incorporates activities and discussions focused on cognitive and social functioning, reminiscence therapy, and reality-orientation (Woods et al., 2012), and has shown consistent positive intervention effects that persist up to three

months post treatment (McDermott et al., 2019; Woods et al., 2012). A recent Cochrane review conducted by Woods et al. (2023) revealed successful cognitive stimulation programs in older adults with mild to moderate dementia over and above any medication effects. While the trials reviewed were of variable quality with some inconsistency in methodology, there were findings of improvements in self-reported quality of life and well-being. Several recent systematic reviews focused on the cognitive effects of cognitive stimulation in older adults with MCI or dementia revealed objective improvements in general cognition, memory, orientation, calculation, and praxis (Cafferata et al., 2021; Chao et al., 2020; Gómez-Soria et al., 2023; Lobbia et al., 2019; Saragih et al., 2022). Similar findings of cognitive benefits were also reported in a review of reviews (Meyer & O'Keefe, 2020).

The individual cognitive stimulation (iCS) intervention explored in the current study is an adaptation of Spector et al. (2006) cognitive stimulation intervention that has been thoroughly detailed elsewhere (Justo-Henriques, 2021; Justo-Henriques et al., 2020). In short, it integrates aspects of cognitive stimulation, reminiscence, and reality-oriented therapy. The initial pilot study using this individual format protocol showed some benefit in a small sample with mild cognitive impairment (Justo-Henriques et al., 2019) with similar effects in a larger quasi experimental study that also revealed improvements on depressive symptoms (Justo-Henriques et al., 2021a).

A similar Portuguese iCS protocol primarily focused on reminiscence therapy showed benefits in a large mixed dementia sample of older adults living in residential care facilities undergoing twice weekly sessions over 13 weeks with improvements in memory and executive functioning (Justo-Henriques et al., 2021b), global cognition, depressive symptoms, and quality of life (Pérez-Sáez et al., 2022). In a mixed dementia sample from the Azores, a Portuguese archipelago off the coast of Portugal (Justo-Henriques et al., 2021c), this protocol revealed inconsistent results, which may have been related to the timing of the COVID pandemic, the implementation of the intervention, or cohort effects, warranting further investigation.

The current protocol was modified for administration in a home-based setting and incorporated reminiscence therapy as well as other aspects of cognitive therapy (protocol details in Justo-Henriques & Carvalho, 2021) and proved to be effective in a year-long randomized controlled mixed dementia sample (Justo-Henriques et al., 2023) revealing improvements in depressive symptoms and cognitive functioning. When administered to a diverse sample of midlife and older adults with psychiatric conditions the protocol again showed improvements in cognition and depressive symptoms (Justo-Henriques et al., 2021d; Justo-Henriques et al., 2022), and in QoL (Justo-Henriques et al., 2022).

Clearly, the current cognitive stimulation protocol has thoroughly been explored, though there has been variability in its previous execution. For example, group assignments in previous studies were not randomized, the intervention has been conducted on mixed dementia diagnostic samples, the outcome measures have largely consisted of brief screening tools, the intervention duration has ranged from 12 to 47 weeks, and frequency has varied between once and twice weekly. Furthermore, therapist training has varied as a function of training facilities and staffing to conduct the interventions.

The current study is the first to explore the cognitive stimulation intervention using a rigorously standardized group of trained therapists conducting the 12-week intervention in a more refined diagnostic sample of persons with AD. In addition, the current study also has a more detailed presentation format using digital media (i.e., a variety of large and appealing images, sounds, audio and video clips of musical themes, mathematical operations) to reinforce material covered during the intervention, a more comprehensive cognitive protocol, and a randomized group assignment. Based on previous findings, we expect significant improvements in our intervention group relative to our control group on memory, executive functioning, and global cognitive functioning for both post-intervention and follow-up outcomes.

