

Review Article

Cognitive Therapy for Dementia Patients: A Systematic Review

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Keywords

Alzheimer therapy · Dementia · Systematic review · Skills training · Reality orientation · Cognitive therapy

Abstract

Background: Cognitive therapy is a well-established intervention for treating elderly suffering from dementia. In particular, reality orientation and skills training seem to be effective interventions for reversing cognitive impairment among elderly, although findings are inconclusive. Therefore, a systematic update of the existing evidence of cognitive therapy for people suffering from dementia is needed. **Aim:** To review existing scientific evidence regarding the efficacy of cognitive therapies for elderly suffering from dementia. **Methods:** Studies were retrieved from several bibliographic databases (January 2009 to December 2017) with pre-specified selection criteria, data extraction, and methodological quality assessment. **Results:** In total, 10 reality orientation, 25 skills training, and 12 mixed trials were identified as meeting the inclusion criteria and were systematically reviewed. Results from reality orientation trials showed minor effects for cognitive assessments, while skills training trials and mixed trials showed contradicting effects on cognition. Effects on other outcomes (e.g., daily functioning, depression, language) were limited or not found. **Conclusions:** Skills training trials and mixed trials seem to affect cognitive impairment in a positive way, although the results are inconclusive. Comparison between studies was difficult due to differences in form of intervention. Because findings are inconclusive, more structuralized and comparable randomized controlled trials are needed.

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Introduction

The prevalence of older people diagnosed with dementia is reported to be around 6% worldwide [1], and this number is projected to triple by 2050 [2, 3]. Therefore, the global societal economic cost of dementia is estimated at around USD 818 billion [4]. Due to ageing population, the societal and financial burden of dementia is expected to rise in the next few decades [3]. Therefore, dementia is considered the greatest global challenge for health and social care in the current century [2], making it of great importance to assess the effectiveness of conducted therapies.

Dementia is a neuropsychiatric syndrome that is characterized by cognitive decline and progressive deterioration of daily functioning, commonly associated with behavioral and psychological symptoms of dementia (BPSD) [5]. About 5 out of every 6 dementia patients will develop some BPSD during the course of the disease [6–9]. In general, BPSD are clustered into one of five syndromes: psychosis, aggression, psychomotor agitation, depression, and apathy [6]. Studies have shown that the prevalence of BPSD is over 90% of the patients that report or show at least one of the five syndromes, which lead to multiple difficulties in daily life [10–13].

Momentarily, different pharmacological and non-pharmacological therapies are recommended to reduce the frequency and severity of BPSD, that have been shown to be effective in slowing down the impairment, especially with regard to the cognitive symptoms that are inherent to dementia [14]. In general, non-pharmacological interventions are considered as a preferable alternative to pharmacotherapy, mainly because of the adverse effects that are found in pharmacological therapies [15, 16]. The American Psychiatric Association [17] distinguishes non-pharmacological therapies that are conducted to treat dementia into four different categories: (1) cognition-oriented treatments (e.g., reality orientation, skills training), (2) emotion-oriented treatments (e.g., supportive therapy, validation/integrated emotion-oriented care, Snoezelen, reminiscence), (3) behavior-oriented treatments (behavior therapy), and (4) stimulation-oriented treatments (e.g., activity or recreational therapy, art therapy, music therapy, exercise, psychomotor therapy). There is conflicting evidence with regard to the effectiveness of non-pharmacological interventions to improve BPSD [14], which makes it necessary to have a clear overview of the existing evidence.

Because dementia is characterized by the onset of cognitive deficits that progress over time, these impairments in functional abilities of daily living have an enormous and often dramatic impact on the quality of life of both the patients and their caregivers [18]. Therefore, improving dementia patients' cognitive functioning can delay hospitalization and reduce the costs for national health care and improve patients' and carers' well-being [19]. Cognition-approach treatments aim to redress cognitive deficits, the most prevalent and important element of suffering from dementia. Cognitive therapy is mostly theoretically driven and uses particular exercises targeting specific cognitive functions in order to optimize functioning to improve daily life [20], and has been increasingly applied to treat different symptoms that are related to dementia [21].

The current study will focus on the existing scientific evidence on cognition-oriented approaches for treating people with dementia and systematically review the findings of studies that tested their effectiveness. Reality orientation, skills training trials, and studies using a mix of these two treatments will be included. This study is an update of a previous systematic review [22], whereby randomized controlled trials (RCTs) or controlled trials using cognition-oriented approaches for treating people with dementia were analyzed until 2009. The same methodological approach will be used in this systematic review until December 2017.

Methods

The search strategy to identify the key studies that we used involved using the following bibliographic databases: PubMed, Google Scholar, Cochrane Library, PsycINFO, and EMBASE. The bibliographic search included studies identified between January 2009 and December 2017 and was restricted to peer-reviewed papers written in English. Additional papers were identified by searching the reference lists of the retrieved articles, previous systematic reviews and meta-analyses.

The search strategy that was used was as follows: [dementia[majr] OR dementia [ti] OR Alzheimer[majr] OR Alzheimer[ti]] AND [psychotherapy[mh] OR psychotherapy[ti] OR cognitive therapy[mh] OR cognitive therapy [ti]] and [randomized controlled trial[pt] OR controlled clinical trial[pt] OR clinical trial[pt] OR random * [ti] OR placebo * [ti] OR blind[ti] OR blinding[ti] OR trial * OR outcome * OR randomized controlled trials[mh] OR random allocation[mh] OR double blind method[mh] OR single blind method[mh] OR clinical trials[mh] OR placebos[mh] OR outcome assessment[mh] OR outcome * [ti] OR metaanalysis[pt] OR metaanal * [ti] OR meta-anal * [ti] OR systematic review[ti, ab] OR quantitative review[ti, ab] OR quantitative overview[ti, ab] OR systematic overview[ti, ab]].

Two independent reviewers screened the search results looking for studies that were considered eligible according to the abstracts. Disagreements were resolved by consensus.

Inclusion Criteria

The inclusion criteria of this systematic review were studies that reported on intervention studies regarding cognition-oriented care approaches for dementia in older people diagnosed as having Alzheimer disease or at risk for Alzheimer disease. Only RCTs were considered eligible. Animal studies were excluded.

Data Extraction and Quality Assessment

Data extraction was performed by two reviewers. Study features and outcomes were entered into a database specifically designed for this review. Quality criteria were based on the Scottish Intercollegiate Guidelines Network (SIGN) checklists [23]. One reviewer assessed quality criteria and a second checked for accuracy. Disagreements were resolved by consensus and, if necessary, by a third reviewer. According to SIGN codes for study assessment, those trials that were clearly of an adequate quality were graded as “++” (RCTs with a very low risk of bias) or “+” (RCTs with a low risk of bias), while those of insufficient quality were graded as “–” (RCTs with a high risk of bias).

