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The Effect of Cognitive Stimulation on Nursing Home Elders: A Randomized Controlled Trial

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Abstract

Purpose: This paper describes the effectiveness of cognitive stimulation therapy (CST) on cognition and depressive symptoms in older adults in nursing homes (NHs).

Design: A randomized controlled trial, carried out from 2012 to 2013, included 56 residents from four NHs, 36 women and 20 men (randomized into experimental and control groups). Eight participants dropped out.

Methods: Participants of the experimental group underwent 14 CST sessions (7 weeks) in groups of six to eight older adults, and participants of the control group received usual care. The Montreal Cognitive Assessment, the Geriatric Depression Scale-15, and the Barthel Index of activities of daily living (ADLs) were administered at baseline and postintervention.

Findings: Repeated measures revealed that CST increased cognition ($F = 8.581$; $p = .005$; partial η squared $= 0.157$; power $= 0.82$). There were no statistically significant differences in depressive symptoms ($F = 1.090$; $p = .302$). Baseline level of ADLs did not affect the outcomes.

Conclusions: CST had significantly improved cognition, explaining the 15.7% variability, but there was no statistical evidence of its effectiveness on depressive symptoms. This improvement was not affected by the baseline level of dependence-independence in ADLs.

Clinical Relevance: CST offers a range of activities, providing general stimulation for thinking, concentration, and memory, usually in a social setting. These results will support implementation of CST in NHs. In addition to the impact on elderly independence and autonomy, CST may also have an economic impact by reducing the direct costs of the impact of elders' cognitive frailty.

Population aging has led to an increase in the prevalence of dementia (Wimo & Prince, 2010). International studies suggest that cognitive stimulation therapy (CST) is associated with a decreased risk for cognitive impairment (CI) and should begin as soon as possible (Woods, Aguirre, Spector, & Orrell, 2012). CST increases brain and cognitive reserve, reducing risk for dementia, delaying its onset; thus, evidence suggests that CST prevents or delays dependence and inability to self-care (Apóstolo, Cardoso, Marta, & Amaral, 2011). Additionally, evidence also suggests that older adult patients with depressive symptoms have a higher risk of developing CI and dementia (Bunce, Batterham, Mackinnon, & Christensen, 2012).

An early CST intervention will contribute to the improvement of elders' quality of life by delaying the onset of dementia and increasing their capacity for self-care (Apóstolo, Cardoso, et al., 2011). This study aims to analyze the effectiveness of CST on cognition and depressive symptoms in older adult residents in Portuguese nursing homes (NHs).

Literature Review

Population aging has led to an increase in the prevalence of chronic degenerative diseases, particularly dementia. The World Alzheimer Report 2010 (Wimo & Prince, 2010) estimates that 35.6 million people worldwide lived with dementia in 2010. This number is estimated to double every 20 years, to 65.7 million in 2030, and 115.4 million in 2050. The total estimated worldwide costs of dementia were US$604 billion in 2010 (Wimo & Prince, 2010).

CI is increasingly recognized as an important public health issue associated with increased risk for developing dementia. Petersen et al. (2010) suggest that approximately 16% of older adults without dementia are affected by mild cognitive impairment (MCI). Depressive symptoms are common among the older adult population and have been associated with cognitive and functional impairment, particularly with memory and executive function (Bunce et al., 2012; Köhler et al., 2010; Reppermund et al., 2011).

Reports on the prevalence of depression in older adults are inconclusive and indeterminate, and identify methodological weaknesses, mainly concerning the selection of samples (Luppa et al., 2012). In Portugal, a pilot study revealed that 63.29% of residents in NHs were classified as having depressive disorder (Apóstolo, 2013a).

CST is often discussed as an intervention both for normal aging as well as preventing or delaying the onset of dementia. This therapy is defined as the engagement in a range of activities and discussions (usually in a group) aimed at general enhancement of cognitive and social functioning (Woods et al., 2012).