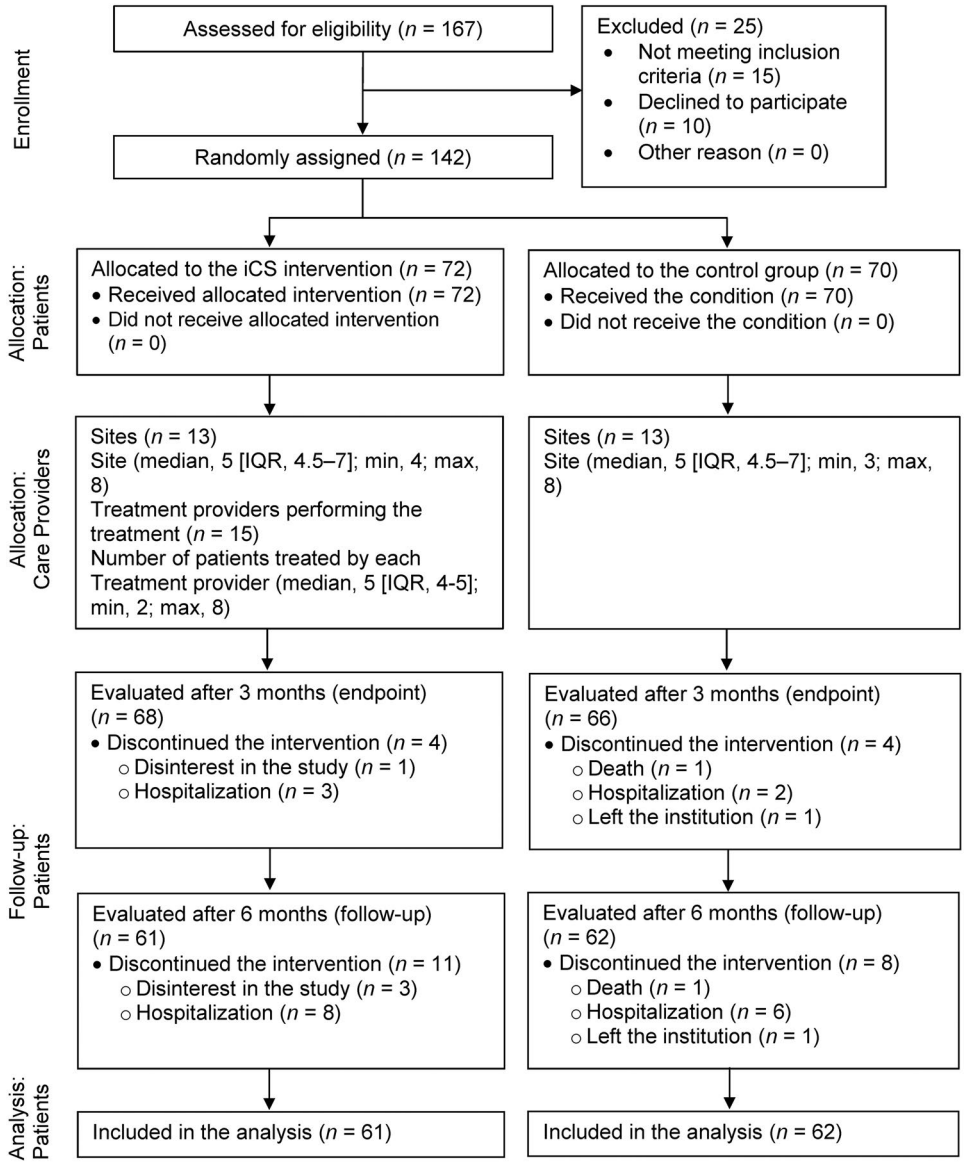
Method

Our approved clinical trial of iCS for older adults with mild to moderate AD was a multicenter, single-blind (outcomes assessor), randomized, parallel two-arm (CS vs. treatment as usual, 1:1 ratio), controlled trial. Participants in the intervention group received two sessions of iCS per week for 12 weeks in addition to their regular activities. Participants in the control group underwent their usual activities. Participants were assessed at baseline (T0), after the intervention (T1), and 12 weeks post intervention (T2).

Participants

A Portuguese nationwide (mainland and islands) mailing was sent to social care institutions (e.g., day programs, residential settings), inviting them to take part in a RCT on iCS for older adults diagnosed with mild or moderate AD. A pre-meeting was held with the organizations that were available to participate, in order to provide more information about the study (inclusion and exclusion criteria, evaluation instruments, and schedule). Eighteen social care institutions expressed initial interest and after additional information was provided, 13 institutions agreed to participate. The institutions were then asked to refer participants, resulting in 167 participants completing the eligibility assessment. After baseline assessment, 142 participants were selected for the RCT: 72 were randomly allocated to the intervention group and 70 to the control group (see Figure 1).

Inclusion criteria for the study were: a diagnosis of probable Alzheimer's disease according to DSM-5-TR criteria (participant diagnosis was confirmed from their health records at the institution; no biomarker data were available); signed informed consent by the participant (if they had the capacity to do so) or their legal representative; intact communication skills; 65 years or older; native Portuguese speaking; receiving care and support services for older adults for at least three months (including those living in long-term care centers, attending day and social programs, and receiving home-based services); Mini Mental State Examination (MMSE) score between 10 and 24 points (this range reflects the well document cutoff of MMSE 24 as denoting mild dementia used in clinical trials (Chapman et al., 2016) and a lower cutoff of MMSE 10 as denoting the distinction between moderate and severe dementia, also commonly used in clinical trials (e.g., NICE Guidelines, 2018b)). Pharmacological treatment for



Abbreviations: IQR = Interquartile Range; iCS = Individual Cognitive Stimulation.

Figure 1. CONSORT diagram of participant flow through the study.

Alzheimer's disease was recorded for each participant, including donepezil, memantine, rivastigmine and/or galantamine. Availability of and changes to medications should have affected both groups equally.

Exclusion criteria were as follows: impaired communication skills; severe sensory and physical limitations; acute or serious illness preventing participation in the iCS sessions; evidence of aggressive and disruptive behaviour, as observed by staff at the facility; starting or restarting psychoactive substances; starting neuroleptics or anti-psychotics within two months of recruitment.

After completion of baseline assessment, participants were randomly allocated to either the control group or the experimental group. Due to the multicenter nature of the study, each institution had two groups, one intervention and one control group, with a 1:1 ratio. A non-stratified permuted block randomization process (with a variable block size) was carried out using the software DatInf® RandList by one of the study principal investigators blinded to baseline scores and demographics of the participants. The overall number of participants at each institution ranged from 7 to 16. Group assignment was concealed from participants, therapists, and institution staff until the intervention started. Evaluators remained blinded to groups until completion of endpoint assessments. Enrollment of participants was performed by the researchers responsible for communicating with the institutions who assessed eligibility. Trained therapists at each institution administered the intervention.

Written informed consent was obtained from all participants or their legally authorized representatives prior to the intervention, after they had been provided with written information on the study. Such information included details on the research protocol (duration, nature, and number of sessions), data management, the voluntary nature of participation, and the right to withdraw from the study at any time without affecting care or treatment at the institutions. Therapists monitored participants for disinterest to determine if they wished to withdraw.

The authors attest that all procedures followed in this study complied with the ethical standards of the relevant national and institutional committees on human experimentation and with the Declaration of Helsinki of 1975, as revised in 2008. The Health Sciences Research Unit: Nursing of Coimbra approved all procedures involving human subjects/patients, with approval number P876_05_2022.

Intervention

The intervention consisted of an iCS biweekly 12-week program, totaling 24 sessions. Each session had an average duration of 45 min and was structured in four components with specific durations: (i) welcome/greeting (5 min); (ii) orientation to place and time (10 min); (iii) cognitive stimulation main activity (25 min); (iv) processing and session review (5 min) (Table 1).

The iCS sessions were one-to-one and led by a previously trained therapist (health professional). The sessions included several activities based on the principles of iCS and the degree of difficulty of the exercises was adjusted according to the level of participant, i.e., mild or moderate AD. All sessions were novel (i.e., each of the 24 sessions differed, though the structure of 4 series of 6 thematic sessions was consistent); throughout the program, the degree of difficulty was increased from session to session.

The iCS sessions were conducted by 15 therapists and/or other rehabilitation professionals who received a 6-h group training on the protocol (including objectives and schedule for each session, all protocols and materials, and recommendations about the intervention) by two of the principal investigators for standardization. Detailed demographics of the professionals involved is provided in supplementary material (supplemental Table S1). Among the therapists and/or rehabilitation professionals, 80% were women, approximately 35 years old, and had 9 years of professional

Table 1. Basic structure of the iCS program adapted from Justo-Henriques (2021).