Results

By following the search strategy, we identified 1,496 records through database searching, 31 were included double. Subsequently, 1,415 records were removed after analyzing the abstracts. Finally, 81 full-text articles were assessed for eligibility by applying the inclusion/exclusion criteria, whereby 34 articles were excluded after analyzing the full articles (not an RCT [$n = 19$], no cognitive therapy [$n = 9$], not about dementia patients or at risk for dementia [$n = 5$], or not in English [$n = 1$]). The total number of trials included in the review was 47. Quality criteria of the RCTs were based on 2008 SIGN checklists. Results that were analyzed in the current study were changes between baseline and follow-up (longest follow-up period between baseline measurement and postmeasurement reported in the study) in each condition as well as time \times condition interactions. If no interaction effects were reported between condition and time, and only between-group differences were analyzed and reported, we reported these findings and included a note that only between- or within-group findings were analyzed.

The search process and total number of trials included in this review are illustrated in Figure 1. Details of all included trials are summarized in Table 1 for reality orientation interventions ($n = 10$), in Table 2 for skills training interventions ($n = 25$), and in Table 3 for mixed interventions ($n = 12$).

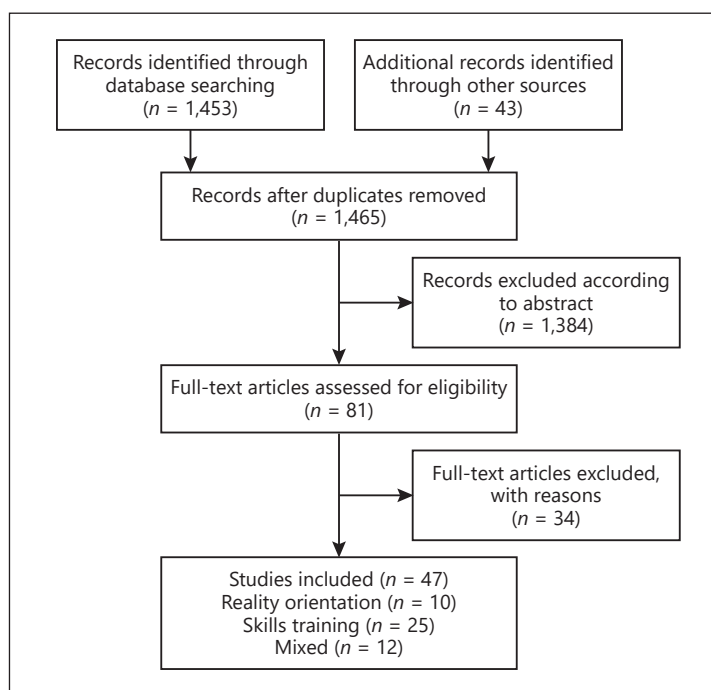


Fig. 1. Flow diagram of selection of papers for inclusion in the review.

Reality Orientation Trials

Reality orientation therapy uses repeatedly the presentation and information with regard to the orientation of the patient, aiming to provide an increased understanding of their surroundings. The therapy consists of providing information about personal and current situations that are trivial for the patient's daily living, for example their name, address, date, and where the person currently is located. For the current systematic review, 10 published trials, all rated as RCT+, that assessed the effects of reality orientation were selected that met the inclusion criteria [24–33].

For reality-orientated interventions, a variation of levels of dementia was found between the studies (see also Table 1). Some studies included elderly at risk for dementia [28], elderly with mild cognitive impairments [24], patients with mild to moderate dementia [26, 30–32], diagnosed with Alzheimer disease [25, 27, 33], or a combination of these patients [29]. Assessment of cognitive impairment was mostly conducted using the Mini-Mental State Examination (MMSE) [24–27, 29–33] and the Hamilton Depression Rating Scale (HDRS) [28].

Sample sizes among the included studies ranged from 20 to 356 patients, whereby groups were not matched by level of impairment. The average patient age was above 75 years in all studies. Therapy was heterogeneous in both number and length of the sessions. For example, Cove et al. [27] conducted weekly sessions (45 min) for 14 weeks, while Alves et al. [24] conducted 3 sessions per week (60 min) for 1.5 months, while Bergamaschi et al. [26] conducted 100 sessions (120 min) for 1 year. The total duration of the therapy varied between studies from 6 weeks to 1 year. For the control group, most patients received treatment-as-usual/usual care/no treatment, on a waitlist, except for the patients in the study by Bergamaschi et al. [26], where patients received nonspecific cognitive treatment with cholinesterase inhibitors, and in the study by Giuli et al. [29], where the patients in the control condition received general psychoeducational therapy.

As can be seen in Table 1, studies used different outcome measurements, although most studies focused on cognition, memory, daily functioning, quality of life (patient and

Table 1. Characteristics of reality orientation trials

First author, year [Ref.]	Study design (quality) ^a	Participants	Intervention	Outcomes	Results			
					measurement tool	change from baseline (SD), intervention group(s)	change from baseline (SD), control group(s) <i>p</i> value	
Alves, 2014 [24]	RCT+	Portugal <i>n</i> = 20 Cognitive impairments with or without dementia (MMSE: 17.4±4.25 for intervention group, 18.71±5.02 for control) Age intervention: 79.60±9.06 Age control: 77.71±12.38 Age range not specified	<i>Intervention:</i> CST <i>Treatment:</i> 17 sessions, 1 h, 1.5 months (3 sessions per week; 2 sessions in the final week) <i>Control:</i> waiting list	Cognition Functionality Depression Quality of life Caregiver outcomes	MMSE ADAS-Cog Digit span forward Digit span reverse Digit span total GDS IADL QoL-patient QoL-caregiver Zarit	+3.0 (2.12) -4.10 (6.24) +0.20 (1.87) +1.10 (1.91) +1.30 (2.06) +0.20 (4.96) -0.90 (2.28) -2.30 (5.21) -0.44 (2.79) +0.70 (4.22)	+4.57 (3.31) -2.14 (4.22) +1.57 (2.57) +0.14 (1.77) +1.71 (4.03) +0.14 (2.41) +1.86 (2.67) +0.57 (4.35) n.r. -2.86 (5.79)	0.26 0.43 0.49 0.25 0.88 0.84 0.07 0.15 0.19
Baglio, 2015 [25]	RCT+	Italy <i>n</i> = 60 AD Age intervention: 75.61±5.86 Age control: 76.50±5.65 Age range not specified	<i>Intervention:</i> multidimensional stimulation group therapy (MST) <i>Treatment:</i> 30 sessions, 2.5 h a day, 3 days a week <i>Control:</i> usual control	ADAS-Cog Language Functions Neuropsychiatric inventory Health survey	Global score Word recall Naming objects fingers Remembering test Spoken language Functional living skills NPI global NPI distress SF-36 mental SF-36 physical	n.r. n.r.	n.r. n.r.	0.344 0.045 0.004 0.061 0.010 0.649 0.019 0.054 0.830 0.992
Bergamaschi, 2013 [26]	RCT+	Italy <i>n</i> = 32 MMSE range 18–24 Patients received ChEIs for almost 1 month Age intervention: 78.19±5.5 Age control: 77.72±5.06 Age range not specified	<i>Intervention:</i> cognitive training and ChEIs <i>Treatment:</i> 1 year, five 1-month cycles of CT (one cycle: 20 sessions, 2 h per day, 5 days a week) with a break of 4 weeks between each cycle <i>Control:</i> nonspecific cognitive treatment and ChEIs	Cognition Memory Verbal fluency Everyday functioning Depression Neuropsychological abilities	MMSE Memory int. Story recall Verbal fluency Clock ADL IADL CSDD MODA	+2.75 +0.94 +1.12 +1.06 +2.47 +0.31 -0.38 +1.07 +3.81	-3.57 -0.86 -0.13 -1.72 -0.49 -1.43 -1.32 -0.44 -5.49	<0.001 <0.05 ns ns ns ns ns ns ns ns
Cove, 2014 [27]	RCT+	UK <i>n</i> = 68 Mild to moderate dementia (MMSE 18–30) Age intervention 1: 75.4±5.56 Age intervention 2: 76.8±6.62 Age control: 77.8±7.47 Age range not specified	<i>Intervention 1:</i> CST + carer training <i>Intervention 2:</i> CST only Treatment: 14 (45-min sessions) of weekly CST <i>Control:</i> waiting list	Cognition Quality of life Quality of caregiving relationship	MMSE ADAS-Cog QoL-AD QCR	-0.14 +1.75 +0.02 +0.52	-0.78 +2.41 +0.54 +0.28	0.92 0.98 0.44 0.39