The evidence base for the effectiveness of CST was reported in a recent systematic review (Woods et al., 2012). In total, 15 randomized control trials (RCTs) met the inclusion criteria for the meta-analysis. There were 718 participants (407 receiving cognitive stimulation and 311 in control groups) in the pooled analysis, with small changes reported in multiple trials on commonly used brief measures of cognitive function; adverse effects had not been reported. No differences in relation to mood (self-report or staff-rated), activities of daily living (ADLs), general behavioral function, or problem behavior were noted. These benefits were irrespective of any medication effects. Nevertheless, this review reports trials with small sample sizes and very limited details of the randomization method.

In Portugal, despite limitations in sample size, randomization, and group allocation, pilot studies with institutionalized older adults in NHs showed a positive impact of CST on cognition. Improvement ranged between 50% and 85.72%, but the results were not stylistically significant on the effect of CST on mood (Apóstolo, Cardoso, et al., 2011; Apóstolo, Gil, Rosa, Almeida, & Fernandes, 2013; Apóstolo, Rosa, & Castro, 2011). Studies with healthy (not cognitively impaired) community-dwelling older adults showed a positive impact of CST, which was effective in reducing depressive symptoms (54.83% of the older adults improved; intervention explains 21% of the variance), but there was no statistical evidence of CST's effectiveness on cognition (Apóstolo et al., 2013; Apóstolo, Cardoso, & Paúl, n.d.).

The National Institute for Health and Clinical Excellence and the Social Care Institute for Excellence issued guidelines for care of older adults with dementia in 2006. This guideline recommended that all people with mild to moderate dementia should have the opportunity to participate in cognitive stimulation groups, irrespective of whether or not they are receiving acetylcholinesterase-inhibiting medication. This recommendation was reinforced by the World Alzheimer' Report 2011 (Prince, Bryce, & Ferri, 2011). Both positions sustain the rationale that the maintenance of cognitive health is of vital importance in the reduction of risk and raising protection against dementia (delaying its onset), preventing elderly dependence, and reducing direct and indirect costs, institutionalization, and caregivers' burden. In the current study, we hypothesize that elderly residents in NHs who received 14 sessions of CST will achieve improved cognition and depressive symptoms.

Methods

Study Design

This study is a multicenter design, randomized, single-blind trial. This design was used to measure the differences in cognition and depressive symptoms between a treatment group and a usual care group (comparison) of elderly residents in NHs.

Sample Size

Sample size was calculated by an independent investigator using G*Power 3 software. G*Power 3 provides improved effect size calculators and offers all types of power

Journal of Nursing Scholarship, 2014; 46:3, 157–166.