Duration	Contents	Materials and activities
5 min	Start of session	Greeting Mood assessment Session agenda
10 min	Orientation	Temporal and physical orientation.
25 min	Stimulation of cognitive domains	Scheduled main session activities (presented in digital format via *via PowerPoint*) covered six themes: • Portuguese language (identify missing letters in words, synonyms or associated words, alphabetize, memorize words (timed), develop a related theme); • mathematics (calculations, memorize results or numbers (timed), simulate purchase transactions, sort numbers); • daily activities (naming objects, timed memorization of objects, comparing utensils, categorizing (e.g., clothing, footwear, food, medication, technical aids, personal hygiene products, kitchen utensils, and rooms in a house)); • the past (identify, name, and associate images from the present and the past, such as modes of transportation, appliances, housing, media, professions, clothing, celebrities, politics, regional and local references, identify similarities and differences, memorize (timed) past historical images; • fruit (identify fruits through images or riddles, memorize (timed) the fruits presented and their sequence, associate fruits with the harvest seasons, associate fruits with other products derived from them, associate images of fruits with words); • sounds (associating sounds with images, memorizing (timed) sounds and sequences, associating musical themes with interpreters; identifying names of musical themes; associating musical themes with geographical areas, such as cities, regions, archipelagos; identifying and counting words in a musical theme).
5 min	End of session	Processing and debriefing Session evaluation Closing

Abbreviations: iCS: Individual Cognitive Stimulation.

experience with about 5 years of experience with iCS therapy. Regarding their professions, 5 were Psychologists, 3 Social Educators, 2 Gerontologists, 2 Occupational Therapists, 2 Social Workers and 1 Psychomotor Therapist. Regarding their educational level, 8 had a bachelor's degree and 7 had a master's degree.

The proposed protocol was adapted from Justo-Henriques (2021), supported for persons with neurocognitive disorders (Justo-Henriques et al., 2019; Justo-Henriques et al., 2021a), converted into digital format (*Microsoft PowerPoint* presentation), with 4 series of 6 themed sessions. The activities included in the intervention protocol are based on the therapeutic tools of CS, *Roletas da Memória*© [Memory Roulettes], comprised of Portuguese language, math, and daily living activities, and *Bingos Seniores*© [Senior Bingos], which includes fruit bingo, travel to the past bingo, and sound bingo.

Throughout the intervention, therapists recorded the participants' attendance and engagement *via* an electronic session evaluation questionnaire and were instructed to contact the principal investigators with any questions or concerns. The sessions were held at each institution, with the therapist determining the time and location for each session, preferably in a room with minimal distractions and in accordance with intervention deadlines (Justo-Henriques et al., 2020). The intervention lasted 12 weeks, from 6 March 2023 to 26 May 2023.

The participants in the control group did not receive the iCS intervention, rather following their daily routines coordinated by the facility/program. While the specific activities varied at each program, they included social activities, cognitive games, and dispensing medications. All activities offered to the control group were also available to those in the CS group; therefore, the trial examines the additional effects of iCS beyond regular activities. It is possible that some participants in the control group may have engaged in some form of cognitive stimulation work during data collection, though none of the institutions offered a structured iCS program during the study period.

Instruments

The protocol included several tools administered to all participants (intervention and control groups) by evaluators trained on their use and blinded to participant group. Data were collected at baseline (T0), after the iCS intervention (T1), and at a 12 weeks follow-up (T2). The outcome measures addressed global cognitive function and other specific cognitive domains (memory and executive function).

Cognitive functioning was assessed using the Mini-Mental State Examination (MMSE; Folstein et al., 1975) and Alzheimer's Disease Assessment Scale—Cognitive Subscale (ADAS-Cog; Mohs et al., 1983; Rosen et al., 1984). The MMSE is among the most common screening measures of global cognition implemented in clinical and research practice (Cronbach's alpha = .89). Scores range from 0 to 30, with higher scores indicating better cognitive functioning (Guerreiro et al., 1994; Morgado et al., 2009). ADAS-Cog evaluates the severity of cognitive deficits in AD in the following domains: memory, orientation, language, praxis, and constructive capacity. The total score in the Portuguese version of ADAS-Cog (Cronbach's alpha = .554) is composed of 11 subtests, ranging from 0 to 68 points (with higher scores reflecting better performance), (Guerreiro et al., 2008; Nogueira et al., 2018). Notably, this relatively low alpha value may be due to the variability among subtests. ADAS-Cog is commonly used in clinical trials to evaluate the cognitive effects of the dementia medications (Moniz-Cook et al., 2008)

The Memory Alteration Test (MAT) was used to assess memory function (Rami et al., 2007; Sousa et al., 2015). It is an easy and quick instrument that assesses five memory domains: temporal orientation, encoding, semantic memory, free recall, and cued recall. Total scores range from 0 to 50, with higher scores indicating better memory. It has good psychometric properties (Cronbach's alpha = .93) and is highly sensitive to detecting mild cognitive decline (Rami et al., 2007).

The Free and Cued Selective Reminding Test (FCSRT) was used to assess memory function (Buschke, 1984; Lemos et al., 2012, 2015). FCSRT is a verbal learning and memory test that allows prompting encoding and retrieval conditions by using semantic cues on learning and recall trials (Cronbach's alpha =0.915 for the immediate recall and 0.879 for the delayed recall). It is composed of 16 semantically categorized, unrelated items/words.

The Frontal Assessment Battery (FAB) was used to assess executive function (Dubois et al., 2000; Lima et al., 2008) in several subtests: conceptualization, mental flexibility, motor programming, sensitivity to interference, inhibitory control, and environmental autonomy (Cronbach's alpha = .83). Scores range from 0 to 18, with higher scores indicating better executive functioning.

Data analysis

Chi-square tests for categorical variables and t-tests for continuous variables were performed to determine whether the groups were homogenous prior to treatment. No imputation of missed data was made, thus only data from participants who completed the follow-up assessment were analyzed.

The impact of iCS on outcomes (MMSE, ADAS-Cog, MAT, FCSRT, FAB) were analyzed using linear mixed models, with Group Assignment as between-subjects factor (iCS, control) and Time as within-subjects factor (baseline T0, endpoint T1, follow-up T2). The main factor of interest was the Group X Time interactions. Post-hoc multiple comparisons with Bonferroni corrections were considered between timepoints and between groups. Statistical analysis was performed using IBM SPSS Statistics, version 25, and GraphPad Prism 10.2.3 (GraphPad Software Inc., CA).

Results

Sociodemographic and clinical characteristics

Recruitment took place from February to September 2023. A total of 142 participants were selected: 72 (50.7%) allocated to the iCS group and 70 (49.3%) allocated to the control group. No significant differences were found between the intervention and control groups regarding age, gender, educational level, marital status, type of institution attended and prescribed medications (Table 2). No significant differences were found between the intervention and control groups regarding clinical condition or baseline mean scores in MMSE, ADAS-Cog, MAT, FCSRT and FAB (Table 3).

Of the 72 participants in the iCS group, 71 participants completed the iCS program (only one participant withdrew from the iCS intervention, due to disinterest), but only 61 (84.7%) completed the three assessments. The T1 assessment could not be completed for 4 participants (5.5%), and the T2 assessment could not be completed for 7 more participants (9.7%; see Figure 1). Three of these participants withdrew from the study due to disinterest and the other 8 due to hospitalization. No serious adverse events related to the trial were recorded.