Table 1 (continued)

First author, year [Ref.]	Study design (quality) ^a	Participants	Intervention	Outcomes	Results			
					measurement tool	change from baseline (SD), intervention group(s)	change from baseline (SD), control group(s) <i>p</i> value	
Diamond, 2014 [28]	RCT+	Australia <i>n</i> = 64 Older adults at risk of dementia MMSEF <24, HDRS <20 Age: 66.5±8.6 Age range not specified	<i>Intervention:</i> immediate intervention <i>Treatment:</i> 7 weeks, two sessions a week, 1-h healthy brain ageing psychoeducation and 1-h computer-based CT <i>Control:</i> TAU waitlist	Verbal learning and memory Non-verbal memory Language Psychomotor speed Depression Memory Sleep	RAVLT-15 RAVLT% LOGMEM-I LOGMEM% RCFT Phonemic fluency Semantic fluency Digit span TMT-A TMT-B GDS EMQ PSQI	+0.12 (.9) +0.31 (1.0) +0 (2.4) +0.69 (3.2) +4.91 (34.8) +0.14 (0.8) +0.02 (1.0) +1.25 (1.8) +0.03 (1.0) +0.14 (0.9) -4.88 (5.5) -6.0 (8.2) -1.38 (2.6)	-0.21 (1.1) -0.31 (1.2) +0.11 (1.8) +1.61 (2.7) +6.14 (38.4) +0.04 (0.8) -0.01 (1.3) +0.39 (2.3) +0.09 (1.1) -0.16 (1.1) -1.33 (4.3) -0.82 (10.4) +0.62 (3.44)	0.18 0.03 0.84 0.23 0.89 0.38 0.91 0.10 0.82 0.25 0.01 0.03 0.01
Giuli, 2016 [29]	RCT+	Italy <i>n</i> = 321 Age: Healthy (intervention 72.7±5.2, control 72.2±6.6), MCI (intervention 76.0±6.3, control 76.5±6.3) AD (intervention 76.5±4.3, control 78.7±5.9) Age range: 65 and older	<i>Intervention:</i> CT <i>Treatment:</i> 10 sessions of 45 min once a week, 10 weeks in total <i>Control:</i> general psychoeducational approach	Working memory Depression Cognition Functions Memory Verbal memory Attention Orientation and spatial attention	Forward verbal span Backward verbal span GDS MMSE ADL IADL Prose memory test Word pairing learning Semantic word fluency Attentive matrices ADAS Supra-span of Corsi	+0.33 +0.32 +0.18 +0.02 +0.04 +0.26 +0.63 +0.65 +0.15 +1.95 -3.3 +0.04	-0.17 -0.22 +1.24 +0.03 -0.09 -0.24 +0.12 -0.17 -0.17 -0.61 -0.01 -0.01	<0.01 <0.01 ns ns ns <0.05 <0.001 ns ns <0.05 <0.001 ns
Kurz, 2012 [30]	RCT+	Germany <i>n</i> = 201, mild dementia (MMSEF ≥21) Age intervention: 72.4±8.55 Age control: 75.0±7.05 Age range not specified	<i>Intervention:</i> cognitive rehabilitation <i>Treatment:</i> 12 weekly sessions of 1-h <i>Control:</i> standard medical management	Functioning Quality of life Depression Behavioral disturbance Carer burden Cognition Memory Attention Executive function Treatment	B-ADL AFIB (patient) AFIB (carer) DEMQUOL (patient) DEMQUOL (carer) GDS NPI BDI ZBI MMSE WMS-R LM TMT-A RWT ZUF-8 (patient) ZUF-8 (carer)	+0.73 (1.8) -0.02 (0.3) -0.24 (0.5) +0.67 (9.6) -2.75 (11.5) -1.23 (4.5) +1.16 (8.7) +0.76 (6.3) +2.48 (8.6) -1.48 (3.8) +0.82 (3.5) +6.05 (34.8) -2.10 (4.6) +3.54 (0.4) +3.49 (0.5)	+0.86 (1.6) +0.01 (0.5) -0.29 (0.5) -2.32 (13.0) -4.89 (13.6) -0.41 (3.9) +0.42 (3.9) +0.57 (6.5) +2.92 (10.7) -2.22 (3.2) +0.09 (4.8) +5.98 (38.0) -1.48 (5.1) +3.43 (0.4) +3.39 (0.5)	0.640 0.584 0.521 0.088 0.277 0.201 0.539 0.850 0.767 0.175 0.268 0.990 0.406 0.090 0.167

Table 1 (continued)