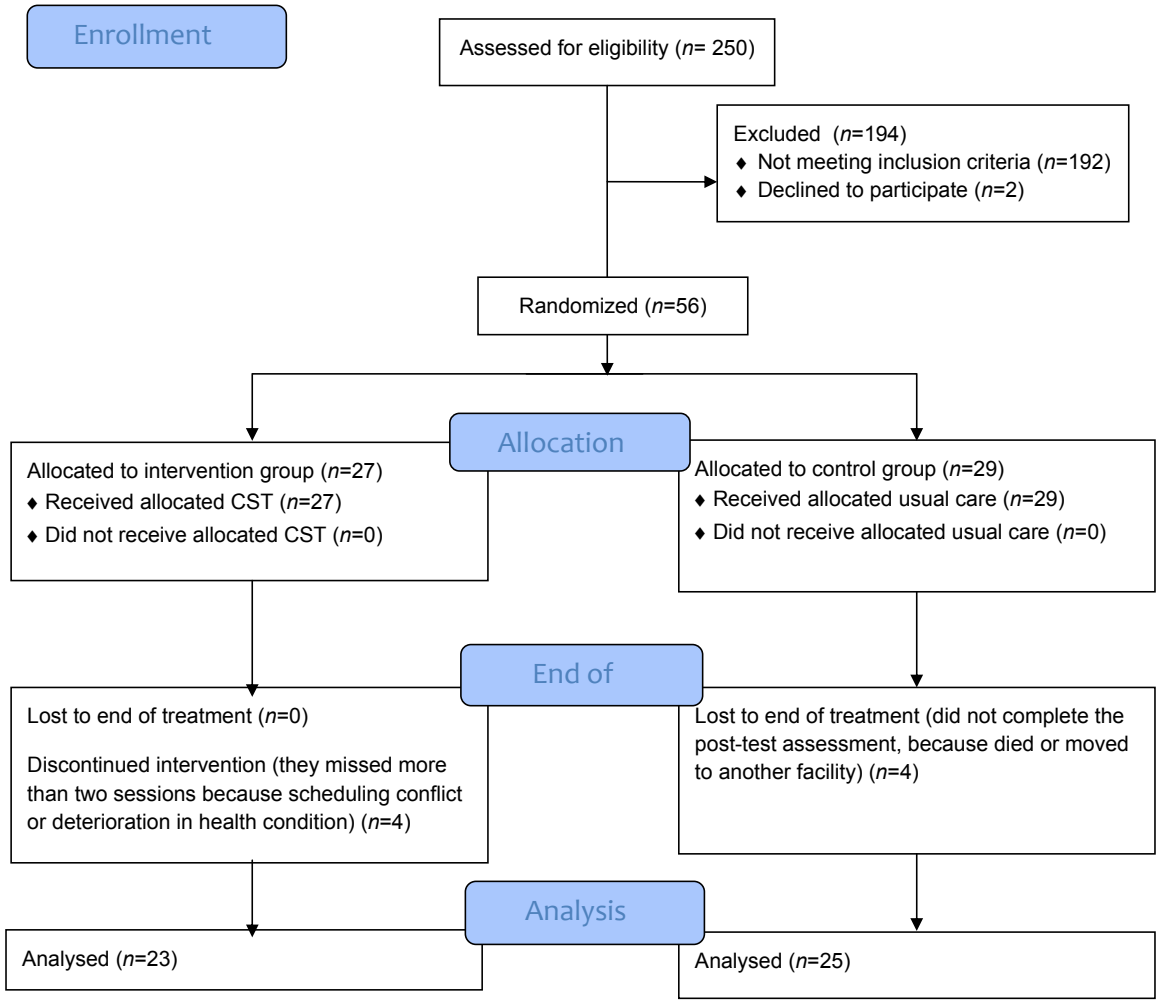

Figure 1. Trial flow diagram.

analyses (Faul, Erdfelder, Lang, & Buchner, 2007). Power analysis was based on a type I error of 0.05, power of 0.80, and effect size $f = 0.35$, and repeated measures between factors determined a sample size of 44.

Setting and Participants

This study was carried out from March 2012 to April 2013 at four NHs in the central region of Portugal: one in the center of the city, and the other sites in three towns located at 15, 25, and 33 km from the center of the city, assuring representation of participants from rural, semirural, and urban environments. In previous studies (Apóstolo, Cardoso, et al., 2011), the following eligibility criteria were successfully used (which were also proposed by Aguirre et al., 2010):

1. likely to remain in a group for 45 to 60 min
2. can have a "meaningful" conversation
3. hear well enough to participate in a small group discussion
4. vision good enough to see most pictures
5. classified as having a Montreal Cognitive Assessment (MoCA) score between 10 and 25

Older adults who did not meet the criteria were excluded. To avoid confounding factors, older adults currently taking cholinesterase inhibitors or antipsychotic medication were excluded.

Recruitment and enrollment of the participants is described in a trial flow diagram (**Figure** 1). Fifty-six older adults met the inclusion criteria: 20 males and 36 females with a mean age of 81.44 ($SD = 5.79$, ages ranged from 67 to 92).