Of the 70 participants in the control group, four (5.7%) did not complete the T1 assessment, and another four patients (5.7%) could not be assessed at follow up, resulting in 62 participants (88.6%) completing the three assessments.

For those participants who completed the trial, no significant differences were found between the intervention and control groups regarding demographic variables (all $X^2 < 6.314$, $p > .177$) or baseline mean scores for the outcomes (all $t < 0.407$, $p > .605$).

Effects of iCS at endpoint and follow-up

MMSE

No significant interaction Group×Time was found on the MMSE ($F_{(1.98,108.1)} = 1.44$, $p = 0.24$, $\eta_p^2 = 0.01$).

Table 2. Sociodemographic and clinical characteristics of the sample.

	Overall sample ($n = 142$)	iCS group ($n = 72$)	Control group ($n = 70$)		
Age				*T*	*p*
Mean (*SD*)	82.85 (7.36)	83.32 (7.60)	82.37 (7.12)	−.767	.445
Range	65–98	65–98	65–94		
Gender				X^2	*p*
Male	38 (26.8%)	18 (25%)	20 (28.6%)	.003	.956
Female	104 (73.2%)	54 (75%)	50 (71.4%)		
Educational level					
1–2 years	12 (8.5%)	8 (11.1%)	4 (5.7%)	6.314	.177
3–4 years	95 (66.9%)	44 (61.1%)	51 (72.9%)		
5–6 years	11 (7.7%)	6 (8.3%)	5 (7.1%)		
7–12 years	16 (11.3%)	10 (13.9%)	6 (8.6%)		
Higher education	8 (5.6%)	4 (5.6%)	4 (5.7%)		
Marital status					
Single	12 (8.5%)	7 (9.7%)	5 (7.1%)	.373	.946
Married	42 (29.6%)	20 (27.8%)	22 (31.4%)		
Divorced	7 (4.9%)	4 (5.6%)	3 (4.3%)		
Widowed	81 (57%)	41 (56.9%)	40 (57.1%)		
Type of institution attended					
Home support service	8 (5.6%)	3 (4.2%)	5 (7.1%)	.736	.692
Day care	41 (28.9%)	20 (27.8%)	21 (30%)		
Long-term care center	93 (65.5%)	49 (68.1%)	44 (62.9%)		
Social response attended for at least 3 months					
Yes	139 (97.9%)	71 (98.6%)	68 (97.1%)	.370	.543
No	3 (2.1%)	1 (1.4%)	2 (2.9%)		
Prescribed medications					
Antidepressants	77 (54.2%)	38 (52.8%)	39 (55.7%)	.123	.725
Neuroleptics/ Antipsychotics	19 (13.4%)	12 (16.7%)	7 (10%)	1.361	.243

Results of between-group comparisons.
Abbreviations: iCS: Individual Cognitive Stimulation.

Table 3. Baseline scores of the outcomes.

	Overall sample ($n = 142$)	iCS group (n = 72)	Control group (n = 70)			
Baseline assessment	Mean (SD)	Mean (SD)	Mean (SD)	t	p Value	Cohen's d
MMSE	18.42 (4.19)	18.40 (4.38)	18.44 (4.01)	0.057	.955	0.010
Range	10–24	10-–24	10–24			
ADAS-Cog	28.20 (10.27)	28.38 (10.51)	28.01 (10.08)	−0.209	.835	0.035
Range	10–58	10–58	12–56			
MAT	18.11 (10.22)	17.96 (10.44)	18.26 (10.06)	0.174	.862	0.034
Range	1–43	1–43	1–41			
FCSRT IR	15.85 (12.16)	16.38 (12.13)	15.31 (12.25)	0.518	.605	0.087
Range	0–45	0–44	0–45			
FCSRT DR	5.33 (4.77)	5.47 (4.58)	5.19 (4.99)	0.357	.722	0.060
Range	0–16	0–16	0–16			
FAB	7.08 (3.08)	7.00 (2.86)	7.17 (3.32)	0.330	.742	0.055
Range	2–17	2–14	2–17			

Results of between-group comparisons at baseline.
Abbreviations: ADAS-Cog: Alzheimer's Disease Assessment Scale-Cognitive; FAB: Frontal Assessment Battery; FCSRT IR: Free and Cued Selective Reminding Test Immediate Recall; FCSRT DR: Free and Cued Selective Reminding Test Delayed Recall; iCS: Individual Cognitive Stimulation; MMSE: Mini-Mental State Examination; MAT: Memory Alteration Test.

ADAS-Cog

A marginally significant Group X Time interaction was obtained on the ADAS-Cog ($F_{(1.86,101.4)} = 3.10$, $p = 0.05$) with a small effect size ($\eta_p^2 = 0.03$). However, no significant

differences were found at multiple comparisons despite the control group worsening ADAS-Cog scores across the three assessments, while the iCS group improved from T0 to T1, and returning to baseline scores at T2.

MAT

A significant Group×Time interaction was found on the MAT ($F_{(1.96,106.5)} = 7.37$, $p = 0.001$, but with a small effect size ($\eta_p^2 = 0.05$). Multiple comparisons showed that the iCS group significantly improved MAT scores from baseline (T0) to endpoint (T1) ($p = 0.007$) and follow-up (T2) ($p < 0.0001$), while the control group maintained their scores across trials.

FCSRT

For the FCSRT the following measures were chosen for analysis: Total Immediate Recall—the sum of free and cued recall across the 3 trials (IR), and Total Delayed Recall—the sum of free and cued recall in the delayed trial (DR).

For FCSRT IR a marginally significant Group×Time interaction was found ($F_{(1.74,93.7)} = 3.21$, $p = 0.05$), with a small effect size ($\eta_p^2 = 0.02$) (Table 4). Multiple comparisons showed that the iCS group significantly improved their FCSRT IR scores between assessments (baseline (T0) to endpoint (T1): $p = 0.04$, T0 to follow-up (T2): $p = 0.0006$; and T1 to T2: $p = 0.02$), while the control group maintained their scores through the trial (Table 4).

For FCSRT DR a significant Group×Time interaction ($F_{(1.59,86.62)} = 3.99$, $p = 0.03$, yet small ($\eta_p^2 = 0.03$), showed that the iCS group significantly improved their FCSRT DR scores from baseline (T0) to follow-up (T2) ($p = 0.01$), while the control group maintained their scores through the trial (Table 4).

FAB

No significant Group×Time interaction was found on the FAB scores ($F_{(2.0,108.7)} = 2.37$, $p = 0.10$, $\eta_p^2 = 0.02$) (Table 4).