First author, year [Ref.]	Study design (quality) ^a	Participants	Intervention	Outcomes	Results measurement tool	change from baseline (SD),		p value
						intervention group (s)	control group(s)	
Orrell, 2014 [31]	RCT+	UK n = 236 dementia patients Age intervention: 82.7±7.9 Age control: 83.5±7.2 Age range not specified	<i>Intervention:</i> CST maintenance <i>Treatment:</i> all participants received 7-week, 14-session CST program, then weekly maintenance CST group program, 24 weeks <i>Control:</i> TAU	Cognition Quality of life Cognition Quality of life Neuropsychiatric inventory Functioning Quality of life	ADAS-Cog QoL-AD MMSE DEMQL NPI ADCS-ADL Proxy QoL-AD Proxy DEMQOL	+4.84 -0.48 -1.46 -5.67 -6.27 +4.96 +0.59 +0.42 -4.45	+2.09 -2.66 -2.31 -6.27 +9.05 +0.85 +0.75 -5.59	0.67 0.03 0.15 0.87 0.53 0.54 0.95 0.50
Orell, 2017 [32]	RCT+	UK n = 356, mild to moderate dementia (MMSE ≥10) Age: 78.2±7.49 Age range not specified	<i>Treatment:</i> 75-, 30-min sessions, 25 weeks <i>Intervention:</i> iCST <i>Control:</i> TAU	Cognition Quality of life Neuropsychiatric inventory Depression Quality of caregiving relationship Cognition Daily living Quality of life (patient)	ADAS-Cog QoL-AD DEMQL NPI total GDS 15 QCPR total MMSE BADLS QoL-AD DEMQOL	-0.78 -0.15 +1.61 +0.36 -0.24 +1.71 -0.44 +10.23 -0.42 +1.43	+0.60 -0.25 +2.94 +0.60 -0.31 -1.17 -0.14 +10.07 -1.1 -0.41	0.45 0.97 0.79 0.79 0.94 0.02 0.23 0.36 0.45 0.15
Venturelli, 2016 [33]	RCT+	Italy n = 80 with AD, MMSE 10–15 Age intervention 1: 84±7 Age intervention 2: 86±9 Age intervention 3: 85±8 Age control: 84±10 Age range: 65–75	<i>Intervention 1:</i> aerobic exercise <i>Intervention 2:</i> cognitive training <i>Intervention 3:</i> aerobic exercise + cognitive training <i>Treatment:</i> 3 months, 5 days/week, 1 h <i>Control:</i> NT	Cognition	MMSE intervention 1 MMSE intervention 2 MMSE intervention 3	13.6 (1.9) 13.8 (1.4) 13.5 (1.6)	13.8 (1.9)	ns

ABS, Agitated Behavior Scale; ADL, activities of daily living; AD, Alzheimer disease; ADAS-Cog, Alzheimer's Disease Assessment Scale-Cognitive subscale; ADCS-ADL, Alzheimer Disease Cooperative Study-Activities of Daily Living Scale; AFIB, atrial fibrillation; BADLS, basic activities of daily living; BADLS, Bayer Activities of Daily Living Scale; BPI, Brief Pain Inventory; ChEIs, cholinesterase inhibitors; CSDD, Cornell Scale for Depression in Dementia; CST, cognitive stimulation therapy; iCST, individual CST; CT, cognitive training; DEMQOL, System of Quality of Life Assessment in Dementia; EMQ, Everyday Memory Questionnaire; GDS, Geriatric Depression Scale; HDRS, Hamilton Depression Rating Scale; IADL, instrumental activities of daily living; LOGMEM-i, Logical Memory Test, immediate recall; LOGMEM%, Logical Memory Test, percent retention; MCI, mild cognitive impairment; MMSE, Mini-Mental State Examination; MODA, Milan Overall Dementia Assessment; MST, mnemonic strategy training; NPI, Neuropsychiatric Inventory; ns, not significant; n.r., not reported; NT, no treatment; PSQI, Pittsburgh Sleep Quality Index; QCPR, Carer-patient relationship; RAVLT, Rey Auditory Verbal Learning Test; RCT, randomized clinical trial; RWT, The Royal Wolverhampton National Healthy System Trust; SD, standard deviation; SDS, sundowning syndrome; QoL, Quality of Life; QoL-AD, Quality of Life - Alzheimer disease; SF-36, Short Form Health Survey-36; TAU, treatment as usual; TMT-A, Trail Making Test Part A; TMT-B, Trail Making Test Part B; WMS-R LM, Wechsler Memory Scale-Revised Logical Memory; ZBI, Zarit Burden Interview; ZUF, Patient satisfaction of the CSQ - Cares styles Questionnaire-German version.

^a Quality assessment according to SIGN criteria.

Table 2. Characteristics of skills training trials

First author, year [Ref.]	Study design (quality) ^a	Participants	Intervention	Effect variables	Results		p value	
					measurement tool	variation from baseline (SD), intervention group		change from baseline (SD), control group
Amieva, 2013 [34]	RCT	France n = 653 Moderately severe to severe dementia (MMSE 16–26) Age: 78.7±6.7 Age range: 50+	<i>Intervention:</i> cognitive training therapy <i>Control 1:</i> reminiscence therapy <i>Control 2:</i> individualized cognitive rehabilitation therapy <i>Control 3:</i> usual care <i>Treatment:</i> 2 years: weekly sessions, 90 min/session during the first 3 months, every 6 weeks for the next 21 months	Cognition Cognition Functional status Behavioral Depression Quality of life Apathy Caregiver's burden Institutionalization	MMSE ADAS-Cog DAD AGGR NPI MADRS QoL Apathy inventory Zarit burden interview	48.0% +18.7 –2.8 +8.14 +16.18 +9.56 –4.6 +10.13 +11.5 31.8%	47.8% +18.41 –1.56 +8.58 +16.02 +9.69 –4.45 +8.04 +11.0 27.3%	0.77 0.71 0.67 0.99 0.53 0.31 0.13 0.21 0.70 ns
Bahar-Fuchs, 2017 [35]	RCT	Australia n = 43 MCI (n = 9), MnNPS (n = 11), both (n = 25) Age: 74.6±6.8 Age range not specified	<i>Intervention:</i> tailored computerized cognitive training <i>Control:</i> general computerized cognitive training <i>Treatment:</i> min 8 weeks, max 12 weeks, 2 sessions a day (20–30 min), 3 days a week	Cognition Mood Meta-memory Care and burden	Global cognition Delayed memory Learning & memory Non-memory Mood composite MMQ-contentment MMQ-mistakes MMQ-strategies MFD Zarit Burden BADL	+0.58 +0.69 +0.97 +0.45 +0.04 +5 +6 0 –0.1 –1 +1	+0.35 +0.45 +0.47 +0.30 –0.68 +3 +3 +3 +0.1 +2 +2	ns ns ns ns ns ns ns ns ns ns ns
Buschert, 2012 [36]	RCT	Germany n = 27 MMSE 27.4 Age: 71.2±7.0 Age range not specified	<i>Intervention:</i> cognitive training <i>Control:</i> paper-and-pencil exercises for self-study, then cognitive training <i>Treatment:</i> 6 months, weekly 2 h	Cognition Quality of life	ADAS-Cog MMSE RBANS story memory RBANS story recall TMT-A TMT-B MADR QoL-AD	–0.70 (4.78) –0.70 (2.26) +0.17 (1.22) –0.25 (0.93) –5.60 (27.50) –2.50 (59.69) –2.50 (2.05) +2.12 (1.72)	+4.13 (4.32) –1.63 (1.68) –4.25 (1.34) –1.78 (1.06) +6.50 (19.48) +29.88 (59.93) –1.12 (2.24) –0.62 (5.21)	0.041 0.351 0.029 0.316 0.310 0.270 0.658 0.136
Coen, 2011 [37]	RCT	Ireland n = 27 Mild to moderate dementia (MMSE 10–23) Age intervention group: 78.4±5.0 Age control: 81.3±6.2 Age range not specified	<i>Intervention:</i> cognitive stimulation therapy <i>Control:</i> routine activities <i>Treatment:</i> 14 (45-min sessions) twice a week over 7 weeks	Cognition Clinical dementia Anxiety Depression Quality of life Behavior	MMSE ADAS-Cog CDR RAID GDS-15 QoL-AD BRS	+0.8 (3.6) –0.2 (7.2) +0.5 (2.0) –1.1 (7.3) +0.9 (3.0) +3.6 (3.7) 0.0 (3.6)	–2.1 (2.5) –2.3 (4.1) 0.1 (2.1) 1.6 (6.4) –0.1 (1.9) +0.5 (4.4) +1.4 (5.4)	0.013 0.387 0.680 0.268 0.288 0.055 0.450