Table 1 shows baseline sample characteristics and group comparisons of sociodemographic and clinical data of the participants. The two groups did not differ significantly on sex, education, marital status, age, ADLs,

Table 1. Baseline Characteristics and Group Comparisons of Sociodemographic and Clinical Data ($N = 48$)

		Experimental ($n = 23$)		Controls ($n = 25$)		Total ($N = 48$)	
Variables		*n*	%	*n*	%	*n*	%
Sex	Male	7	30.43	8	32.00	15	31.25
	Female	16	69.57	17	68.00	33	68.75
		$\chi^2 = 0.014$; $p = .907$					
Marital status	Single	4	17.39	2	8.00	6	12.50
	Married	5	21.74	6	24.00	11	22.92
	Divorced	8	34.78	9	36.00	17	35.42
	Widowed	6	26.09	8	32.00	14	29.17
		Fisher's Exact Test = 1.088; $p = .839$					
Education	4 years	19	82.61	21	84.00	40	83.33
	5–9 years	1	4.35	2	8.00	3	6.25
	10–12 years	1	4.35	1	4.00	2	4.17
	Higher	2	8.70	1	4.00	3	6.25
		Fisher's Exact Test = 1.088; $p = .920$					
Age (years)		Min: 70; Max: 92; Mean: 82.04; *SD*: 5.91		Min: 71; Max: 92; Mean: 81.28; *SD*: 5.47		Mean: 81.65 *SD*: 5.64	
		$t = 0.465$; $p = .644$					
Baseline ADLs (Barthel)	Total	—	—	—	—	—	—
	Severe dependency	2	8.70	2	8.00	4	8.33
	Moderate dependency	5	21.74	8	32.00	13	27.08
	Slight dependency	2	8.70	6	24.00	8	16.67
	Independence	14	60.87	9	36.00	23	47.92
		Mean: 88.04; *SD*: 22.85		Mean: 88.04; *SD*: 17.45			
		$t = 0.001$; $p = 1.000$					
Baseline depressive	Depression	11	47.83	9	36.00	20	41.67
	No depression	12	52.17	16	64.00	28	58.33
		Mean: 6.17; *SD*: 4.36		Mean: 6.88; *SD*: 3.88			
		$t = -0.594$; $p = .555$					
Baseline cognition (MoCA)		Min:10; Max: 25; Mean: 17.22; *SD*: 5.04		Min:10; Max: 25; Mean: 16.88; *SD*: 4.68			
		$t = 0.240$; $p = .811$					

Note. ADLs = activities of daily living; MoCA = Montreal Cognitive Assessment.

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depressive symptoms, and cognition. Ten (20.83%) of the total older adults sampled used antidepressant medication, and during the 7 weeks of the CST program they maintained the same antidepressant medication.

Intervention Protocol

In the experimental group (EG), the intervention was the CST program, Making a Difference, which was applied to older adults in groups of six to eight and comprised a 14-session program running twice a week (7 weeks; Apóstolo & Cardoso, 2013). The Making a Difference program was adapted to Portuguese (Apóstolo & Cardoso, 2013). The control group (CG) received usual care and participated in the Making a Difference program after the EG completed the program.

The Making a Difference Program

Each of the 14 CST sessions fell within general themes as follows: Physical games; Sound; Childhood; Food; Current affairs; Faces/scenes; Word association; Being creative; Categorizing objects; Orientation; Using money; Number games; Word games; and Team quiz. Each session of the Making a Difference took about 45 to 60 min and incorporated the use of a reality orientation board, displaying both personal and orientation information, including the group name and the group song (as chosen by participants). The guiding principles of CST involved:

1. using new ideas, thoughts and associations
2. using orientation (both sensitively and implicitly)
3. a focus on opinions rather than facts
4. using reminiscence as an aid to the here and now
5. providing triggers to aid recall
6. creation of continuity and consistency between sessions
7. focus on implicit (rather than explicit) learning
8. stimulating language
9. stimulating executive functioning being person centered

Making a Difference aimed to create an environment where people had fun, and learned and strengthened their abilities and relationships among the group members, thus maintaining their social and cognitive skills at their optimal ability (Aguirre et al., 2010; Spector, Thorgrimsen, Woods, & Orrell, 2006). The intervention was delivered by a team of research assistants, licensed and nonlicensed, who were previously trained by the principal investigator.