Adherence to intervention

Adherence to iCS sessions was high (Table 5). Mean attendance of participants was 22.9 sessions (out of 24 sessions), with 93% of participants attending more than 20 sessions; 75.0% of participants attended 23 or 24 sessions, and 68.0% of participants attended all sessions. The reasons for not attending the 77 sessions were: hospitalization due to physical illness or a physical acute illness (51.9%), refusal to participate (27.3%), dropping out of the study (10.4%), medical appointments (3.9%), absence (3.9%), and family death (2.6%).

Degree of participation during the intervention

After analyzing the individual records of each session, we were able to obtain data regarding the level of collaboration of participants throughout the intervention

Table 4. Longitudinal Analysis of Cognitive Performance for iCS vs. Control Group at Baseline (T0), Endpoint (T1), and Follow-up (T2) Assessments.

	iCS ($n = 61$)			Control ($n = 62$)			Group × Time				Multiple comparisons								
											iCS			Control			iCS vs Control		
	T0 Mean (*SD*)	T1 Mean (*SD*)	T2 Mean (*SD*)	T0 Mean (*SD*)	T1 Mean (*SD*)	T2 Mean (*SD*)	*df*	*F*	*p*	η_p^2	T0 vs T1	T0 vs T2	T1 Vs T2	T0 vs T1	T0 vs T2	T1 vs T2	T0	T1	T2
MMSE	18.87 (4.35)	19.48 (5.60)	19.64 (5.87)	18.34 (3.98)	18.32 (5.21)	18.32 (5.30)	1.98, 108.1	1.44	0.24	0.01									
ADAS-Cog	27.48 (9.38)	25.84 (13.30)	27.15 (14.53)	28.18 (9.74)	29.63 (11.67)	30.26 (12.48)	1.86, 101.4	3.10	0.05	0.03	0.86	>0.99	>0.99	0.42	0.27	>0.99	>0.99	>0.99	>0.99
MAT	19.00 (10.19)	20.82 (12.54)	22.13 (13.30)	17.85 (9.79)	17.98 (10.27)	17.48 (10.09)	1.96, 106.5	7.37	0.001	0.05	0.007	<0.0001	0.38	>0.99	>0.99	>0.99	>0.99	>0.99	0.08
FCSRT IR	17.57 (12.38)	19.64 (14.90)	21.39 (16.17)	14.56 (12.25)	14.38 (13.56)	15.51 (13.94)	1.74, 93.70	3.21	0.05	0.02	0.04	0.0006	0.02	>0.99	>0.99	>0.99	>0.99	0.20	0.12
FCSRT DR	5.84 (4.65)	6.67 (5.83)	6.95 (5.95)	4.92 (4.92)	4.55 (5.01)	4.87 (4.91)	1.59, 86.62	3.99	0.03	0.03	0.24	0.01	0.69	>0.99	>0.99	>0.99	>0.99	0.16	0.20
FAB	7.30 (2.91)	7.74 (3.79)	7.56 (3.91)	7.15 (3.41)	6.87 (3.35)	6.68 (3.50)	2.0, 108.7	2.37	0.10	0.02									

Note: Interaction between Time (T0 versus T1 versus T2) and Group (iCS versus Control) was carried out by linear mixed models. Post-hoc multiple comparisons with Bonferroni corrections were considered; ADAS-Cog: Alzheimer's Disease Assessment Scale-Cognitive; FAB: Frontal Assessment Battery; FCSRT: Free and Cued Selective Reminding Test; FCSRT IR: Free and Cued Selective Reminding Test Immediate Recall; FCSRT DR: Free and Cued Selective Reminding Test Delayed Recall; iCS: Individual Cognitive Stimulation; MMSE: Mini-Mental State Examination; MAT: Memory Alteration Test; T0: Baseline assessment; T1: Endpoint assessment; T2: Follow-up assessment.

Table 5. Attendance at iCS sessions.

Attendance	*n* = 72	%
Sessions attended		
M (*SD*)	22.9 (2.43)	
Number of sessions attended		
From 0 to 5	0	0
From 6 to 10	0	0
From 11 to 15	3	4.2
From 16 to 20	2	2.8
From 21 to 24	67	93.0

Abbreviations: iCS: Individual Cognitive Stimulation.

program, operationalized by active participation in the iCS activities. Participation was very high. Of the 1651 iCS sessions (including all participants in the intervention group), the participants completed 1444 (87.5%) of them. Participants appeared minimally engaged in 194 (11.7%) sessions and not engaged in only 13 (0.8%) sessions (in these cases, drowsiness or minimal attention and concentration prevented meaningful participation), according to the qualitative judgment provided by the therapists at the end of each session.

Discussion

The current randomized controlled clinical trial explored the efficacy of a 12-week standardized iCT program for older adults. While several interventions exist for older adults with mild to moderate AD, including nutrition, pharmacotherapy, and exercise, the current study focused on cognitive interventions. Cognitive therapy is among the nonpharmacologic treatment options that has shown empirical support for cognitive, behavioral, and emotional benefits for persons with major neurocognitive disorder (Woods et al., 2012). Nonpharmacologic therapies present with a number of benefits including no negative side effects and in some cases can be more cost effective than medications. Nonpharmacologic therapies in older adults also have been shown to enhance brain plasticity (Cabeza, 2002; Nagamatsu et al., 2012), further highlighting the effectiveness of these treatment options.

The current cognitive intervention, iCT, integrates aspects of cognitive stimulation, reminiscence, and reality-oriented therapy. While the intervention used has been explored previously in multiple studies, this was the first to explore iCT using a rigorously standardized set of therapists, a more refined diagnostic sample of persons with MCI and AD, a concrete presentation using digital media to reinforce material covered during the intervention, a comprehensive cognitive protocol, and a randomized group assignment. We compared the intervention group relative to the control group on tasks of cognitive functioning.

The well-matched intervention and control groups would be characterized as in the moderate dementia range given their cognitive performances at baseline. Within this group, there is good evidence to support the efficacy of the intervention, particularly regarding memory performance. Specifically on the memory measure, the iCS group showed improvements across the three time points relative to the control group, with statistically significant differences at follow-up between the two groups (mainly in FCSRT DR and MAT). Not only were the improvements on memory notable

across the time points, but perhaps even more importantly, is the continued benefits at follow-up, which is particularly encouraging in this memory impaired sample.