Table 2 (continued)

First author, year [Ref.]	Study design (quality) ^a	Participants	Intervention	Effect variables	Results		p value	
					measurement tool	variation from baseline (SD), intervention group		change from baseline (SD), control group
Dawson, 2014 [38]	RCT+	Canada n = 19 Age intervention: 74.10±8.77 Age control: 73.67±5.43 Age range not specified MoCa intervention group 27.4 MoCa control group 28.0	<i>Intervention:</i> occupation based strategy training <i>Control:</i> education + cognitively stimulating exercises <i>Treatment:</i> 8 weeks, 3 group sessions (8 h total) and 9 individual 1-h sessions 3-month follow-up	General self-efficacy General health behaviors	Self-efficacy General health Health distress Physical activity Communication with physicians Visit to physicians/emergency departments	+1.4 0.00 +1.0 +0.07 +1.6 -0.30	+1.0 +0.11 -0.11 -2.12 -2.11 -0.45	ns ns ns 0.02 0.02 ns
Fernández- Calvo, 2011 [39]	RCT+	Spain n = 61 with AD (MMSE >18) ≥1 month cholinesterase inhibitor Age intervention: 74.32±3.99 Age control: 72.33±3.72 Age range not specified	<i>Intervention:</i> multicomponent CT <i>Control:</i> waiting list Treatment: 16 weeks, 48 sessions (90 min, 3 sessions a week)	Cognition Behavioral and psychological symptoms Depression Functions	ADAS-Cog NPI-Q CSD RDRS-2	-0.52 -1.16 -0.88 -0.36	+2.03 +3.16 +3.30 +2.16	<0.05 <0.05 <0.05 <0.001
Förster, 2011 [40]	RCT+	Germany n = 39 Age intervention: 74.5±8.6 Age control: 72.0±7.1 Age range not specified MCI (n = 24) or mild AD (n = 15)	<i>Intervention:</i> group-base multicomponent cognitive intervention <i>Control group:</i> pencil-paper exercises for self-study <i>Treatment:</i> 6 months, weekly sessions of 120 min	Cognition	ADAS-Cog MMSE	-1.4 +0.2	+1.9 -0.8	0.045 0.02
Gagnon, 2012 [41]	RCT+	Canada n = 24 with mild cognitive impairment (MMSE intervention: 28.08; control 27.83) Age intervention: 67.00±7.8, Age control: 68.42±6.04 Age range not specified	<i>Intervention:</i> computer- based training programming <i>Control:</i> fixed priority training <i>Treatment:</i> six 1-h training sessions, 3 times a week for 2 weeks	Attention tasks	Accuracy visual detection task RT visual detection task Accuracy alpha-arithmetic tasks RT visual detection task Dual-test cost scores	+3.39 -2.09 +4.38 +6.53	+25.98 -3.29 +0.83 +11.76	<0.01 ns ns ns

Table 2 (continued)

[illegible]

Table 2 (continued)

First author, year [Ref]	Study design (quality) ^a	Participants	Intervention	Effect variables	Results		p value	
					measurement tool	variation from baseline (SD), intervention group		change from baseline (SD), control group
Kim, 2016 [45]	RCT–	Korea n = 53 with AD Age: 78.48±1.45 Age range not specified	<i>Intervention:</i> cognitive program in conjunction with routine pharmacotherapy (art, music, recollection, horticultural therapy) <i>Control:</i> pharmacotherapy 6 months, 5 times a week, 1 h per session	Cognition	MMSE	+1.79 (1.60)	+0.19 (1.5)	0.90
					Word fluency	+0.05 (2.57)	–1.09 (1.97)	0.76
					Boston naming test	+0.40 (1.79)	+0.19 (1.5)	0.29
					Word list	+1.18(3.1)	–1.50 (3.63)	0.48
					Construction praxis	+0.12 (1.77)	+0.38 (1.77)	0.80
					Word list recall	+0.00 (1.31)	–0.52 (1.07)	0.91
					Word list recognition	+0.46 (1.72)	+0.52 (1.07)	0.13
					Construction recall	+0.78 (1.51)	+0.57 (2.03)	0.55
					GDS	+1.43 (0.84)	+0.01 (0.10)	n.r.
					QoL-patient	+0.40 (0.76)	+0.23 (0.73)	n.r.
					QoL-caregivers	+0.81 (2.34)	+1.09 (2.01)	n.r.
					CDR global	+0.01 (0.05)	+0.23 (0.16)	n.r.
					CDR memory	+0.05 (0.07)	+1.09 (0.17)	n.r.
					CDR orientation	0.00 (0.04)	+0.26 (0.18)	n.r.
					Lam, 2009 [46]	RCT+	China n = 74, mild to moderate dementia (CDR 1 or 2) Age intervention: 83.1±6.9 Age control: 83.8±7.0 Age range not specified	<i>Intervention:</i> skills training program <i>Control:</i> general occupational therapy <i>Treatment:</i> 45 min, twice per week for 8 weeks
DAD total	–0.09	–0.03	ns					
AMPS-motor	–0.47	–0.15	ns					
AMPS-process	–0.46	–0.18	ns					
NPI-depression	–0.89	–0.05	ns					
NPI-apathy	+0.94	–0.50	ns					
CSDD-total	–2.54	–1.61	ns					
CDR home & hobbies	+0.09 (0.07)	+0.26 (0.16)	n.r.					
CDR personal care	+0.03 (0.10)	+0.35 (0.18)	n.r.					
Law, 2014 [47]	RCT+	Australia n = 83 Cognitive impairment and at risk for AD Age: 73.8±7.1 Age range: 60–88	<i>Intervention:</i> functional tasks exercise program <i>Control:</i> cognitive training program <i>Treatment:</i> 13 sessions in 10 weeks, 1 h <i>Control:</i> 6 sessions in 10 weeks, 1 h	Cognition Verbal Learning Cognition Instrumental activities Problems in everyday living				
					NCSE normal	+2.18	+0.85	0.034
					CVVLT immediate	+4.95	+2.55	0.123
					CVVLT delayed	+2.43	+1.18	0.043
					TMT-A	–42.65	–17.34	0.011
					TMT-B	–34.22	–30.86	0.656
					CVFT	+2.54	+0.63	0.19
					Lawton IADL	+1.02	+0.45	0.098
					PEDL	+4.07	+1.25	0.008
					Luttenberger, 2012 [48]	RCT–	Germany n = 61 (catamnesis: n = 52) with primary degenerative dementia Age: 84.33±5.16 Age range not specified	<i>Intervention:</i> motor stimulation, ADLs, and cognitive stimulation <i>Control:</i> standard nursing home care <i>Treatment:</i> 2 h, 6 days a week, 12 months
E-ADL test	–5.70	–11.22	0.049					