The participants allocated to the CG received treatment as usual. This varied between and within NHs and changed over time. Usual care consisted of sessions of unstructured activities, including mainly physical activity, informatics, and painting. The interventions offered to this group were also available to those in the EG (CST).

Outcome Measures and Procedures of Data Collection

Baseline measures (Montreal Cognitive Assessment [MoCA], Geriatric Depression Scale-15 [GDS-15], and Barthel ADL Index) were obtained prerandomization. Postintervention measures were obtained and blinded to group assignment. The same measures were also obtained for the CG at two points in time: before randomization and immediately after the 7-week group intervention period.

Primary outcome: cognition, assessed by montreal cognitive assessment. The MoCA Portuguese version (Freitas, Simões, Martins, Vilar, & Santana, 2010; Nasreddine et al., 2005) is a useful predictive screening tool for the development of dementia in subjects with MCI. It assesses eight domains of cognitive functioning: attention and concentration; executive functions; memory; language; visuo-constructional skills; conceptual thinking; calculations; and orientation. The total score is 30 points; a score of at least 26 is considered normal. In the study of validation to Portuguese, the MoCA Cronbach α was 0.90 (Freitas, Simões, Marôco, Alves, & Santana, 2012). In the study sample, the MoCA Cronbach α was 0.84 (baseline) and 0.86 (postintervention).

Secondary outcome: depressive symptoms, assessed by the Geriatric Depression Scale-15. The GDS-15 Portuguese version (Apóstolo, 2011; Sheikh & Yesavage, 1986) is a scale of hetero-assessment consisting of 15 items with two response alternatives (yes or no), depending on how the person has been recently feeling, especially during the previous week. A score higher than 5 points indicates the existence of depressive disorder (Cavaleiro, Queirós, Azeredo, Apóstolo, & Cardoso, 2013). In the study of validation to Portuguese, the GDS-15 Cronbach ? was 0.83 (Apóstolo, 2011). In the study sample, the GDS-15 Cronbach ? was 0.85 (baseline) and 0.81 (postintervention).

Covariate: activities of daily living, assessed by the Barthel ADL Index. The Barthel ADL Index, by Mahoney and Barthel (1965), Portuguese version

(Azeredo & Matos, 2003) assesses 10 ADLs: feeding, grooming, bathing, dressing, bowel, bladder, toilet use, ambulation, transfers, and stair climbing. The total score ranges from 0 to 100: scores of 0 to 20 indicate "total" dependency, 21 to 60 "severe" dependency, 61 to 90 "moderate" dependency, 91 to 99 "slight" dependency, and 100 no dependency (Azeredo & Matos, 2003). In the study of validation to Portuguese, the Barthel ADL Index Cronbach α was 0.96 (Araújo, Ribeiro, Oliveira, & Pinto, 2007). Within the study sample, the Barthel ADL Index was measured only at baseline, and it's Cronbach α was 0.93.

Randomization: assessing for eligibility. Based on NH files, 250 participants from four NHs were assessed for eligibility. Using the inclusion and exclusion criteria, 56 participants were selected in blocks of 14 participants, representing each of the four NHs (NH A = 14; NH B = 14; NH C = 14; NH D = 14).

Allocation to Groups

Within each block, participants were randomly allocated to groups (experimental or control). Random allocation (True Random Number Generator, http://www.random.org/) was performed by an independent researcher.

Blinding

To avoid detection bias, measures were taken by a different team of research assistants trained in instrument administration. These research assistants did not participate in CST implementation. Explicit reminders were given to participants not to reveal the treatment they were receiving. Group sessions were delivered in a private room. Staff was also reminded to respect the blinding schemas.