There were cognitive benefits in the intervention group on a more comprehensive cognitive measure (ADAS-Cog) between baseline and endpoint, which also is encouraging. While those improvements did not extend to follow-up, the ADAS-Cog is a more comprehensive measure that explored memory performance in addition to other domains including language, visuoconstruction, orientation, and visual attention, some abilities which are not theoretically expected to benefit from the intervention (Woods et al., 2023). Relative to the control group, however, there were improvements between the first two time points, but there was also stability of cognitive performance over time which was not observed in the control group; preservation of cognitive functioning is crucially important in a neurodegenerative sample.

Yet, the small effect sizes observed on the significant impacts of the intervention over time highlight that the benefits of iCS should be interpreted as modest.

While participants in both groups were well-matched, it should be noted a preponderance of women, with limited education (majority were in the 3- to 4-year age range, which was the standard education at the time for this older adult cohort; Vieira, 1985), and residing in long-term care centers, comprised a majority of our sample. While no participant self-reported mood ratings were considered at the time of the intervention, about half of the sample were taking antidepressants at the time of the intervention which also may have affected the results. Due to the current focus on cognitive outcomes, mood or quality of life were not explored in the current study; however, the protocol has previously shown improvements in depressed mood (Pérez-Sáez et al., 2022; Justo-Henriques et al., 2021d; 2022, 2023) and quality of life (Pérez-Sáez et al., 2022; Justo-Henriques et al., 2022). It is also worth noting that our two groups were not entirely blinded to the intervention as the control group merely engaged in the regularly scheduled activities offered at their institutions rather than undergoing individualized sessions with a therapist. However, our goal was to explore the impact of the intervention beyond regular activities, and the outcomes assessor was blinded to the groups. Future studies seek to better disentangle the effects of direct social interactions from the intervention. Finally, the participants diagnoses were obtained from medical health records and not confirmed *via* biomarkers. Thus, there was a reliance on the accuracy of diagnosis made by each participants health provider, which was not confirmed by the research team processes; this may unintentionally have resulted in the presence of some mixed or non-AD dementia participants in the sample. Although not being able to establish the reliability of participant diagnosis presents a critical limitation in this study, it is important to acknowledge the challenges surrounding dementia diagnosis in Portugal, namely the absence of gold standard criteria, which presents a nationwide problem that interferes with accurate forecasts of dementia as well as clinical and research practices (Alves et al., 2024). Most healthcare providers, though, rely on DSM-5-TR criteria for establishing the diagnosis of probable Alzheimer's disease, which constituted a central eligibility criterion for this study.

While many cognitive stimulation protocols emphasize memory skills, the current iCS is unique in that it is standardized in its structure but flexible enough to allow individual differences in interests and cultural knowledge to engage the participants and focus on rapport and the therapeutic relationship. Specifically, the current

intervention applies foundations of reminiscence therapy while also employing cultural references, music, generational games, and reinforces these lessons by using auditory and visual learning aids. The consistent participant adherence and engagement is perhaps the most impressive feature of the reported results: 93% of the participants engaged in 21–24 sessions (average was 22.9 of 24 sessions attended), which is notably high for research participation and points to participant satisfaction with the protocol. Overall, this demonstrates increased efficacy of this novel iCS intervention, adding substantive contributions to the existing cognitive rehabilitation literature.

Our current findings of cognitive stability or improvement in the intervention group is of notable importance as there are limited cognitive interventions that are applicable to Portuguese older adults with cognitive impairments beyond those using the current protocol. Therefore, the current findings join a large volume of data supporting the current iCS intervention in older adults including older adults with mild cognitive impairment (Justo-Henriques et al., 2019; Justo-Henriques et al., 2021a), a large mixed dementia sample of older adults living in residential facilities (Justo-Henriques et al., 2021b; Pérez-Sáez et al., 2022), a year-long randomized controlled mixed dementia sample (Justo-Henriques et al., 2023), a diverse sample of midlife and older adults with psychiatric conditions (Justo-Henriques et al., 2021d; Justo-Henriques et al., 2022). We feel increased and strengthened confidence in the effectiveness of this intervention protocol and its benefits in older adults with cognitive impairment.

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Trial protocol

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References

American Psychiatric Association (APA). (2022). *Diagnostic and statistical manual of mental disorders* (5thed., text rev.). APA. https://doi.org/10.1176/appi.books.9780890425787

Alves, S., Duarte, N., & Gomes, B. (2024). Forecasted dementia prevalence in Portugal (2020-2080). *Journal of Geriatric Psychiatry and Neurology*, *37*(5), 403–412. https://doi.org/10.1177/08919887241237220

Buschke, H. (1984). Cued recall in amnesia. *Journal of Clinical Neuropsychology*, *6*(4), 433–440. https://doi.org/10.1080/01688638408401233

Cabeza, R. (2002). Hemispheric asymmetry reduction in older adults: The HAROLD model. *Psychology and Aging*, *17*(1), 85–100. https://doi.org/10.1037/0882-7974.17.1.85

Cafferata, R. M. T., Hicks, B., & von Bastian, C. C. (2021). Effectiveness of cognitive stimulation for dementia: A systematic review and meta-analysis. *Psychological Bulletin*, *147*(5), 455–476. https://doi.org/10.1037/bul0000325

Chao, I. C. I., Nicpon, K., & Roberts, M. R. (2020). Effect of cognitive stimulation therapy on quality of life: A critical review. *Physical & Occupational Therapy in Geriatrics*, *38*(3), 203–229. https://doi.org/10.1080/02703181.2020.1716915

Chapman, K. R., Bing-Canar, H., Alosco, M. L., Steinberg, E. G., Martin, B., Chaisson, C., Kowall, N., Tripodis, Y., & Stern, R. A. (2016). Mini Mental State Examination and Logical Memory scores for entry into Alzheimer's disease trials. *Alzheimer's Research & Therapy*, *8*(1), 9. 2016 https://doi.org/10.1186/s13195-016-0176-z

Chiu, H. Y., Chen, P. Y., Chen, Y. T., & Huang, H. C. (2018). Reality orientation therapy benefits cognition in older people with dementia: A meta-analysis. *International Journal of Nursing Studies*, *86*, 20–28. https://doi.org/10.1016/j.ijnurstu.2018.06.008

Cuevas, P. E. G., Davidson, P. M., Mejilla, J. L., & Rodney, T. W. (2020). Reminiscence therapy for older adults with Alzheimer's disease: A literature review. *International Journal of Mental Health Nursing*, *29*(3), 364–371. https://doi.org/10.1111/inm.12692

Dubois, B., Slachevsky, A., Litvan, I., & Pillon, B. (2000). The FAB: A frontal assessment battery at bedside. *Neurology*, *55*(11), 1621–1626. https://doi.org/10.1212/WNL.55.11.1621

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state": A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, *12*(3), 189–198. https://doi.org/10.1016/0022-3956(75)90026-6