Table 2 (continued)

First author, year [Ref.]	Study design (quality) ^a	Participants	Intervention	Effect variables	Results	variation from baseline (SD), intervention group	change from baseline (SD), control group	p value
Mavros, 2016 [49]	RCT+	Australia n = 100, MCI Age: 70.1±6.7 Age range not specified	<i>Intervention 1:</i> PRT <i>Intervention 2:</i> CT <i>Control 1:</i> control: sham cognitive training <i>Control 2:</i> sham exercise <i>Treatment:</i> 2–3 days per week for 6 months, 60–100 min	Cognition Executive function Memory function	ADAS-Cog Global domain WAIS-III similarities WAIS-III matrices Category fluency COWAT Executive domain List learning memory sum BVRT Immediate memory I Delayed memory II Memory domain Speed and attention	Intervention 1/ intervention 2 -2.2/-1.7 +0.17/+0.33 +2.0/-1.7 +1.5/+0.5 +1.2/+0.4 +2.9/+2.6 +0.29/+0.19 +1.1/+0.9 +0.2/+0.4 -1.4/-0.7 -1.4/+0.1 -0.07/+0.03 +2.1/+1.9	Control 1/ control 2 -1.2/-1.9 +0.04/+0.08 +1.8/-1.9 -0.2/+0.7 -0.2/+0.8 +4.7/+5.1 +0.16/+0.26 +0.6/+1.0 -0.6/-0.2 -1.0/-1.6 +0.2/-1.6 -0.08/-0.20 +2.0/+2.2	0.66 0.32 0.89 0.79 0.62 0.14 0.39 0.95 0.06 0.23 0.06 0.02 0.84
Mowszowski, 2014 [50]	RCT+	Australia n = 40, MCI (MMSE or late-life depression) Age treatment: 66.00±7.42 Age control: 67.27±8.71 Age range: 51–79 Age range: 50–90	<i>Intervention:</i> CT <i>Control:</i> TAU <i>Treatment:</i> twice-weekly sessions for 7 weeks, 1 h psychoeducation and 1 h individually tailored computer-based CT	Working Memory Language Executive functioning	Digit span RAVLT 1-5 RAVLT 7 COWAT FAS COWAT animals TMT-B	+0.68 -0.04 +0.13 +0.22 +0.11 +0.26	-0.07 -0.12 +0.17 -0.33 +0.14 -0.12	0.306 0.399 0.895 0.047 0.903 0.275
Muñiz, 2015 [51]	RCT+	Spain n = 84 AD Age intervention: 74.9±1.1 Age control: 73.4±1.0 Age range not specified	<i>Intervention:</i> cognitive-motor stimulation <i>Control:</i> standard support <i>Treatment:</i> 3.5-h sessions, twice weekly	Cognition Functions Depression Burden caregiver	ADAS-Cog FAQ Index of ADL GDS BI	+16.00 +13.74 -1.84 -1.24 +4.74	+12.83 +13.19 -2.33 -0.80 +4.79	ns ns <0.05 ns ns
Ngandu, 2015 [52]	RCT+	Finland n = 1,260 at risk for dementia, CAIDE ≥6 Age intervention: 69.5±4.6 Age control: 69.2±4.7 Age range: 60–77	<i>Intervention:</i> multidomain lifestyle-based intervention <i>Treatment:</i> 2 years	Cognition	NTB Executive functioning Processing speed Memory	+0.20 (0.51) n.r. n.r. n.r.	+0.16 (0.51) n.r. n.r. n.r.	0.030 0.039 0.029 0.036

Table 2 (continued)

First author, year [Ref.]	Study design (quality) ^a	Participants	Intervention	Effect variables	Results		p value
					measurement tool	change from baseline (SD), control group	
Olchik, 2012 [53]	RCT+	Brazil n = 112, HC (n = 65) and MCI (n = 47) Age intervention 1: 67±6.1 Age intervention 2: 66.7±5.1 Age control: 68.2±6.8 Age range not specified	<i>Intervention 1</i> : cognitive training <i>Intervention 2</i> : educational training <i>Control</i> : waitlist <i>Treatment</i> : 8 training sessions	Verbal fluency	Categorical verbal fluency FAS RAVLT learning RAVLT immediate RAVLT delayed recall RBMT screening score RBMT immediate story RBMT delayed story	Intervention 1/ intervention 2 +1.8/0 +4.8/+2.6 +5.8/+0.9 +1.9/+0.3 +2.5/-0.1 +2.5/+2.0 +2.9/+1.8 +4.0/+2.0	Control -1.4 +3.7 +1.7 +0.9 +1.8 +3.6 +4.0 +2.6
Rabey, 2012 [54]	RCT+	Israel n = 15, mild to moderate AD (MMSE 18–24 and CDR = 1) Age treatment group: 72.6±8.9 Age control: 75.4±9.07 Age range not specified	<i>Intervention</i> : rTM-COG <i>Control</i> : sham treatment <i>Treatment</i> : 5 days/week, 6 weeks Biweekly maintenance treatment; sessions were 45–60	Cognition Clinical Global Impression of Change Scale Neuropsychiatric Inventory	ADAS-Cog CGIC NPI	Intervention 1/ intervention 2 -3.52 +0.10 -3.43	Control +0.38 +0.04 +1.38
Rojas, 2013 [55]	RCT-	Argentina n = 46 MCI Age intervention: 72±14.29 Age control: 76.93±7.05 Age range not specified	<i>Intervention</i> : CIP <i>Control</i> : no treatment <i>Treatment</i> : 6 months, 2 h, twice per week	Cognition Memory Language Semantic fluency Phonological fluency	MMSE CDR Mem-REC Boston SF PhF	Intervention 1/ intervention 2 0.00 -0.03 +0.42 -2.87 -3.03 -1.46	Control +1.77 -0.10 +1.00 -0.21 +2.40 +1.42
Schmitter-Edgecombe, 2014 [56]	RCT-	USA n = 46 with MCI, CDR 0.5–1.0 and TICS ≥24 Age intervention: 72.96±7.05 Age control: 73.35±7.89 Age range not specified	<i>Intervention</i> : CR-MFG <i>Control</i> : SC <i>Treatment</i> : 3 months, twice weekly, 2-h sessions	Functioning Memory Coping Quality of life Depression	MMAA EFPT bill paying ADL-PI self-report ADL-PI care-partner RBMT-II RBANS immediate RBANS delayed CSE QoL-AD GDS	Intervention 1/ intervention 2 +3.85 -1.09 +0.72 +2.13 +2.0 +7.87 +6.71 +2.05 +1.10 -0.50	Control 0.00 +0.80 -0.50 -0.79 -0.09 -0.96 +0.95 +6.61 +0.18 -0.28
Spector, 2015 [57]	RCT+	UK n = 50, mild-to-moderate dementia (CDR 0.5, 1, or 2) Age: intervention 78±7, control 79±7 Age range: 63–98	<i>Treatment</i> : 10 weekly sessions of 1 h <i>Intervention</i> : CBT <i>Control</i> : TAU	Anxiety Cognition Quality of life Anxiety and depression Neuropsychiatric Inventory	RAID MMSE QoL-AD QoL-caregiver HADC total HADC anxiety HADC depression CSDD NPI total NPI total carer	Intervention 1/ intervention 2 n.r. n.r. n.r. n.r. n.r. n.r. n.r. n.r. n.r.	Control n.r. n.r. n.r. n.r. n.r. n.r. n.r. n.r. n.r.