Statistical Methods

Paired-samples *t* test and repeated measures of analysis of variance (ANOVA) were used to analyze changes over time, and to observe power and effect size on depression symptoms and cognition. Dependence index (Barthel Index) at baseline was entered as a covariate. A significance level of .05 was established a priori for all statistical tests. SPSS 19 software (SPSS Inc., Chicago, IL, USA) was used. The dependent variables were normally distributed within groups. An exception was made for the baseline Barthel Index. Homogeneity of variance and intercorrelations were assumed. Because there were only two levels of repeated measures, sphericity was not an assumption. We decided not to perform intent-to-treat analyses because CG participants did not complete the postintervention assessment.

Ethical Considerations

The study was approved by the Ethical Committee of the Health Sciences Research Unit: Nursing of the Nursing School of Coimbra (no. P12–11/2010). Institutional review board approval was granted, and participants signed an informed consent prior to completing the baseline assessment.

Results

Mean scores and standard deviations for MoCA, and GDS-15 evaluated at baseline and post-intervention, as well as results of paired samples *t* tests and repeated measures of ANOVA are displayed in **Table** 2. In the EG, paired *t* test analysis revealed a statistically significant difference within cognition means but not a statistically significant difference within depressive symptoms. In the CG, the analysis revealed that differences are not statistically significant within cognition or within depressive symptoms.

Repeated measures also revealed that the EG, compared to the CG, achieved increased cognition (mean = +1.78 vs. -1.00; $F = 8.581$; $p = .005$; partial η squared [ηp^2] = 0.157; power = 0.82). This result shows that cognitive stimulation is effective in improving cognition, which explains 15.7% of the variability.

There were no statistically significant differences between the EG and CG in depressive symptoms. The same results were revealed after splitting groups according to the depressant and not depressant classification ($p > .05$; $\eta p^2 = 0.024$; power = 0.18). When the baseline Barthel Index was used as a covariate, the results showed that the ADL level did not affect the CST effect in cognition (F = 1.046; $p = .312$) or in depressive symptoms ($F = 0.325$; $p = .571$).

Discussion

The results of the present study support the effectiveness of CST in the older adult population, showing that the cognitively impaired older adults of the NHs improved, particularly in cognition. Nevertheless, data did not reveal statistically significant eidence of the CST program on elderly depressive symptoms. The benefits of CST in cognition for people at risk for MCI and dementia are well documented (Aguirre et al., 2012; Woods et al., 2012) but with regard to depression, evidence is not clear.

Table 2. Evolution of Experimental and Control Groups of Nursing Home Elders on Cognition and Depressive Symptoms

		Baseline		Postinterv ention		Paired *t*-test (baseline/postinterv ention)		Mean difference (baseline) /postintervention)		Repeated measures	
Outcomes	Groups	*M*	*SD*	*M*	*SD*	*t*	*p*[a]	*M*	*SD*	*F*	*p*
Cognition (MoCA)	EG	17.22	5.04	19.00	5.82	−2.388	.013	1.78	3.58	8.581	.005
	CG	16.88	4.68	15.88	4.82	1.659	.055	−1.00	3.01		
Depressive symptoms (GDS-15)	EG	6.17	4.36	5.61	3.70	1.084	.145	0.57	2.50	1.090	.302
	CG	6.88	3.88	7.08	3.59	−0.397	.348	−0.20	2.52		

Note. EG = experimental group; CG = control group; MoCA = Montreal Cognitive Assessment; GDS-15 = Geriatric Depression Scale-15.
[a]One-tailed.

In fact, several studies on the effectiveness of CST did not reveal a clear improvement in depression. Woods et al. (2012), in a systematic review, concluded that cognitive stimulation was not associated with a clear improvement in mood. Similarly, Apóstolo, Cardoso, et al. (2011), in an experimental study carried out with 23 Portuguese older adults, found that although 20% more participants in the EG had improved their clinical condition when compared to the CG, results were not statistically significant. In people 60 to 80 years of age, being more depressed may have led to a slight acceleration in cognitive decline, but there was no evidence for the hypothesis that there might be reciprocal dynamic influences between cognitive ability and depressive symptoms (Gale, Allerhand, & Deary, 2012).