Gómez-Soria, I., Iguacel, I., Aguilar-Latorre, A., Peralta-Marrupe, P., Latorre, E., Zaldívar, J. N. C., & Calatayud, E. (2023). Cognitive stimulation and cognitive results in older adults: A systematic review and meta-analysis. *Archives of Gerontology and Geriatrics*, *104*, 104807. https://doi.org/10.1016/j.archger.2022.104807

Groot, C., Hooghiemstra, A. M., Raijmakers, P. G. H. M., van Berckel, B. N. M., Scheltens, P., Scherder, E. J. A., van der Flier, W. M., & Ossenkoppele, R. (2016). The effect of physical activity on cognitive function in patients with dementia: A meta-analysis of randomized control trials. *Ageing Research Reviews*, *25*, 13–23. https://doi.org/10.1016/j.arr.2015.11.005

Guerreiro, M., Fonseca, S., Barreto, J., & Garcia, C. (2008). Escala de Avaliação da Doença de Alzheimer (Alzheimer Disease Assessment Scale [ADAS]). In A. Mendonça, M. Guerreiro, & Grupo de Estudos de Envelhecimento Cerebral e Demência (Eds.), *Escalas e Testes na Demência*. (2nd ed.; pp. 41–68). Novartis.

Guerreiro, M., Silva, A. P., Botelho, M. A., Leitão, O., Castro-Caldas, A., & Garcia, C. (1994). Adaptação à população portuguesa da tradução do "Mini Mental State Examination" (MMSE) [Adaptation to the Portuguese population of the translated "Mini Mental State Examination" (MMSE)]. *Revista Portuguesa De Neurologia*, *1*, 9–10.

Hsiao, C. Y., Yeh, S. H., Wang, J. J., Fu, L. Y., Lin, I. F., & Li, I. C. (2018). The effect of gerotranscendence reminiscence therapy among institutionalized elders: A randomized controlled trial. *Neuropsychiatry*, *8*(3), 881–892.

Justo-Henriques, S. I. (2021). Individual intervention protocol based on cognitive stimulation therapy for older adults with mild neurocognitive disorder. *Revista De Enfermagem Referência*, *5*(5), Article e20100. https://doi.org/10.12707/RV20100

Justo-Henriques, S. I., & Carvalho, J. O. (2021). Protocol of a randomised controlled trial of home-based cognitive stimulation in cognitively impaired older adults. *Revista Brasileira de Terapias Cognitivas*, *17*(1), 66–70. https://doi.org/10.5935/1808-5687.20210009

Justo-Henriques, S. I., Otero, P., Torres, A. J., & Vázquez, F. L. (2021a). Effect of long-term individual cognitive stimulation program for people with mild neurocognitive disorder. *Revista de Neurología*, *73*(4), 121–129. https://doi.org/10.33588/rn.7304.2021114

Justo-Henriques, S. I., Pérez-Sáez, E., & Alves Apóstolo, J. L. (2021b). Multicentre randomised controlled trial about the effect of individual reminiscence therapy in older adults with neurocognitive disorders. *International Journal of Geriatric Psychiatry*, *36*(5), 704–712. Epub 2020 Nov 17. https://doi.org/10.1002/gps.5469

Justo-Henriques, S. I., Pérez-Sáez, E., Alves Apóstolo, J. L., & Carvalho, J. O. (2021c). Effectiveness of a randomized controlled trial of individual reminiscence therapy on cognition, mood, and quality of life in Azorean older adults with neurocognitive disorders. *Journal of Clinical Medicine*, *10*(22), 5395. https://doi.org/10.3390/jcm10225395

Justo-Henriques, S., Marques-Castro, A., Pérez-Sáez, E., Carvalho, J., & Sargaço, P. (2021d). Effects of individual cognitive stimulation program at home in adults with psychotic disorders. *Psicologia, Saúde & Doença*, *22*(02), 739–752. https://doi.org/10.15309/21psd220232

Justo-Henriques, S. I., Pérez-Sáez, E., & Apóstolo, J. L. A. (2020). Individual intervention protocol based on reminiscence therapy for older people with neurocognitive disorders. *Revista de Enfermagem Referência*, *5*(3), Article e20043. https://doi.org/10.12707/RV20043

Justo-Henriques, S. I., Pérez-Sáez, E., Carvalho, J. O., Cavallo, M., & Sargaço, P. (2022). Home-based individualized cognitive stimulation (iCS) therapy in Portuguese psychiatric patients: A randomized controlled trial. *Brain Sciences*, *12*(12), 1655. https://doi.org/10.3390/brainsci12121655

Justo-Henriques, S. I., Pérez-Sáez, E., Marques-Castro, A. E., & Carvalho, J. O. (2023). Effectiveness of a year-long individual cognitive stimulation program in Portuguese older adults with cognitive impairment. *Neuropsychology, Development, and Cognition. Section B, Aging, Neuropsychology and Cognition*, *30*(3), 321–335. Epub 2022 Jan 11. https://doi.org/10.1080/13825585.2021.2023458

Justo-Henriques, S., Marques-Castro, A., Otero, P., Vázquez, F., & Torres, Á. (2019). Long-term individual cognitive stimulation program in patients with mild neurocognitive disorder: A pilot study. *Revista de Neurología*, *68*(7), 281–289. https://doi.org/10.33588/rn.6807.2018321

Knight, R., Khondoker, M., Magill, N., Stewart, R., & Landau, S. (2018). A systematic review and meta-analysis of the effectiveness of acetylcholinesterase inhibitors and memantine in treating the cognitive symptoms of dementia. *Dementia and Geriatric Cognitive Disorders*, *45*(3–4), 131–151. https://doi.org/10.1159/000486546

Lemos, R., Martins, C., Simões, M., & Santana, I. (2012). Estudo de adaptação do Teste de Recordação Selectiva Livre e Guiada para a população portuguesa [Adaptation study of the Free and Cued Selective Reminding Test to the Portuguese population]. *Avaliação Psicológica*, *11*(1), 49–61.