Table 2 (continued)

First author, year [Ref.]	Study design (quality) ^a	Participants	Intervention	Effect variables	Results	variation from baseline (SD), intervention group	change from baseline (SD), control group	p value
Suzuki, 2014 [58]	RCT–	Japan n = 48 community dwelling Age intervention: 73.0±7.1 Age control: 73.3±5.4 Age range not specified	<i>Intervention:</i> cognitive training <i>Control:</i> lectures about health maintenance <i>Treatment:</i> 12 weeks, once weekly, for 2 h	Cognition Memory Executive functions Language Intelligence	MMSE MoCA-I Logical memory I Logical memory II Delta logical memory TMT-A TMT-B KPT Letter fluency Category fluency Digit span forward Digit span backward	+0.9 +0.2 +2.8 +4.2 +11.3 –4.5 –12.6 +3.1 +1.3 +0.1 –0.1 +0.1	+0.4 +0.5 +2.8 +1.4 –2.1 +3.7 +32.4 +0.7 +0.9 –1.3 +0.2 +0.2	0.284 0.583 0.873 0.011 0.034 0.111 0.098 0.097 0.872 0.144 0.474 0.750

ADL, activities of daily living; AD, Alzheimer disease; ADAS-Cog, Alzheimer's Disease Assessment Scale-cognitive subscale; AGGIR, Autonomie Gérontologie Groupes Iso-ressources; AMP, Assessment of Motor and Process Skills; BADLS, Bayer Activities of Daily Living Scale; BDI, Beck Depression Inventory; BEM, Battery for Mnestic Efficiency; BI, Burden Interview; BRS, Behavior Rating Scale; BVRT, Benton Visual Retention Test; CDR, Clinical Dementia Rating; CGIC, Clinician's Global Impression of Change; CIP, Cognitively Impaired Persons; COWAT, Controlled Oral Word Association Test; CSDD, Cornell Scale for Depression in Dementia; CT, cognitive training; CVFT, Category Verbal Fluency Test; CVLT, Chinese Version Verbal Learning Test; DAD, Disability Assessment for dementia; DKEFS, Delis-Kaplan Executive Function System; DMS, Visual Object Recognition Memory Test; E-ADL, Erlangen Test of Activities of Daily Living; EFTP, Executive Function Performance Test; FAQ, Functional Activities Questionnaire; FAS, Phonemic Verbal Fluency Task; GDS, Geriatric Depression Scale; HADC, HIV-associated dementia; IADL, Instrumental Activities of Daily Living; KPT, Kitchen Picture Test; LSNS, Lubben Social Network Scale; MADRS, Montgomery and Åsberg Depression Scale; MCI, mild cognitive impairment; Mem-REC, Memory Free Recall; MMAA, Medication Management Ability Assessment; MMQ, Multifactorial Memory Questionnaire; MMSE, Mini-Mental State Examination; MoCA, Montreal Cognitive Assessment; MoCA-I, Montreal Cognitive Assessment Japanese version; MrNPS, Mood-Related Neuropsychiatric Symptoms; NCSE, Neurobehavioral Cognitive Status Examination; NPI, Neuropsychiatric Inventory; NPI-Q, Neuropsychiatric Inventory-Questionnaire; ns, not significant; n.r., not reported; NTB, Neuropsychological Test Battery; PhF, phonological fluency; PRT, Progressive Resistance Training; QoL, Quality of Life; QoL-AD, Quality of Life – Alzheimer's Disease; RAID, Rating Anxiety in Dementia; RAVLT, Rey Auditory Verbal Learning Test; RBANS, Repeatable Battery for the Assessment of Neuropsychological Status; RBMT, Rivermead Behavioral Memory Test; RCT, randomized control trial; RDRS-2, Rapid Disability Rating Scale-2; SD, standard deviation; SF-36, Short Form Health Survey-36; STAI-Y1, State-Trait Anxiety Inventory Y1; STAI-Y2, State-Trait Anxiety Inventory Y2; TMT-A, Trail Making Test Part A; TMT-B, Trail Making Test Part B; TAU, treatment as usual; WAIS, Wechsler Adult Intelligence Scale.

^a Quality assessment according to SIGN criteria.