The CST program Making a Difference used in this study integrated, among other techniques, group interaction and reminiscence therapy. Several published studies using similar techniques on healthy, MCI, and older adults with dementia from the community and NHs also revealed positive effects on depressive symptoms (Chiang et al., 2010; Krishna et al., 2012; Okumiya et al., 2005; Sharif, Mansouri, Jahanbin, & Zare, 2010; Shellman, Mokel, & Hewitt, 2009; Wang, 2007) and in cognition (Okumiya et al., 2005; Wang, 2007). Nevertheless, other studies showed different results, indicating that reminiscence therapy is not effective in reducing depressive symptoms (Chao et al., 2006).

Cognitive training can slow the rate of mental decline in older individuals (Valenzuela, Sachdev, Wen, Chen, & Brodaty, 2008). This effect can be related to brain cognitive and neural reserve, which is linked to the more general concept of brain plasticity. Brain plasticity is the brain's ability to rearrange structure, as well as dendritic connections, leading to the capacity of the brain to change with learning and repair and increase the cognitive reserve (Fratiglioni & Wang, 2007; Vance, Roberson, McGuinness, & Fazeli, 2010). Mental and physical stimulation may increase the cognitive reserve during the individual's entire life, allowing the cognitive function to be maintained in old age and delaying the clinical manifestation of dementia (Fratiglioni & Wang, 2007).

The CST program Making a Difference achieved a high degree of success with the participants. Sessions permitted group interaction, the development of positive personal relationships among the older adults, and their involvement in entertaining activities.?Entertaining activities and group interaction may help to replace the negative processes of thinking, characteristic of depressive symptoms, for a more positive cognitive style, as supported by Apóstolo and Kolcaba (2009). This could justify the improvement in depression; however, in this study this did not happen.

Limitations, Future Research, and Application of Findings

Despite the fact that older adults have been sampled from rural, semirural, and urban environments, the study was conducted in only one geographic area of Portugal. Therefore, the generalizability of the results is limited. The participants were mainly female (68.75%) and they were mainly from a lower educational level (0 to 4 years = 83.33%), which is also a limitation. Future studies should be homogeneous in relation to gender and the educational level of participants. However, it should be noted that the male life expectancy is lower, and they are less available to participate in group activities. Men typically do not meet the defined inclusion criteria as readily as women do, and the educational level of Portuguese older adults is very low.

In future studies, we consider it important to develop new research designs, including testing the medium and long-term effectiveness of CST, which are the main weaknesses of the published studies. Researchers need to conduct research that assesses the effectiveness of CST in preventing frailty, especially when MCI and depression are contributory.

Implications for Practice

Knowledge translation based on the evidence provided by these results will support implementation of cognitive intervention programs in NH. CST is an intervention for people with mild to moderate dementia and provides general stimulation for thinking, concentration, and memory, usually delivered in a social setting, such as a small group.

The CST program used in this study was published and is accessible to the professional community, and it is currently being implemented as best practice in different settings of the central and northern regions of Portugal. Furthermore, the analysis of previous national and international research results lead to the good practice "Cognitive Stimulation and Brain Fitness" (Apóstolo, 2013b), which was recently published in the context of the European Innovation Partnership on Active and Healthy Ageing, on prevention and early diagnosis of frailty and functional decline. In addition to the impact on older adult health (independence and autonomy), the implementation of CST in NHs may also have an economic impact on cost effectiveness by reducing the direct costs of the impact of dementia in older adults.

Conclusions

Our results showed improvement in older adults' cognition after 7 weeks of intervention with the CST program when compared to the CG, which explains the 15.7% variability that we consider a respectable improvement, with good clinical relevance. This improvement is not affected by the baseline level of dependence/independence in ADLs. The results do not evidence elders' improvement in depressive symptoms after CST. These results are consistent with previously reported national and international results, reinforcing knowledge about the effectiveness of CST in older adults' cognition.

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Clinical Resources

- Cognitive stimulation therapy: http://www.cstdementia.com/
- Alzheimer's Association: http://www.alz.org/

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