Lemos, R., Simões, M. R., Santiago, B., & Santana, I. (2015). The free and cued selective reminding test: Validation for mild cognitive impairment and Alzheimer's disease. *Journal of Neuropsychology*, *9*(2), 242–257. https://doi.org/10.1111/jnp.12048

Lima, C. F., Meireles, L. P., Fonseca, R., Castro, S. L., & Garrett, C. (2008). The frontal assessment battery (FAB) in Parkinson's disease and correlations with formal measures of executive functioning. *Journal of Neurology*, *255*(11), 1756–1761. https://doi.org/10.1007/s00415-008-0024-6

Lobbia, A., Carbone, E., Faggian, S., Gardini, S., Piras, F., Spector, E., & Borella, E. (2019). The efficacy of cognitive stimulation therapy (CST) for people with mild-to-moderate dementia: A review. *European Psychologist*, *24*(3), 257–277. https://doi.org/10.1027/1016-9040/a000342

Lourida, I., Soni, M., Thompson-Coon, J., Purandare, N., Lang, I. A., Ukoumunne, O. C., & Llewellyn, D. J. (2013). Mediterranean diet, cognitive function, and dementia: A systematic review. *Epidemiology*, *24*(4), 479–489. https://doi.org/10.1097/EDE.0b013e31829444103

McDermott, O., Charlesworth, G., Hogervorst, E., Stoner, C., Moniz-Cook, E., Spector, A., Csipke, E., & Orrell, M. (2019). Psychosocial interventions for people with dementia: A synthesis of systematic reviews. *Aging & Mental Health*, *23*(4), 393–403. https://doi.org/10.1080/13607863.2017.1423031

Meyer, C., & O'Keefe, F. (2020). Non-pharmacological interventions for people with dementia: A review of reviews. *Dementia (London, England)*, *19*(6), 1927–1954. https://doi.org/10.1177/1471301218813234

Mohs, R. C., Rosen, W. G., & Davis, K. L. (1983). The Alzheimer's disease assessment scale: An instrument for assessing treatment efficacy. *Psychopharmacology Bulletin*, *19*(3), 448–450.

Moniz-Cook, E., Vernooij-Dassen, M., Woods, R., Verhey, F., Chattat, R., Vugt, M. D. E., Mountain, G., O'connell, M., Harrison, J., Vasse, E., Dröes, R. M., & For The Interdem* Group. (2008). A European consensus on outcome measures for psychosocial intervention research in dementia care. *Aging & Mental Health*, *12*(1), 14–29. https://doi.org/10.1080/13607860801919850

Morgado, J., Rocha, C. S., Maruta, C., Guerreiro, M., & Martins, I. P. (2009). Novos valores normativos do Mini-Mental State Examination [New normative values of Mini-Mental State Examination]. *Sinapse*, *2*, 10–16.

Nagamatsu, L. S., Handy, T. C., Hsu, C. L., Voss, M., & Liu-Ambrose, T. (2012). Resistance training promotes cognitive and functional brain plasticity in seniors with probable mild cognitive impairment. *Archives of Internal Medicine*, *172*(8), 666–668. https://doi.org/10.1001/archinternmed.2012.379

National Institute for Health and Care Excellence (NICE). (2018a). Dementia: Assessment, management and support for people living with dementia and their carers. NICE. https://www.ncbi.nlm.nih.gov/books/NBK513207/

National Institute for Health and Care Excellence (NICE). (2018b). Donepezil, galantamine, rivastigmine and memantine for the treatment of Alzheimer's disease. NICE. https://www.nice.org.uk/guidance/ta217/resources/donepezil-galantamine-rivastigmine-and-memantine-for-the-treatment-of-alzheimers-disease-pdf-82600254699973

Nogueira, J., Freitas, S., Duro, D., Tábuas-Pereira, M., Guerreiro, M., Almeida, J., & Santana, I. (2018). Alzheimer's Disease Assessment Scale - Cognitive Subscale (ADAS-Cog): Normative data for the Portuguese population. *Acta Medica Portuguesa*, *31*(2), 94–100. https://doi.org/10.20344/amp.8859

Pérez-Sáez, E., Justo-Henriques, S. I., & Alves Apóstolo, J. L. (2022). Multicenter randomized controlled trial of the effects of individual reminiscence therapy on cognition, depression and quality of life: Analysis of a sample of older adults with Alzheimer's disease and vascular dementia. *The Clinical Neuropsychologist*, *36*(7), 1975–1996. Epub 2021 Jan 19. https://doi.org/10.1080/13854046.2021.1871962

Rami, L., Molinuevo, J. L., Sanchez-Valle, R., Bosch, B., & Villar, A. (2007). Screening for amnestic mild cognitive impairment and early Alzheimer's disease with Memory Alteration Test in the primary care population. *International Journal of Geriatric Psychiatry*, *22*(4), 294–304. https://doi.org/10.1002/gps.1672

Rosen, W. G., Mohs, R. C., & Davis, K. L. (1984). A new rating scale for Alzheimer's disease. *American Journal of Psychiatry*, *141*(11), 1356–1364. https://doi.org/10.1176/ajp.141.11.1356

Saragih, I. D., Tonapa, S. I., Saragih, I. S., & Lee, B.-O. (2022). Effects of cognitive stimulation therapy for people with dementia: A systematic review and meta-analysis of randomized controlled studies. *International Journal of Nursing Studies*, *128*, 104181. https://doi.org/10.1016/j.ijnurstu.2022.104181

Sousa, M., Pereira, A., Costa, R., & Rami, L. (2015). Initial phase of adaptation of Memory Alteration Test (MAT) in a Portuguese sample. *Archives of Gerontology and Geriatrics*, *61*(1), 103–108. https://doi.org/10.1016/j.archger.2015.03.008

Spector, A., Thorgrimsen, L., Woods, B., & Orrell, M. (2006). *Making a difference: An evidence-based group programme to offer cognitive stimulation therapy (CST) to people with dementia*. Hawker Publications.

Vieira, M. (1985). Recent transformations of higher education. *Análise Social*, *30*, 130.

Woods, B., Aguirre, E., Spector, A. E., & Orrell, M. (2012). Cognitive stimulation to improve cognitive functioning in people with dementia. *The Cochrane Database of Systematic Reviews*, *2*(2), CD005562. https://doi.org/10.1002/14651858.CD005562.pub2

Woods, B., O'Philbin, L., Farrell, E. M., Spector, A. E., & Orrell, M. (2018). Reminiscence therapy for dementia. *Cochrane Database of Systematic Reviews*, *2018*(3), Art. No.: CD001120. https://doi.org/10.1002/14651858.CD001120.pub3

Woods, B., Rai, H. K., Elliott, E., Aguirre, E., Orrell, M., & Spector, A. (2023). Cognitive stimulation to improve cognitive functioning in people with dementia. *Cochrane Database of Systematic Reviews*, *2023*(1). https://doi.org/10.1002/14651858.CD005562.pub3

World Health Organization (WHO). (2019). Risk reduction of cognitive decline and dementia: WHO Guidelines. WHO. https://www.who.int/publications/i/item/9789241550543

World Health Organization (WHO). (2021). Global status report on the public health response to dementia. WHO. https://www.who.int/publications/i/item/9789240033245