Table 3. Characteristics of mixed trials

First author, year [Ref]	Study design (quality) ^a	Participants	Intervention	Effect variables	Results		
					measurement tool	variation from baseline (SD) ^b , intervention group	change from baseline (SD), control group <i>p</i> value
Barban, 2016 [59]	RCT+	Italy, Greece, Norway, and Spain <i>n</i> = 348 Age intervention: AD (<i>n</i> = 81, MMSE ≥20, CDR = 1) MCI (<i>n</i> = 106, MMSE ≥25, CDR = 0.5) HE (<i>n</i> = 114, MMSE ≥26, CDR = 0) Age intervention: 74.4±5.7 Age control: 72.9±6	<i>Intervention:</i> training + rest <i>Control:</i> rest + training <i>Treatment:</i> 3 months, 24 (1-h) sessions, twice weekly, 30-min multi component PB-CT (10-min memory, 10-min EFs, 10 other cognitive domains) and 30 of RT	Cognition Memory Executive functions	MMSE Rey words Rey figure Phonological fluency Trail making test A Trail making test B	MCI +0.8 +0.9 +1.4 +3.4 −11.7 −23.7	HE 0 +0.3 −3.8 −6.5 +12.4 +5.9 ns ns ns ns ns
Buettner, 2011 [60]	RCT+	USA <i>n</i> = 77 Age intervention: 81.0±8.7 Age control: 82.2±6.5 Age range: >60 years, AD or MCI (MMSE 18–28)	<i>Intervention:</i> mentally stimulating activities <i>Control:</i> social support <i>Treatment:</i> 4 weeks, 1 h twice weekly	Apathy Depression Quality of life Cognition	AES PHQ-9 QOL MMSE Trail making test B	−3.89 +1.82 +8.61 +0.93 −23.31	+5.14 −1.39 +1.90 −0.62 −13.31 <0.001 0.029 <0.001 <0.001 0.258
D'Onofrio, 2014 [61]	RCT+	Italy <i>n</i> = 90 AD patients (MMSE 18.91±2.82) Age: 77.36±4.37 Age range: 69–87	<i>Intervention:</i> rivastigmine transdermal patch + cognitive stimulation <i>Control:</i> rivastigmine transdermal patch <i>Treatment:</i> rivastigmine transdermal patch plus individual 90-min sessions once a week for 2 months, then 2-month stop and 2 more months' sessions <i>Follow-up:</i> 6 months	Cognition Neuropsychiatric inventory Depression Activities daily life Nutritional status Pressure sores Comorbidity Mortality and frailty status	MMSE CDR NPI NPI-depression HDRS-21 GDS-15 ADL IADL MNA ESS CIRS-C MPI MPI-1N MPI-2N MPI-3N	+1.21 −0.09 −16.13 −7.76 −10.05 −4.45 +0.63 +1.96 +2.52 +0.51 0.00 −0.09 +6.00 −14.00 0.00	0.02 0.005 <0.0001 <0.0001 <0.0001 <0.0001 0.001 <0.0001 0.019 0.044 ns ns ns ns ns
Gaitán, 2012 [62]	RCT+	Spain <i>n</i> = 60, multidomain mild cognitive impairment and mild AD who already received cognitive training Age: 75.82±5.46 Age range not specified	<i>Intervention:</i> CBCT + TCT <i>Control:</i> TCT <i>Treatment:</i> CBCT (FESKITS, Estimulacion Cognitiva, v2.5) 30 sessions, 2–3 times a week for 12 weeks TCT: pen-paper exercises, three 1-h sessions 2–3 days a week	Attention and processing speed Working memory Memory Executive function Orientation Praxis and gnosis Cognition Decision making Memory complaints Depression Anxiety	Several tests Several tests Several tests Several tests Several tests MMSE IGT Net Total <i>T</i> score Decks A Decks B Deck C Decks D Decks (C+D) MFE GDS STAI-S	−2.07 −0.41 −0.39 +2.81 +3.51 −2.52 −2.21 −0.91 −2.96 +2.58 +0.33 −0.46 +0.37 +9.90 +4.61 +8.31	0.78 0.99 0.34 0.09 0.39 0.34 0.03 0.13 0.04 0.73 0.31 0.21 0.08 0.16 0.63 0.03

Table 3 (continued)

First author, year [Ref.]	Study design (quality) ^a	Participants	Intervention	Effect variables	Results	variation from baseline (SD) ^b , intervention group	change from baseline (SD), control group	p value
Jeong, 2016 [63]	RCT+	South Korea n = 293 MCI Age GCI: 70.8±6.9 Age HCI: 68.5±8.5 Age control group: 71.6±6.5 Age range: 50–85	<i>Intervention 1</i> : group-based cognitive intervention (GCI) <i>Intervention 2</i> : home-based cognitive intervention (HCI) <i>Control</i> : waiting list <i>Treatment</i> : 12 weeks, twice a week	Cognition	Modified ADAS-Cog Logical memory Working memory Executive function PMT MMSE CDR-SB AD8 (patient) AD8 (informant) PRMQ (patient) PRMQ (informant) MMQ-Strategy GDS-15 Bayer ADL QOL-AD CGA-NPI	GCI –2.3 (5.2) +5.7 (8.0) +0.11 (0.74) +0.20 (0.49) +0.7 (2.9) –0.1 (2.3) +0.04 (0.86) –0.5 (2.0) –0.7 (2.1) –2.6 (9.0) +0.2 (9.0) +2.4 (14.8) –0.1 (2.6) +0.0 (1.1) +0.7 (3.6) –1.6 (8.8)	HCI/control –2.3 (6.1)/–0.5 (5.2) +4.2 (7.5)/+4.6 (8.4) +0.03 (5.9)/+0.6 (6.6) +0.21 (5.6)/+2.6 (5.4) +0.4 (2.6)/–0.4 (2.7) +0.2 (2.3)/+0.3 (2.4) –0.1 (6.7)/+0.15 (8.8) –0.6 (2.2)/–0.3 (1.9) –0.5 (1.8)/–0.2 (1.7) –3.4 (8.0)/–1.4 (12.1) –0.4 (9.9)/3.0 (10.2) +2.4 (11.3)/–0.4 (15.4) –0.7 (2.5)/–0.5 (3.3) 0.2 (1.3)/0.2 (1.2) +0.7 (3.3)/–0.1 (4.7) –0.6 (5.0)/+1.5 (8.9)	0.03/0.047 0.12/0.59 0.44/0.70 0.45/0.57 0.03/0.08 0.39/0.60 0.12/0.05 0.53/0.14 0.03/0.06 0.11/0.15 0.28/0.06 0.61/0.55 0.24/0.33 0.22/0.71 0.13/0.04 0.03/0.16
Kolanowski, 2016 [64]	RCT+	USA n = 283, mild-moderate dementia, Rating Scale ≥3 and CDR 0.5–2.0 Age: 85.8±6.8 Age range not specified	<i>Intervention</i> : cognitive stimulation activities <i>Control</i> : usual care Treatment 30 days, 30-min session each day, 5 days per week	Delirium duration Delirium severity Cognition Executive function Physical function	CAM DRS Attention Memory Orientation CLOX 1 CLOX 2 Barthel Index	n.r. n.r. n.r. n.r.	n.r. n.r. n.r. n.r.	0.370 0.430 0.190 0.720 0.100 0.009 0.110 0.770
Niu, 2010 [65]	RCT+	China n = 32, moderate AD, MMSE 10–24 and receiving donepezil ≥3 months Age intervention: 80.56±4.23 Age control: 79.13±4.38 Age range not specified	<i>Intervention</i> : cognitive stimulation therapy <i>Control</i> : mock intervention <i>Treatment</i> : 10 weeks, twice weekly for 90 min	Cognition Delusions Hallucinations Agitation Dysphoria Anxiety Euphoria Apathy Disinhibition Irritability Motor behavior Neuropsychiatric inventory	MMSE Delusions Delusions distress Hallucinations Hallucinations distress Agitation Agitation distress Dysphoria Dysphoria distress Anxiety Anxiety distress Euphoria Euphoria distress Apathy Apathy distress Disinhibition Disinhibition distress Irritability Irritability distress Motor Motor-distress Total NPI Total NPI distress	+0.81 (1.11) +0.13 (0.34) +0.06 (0.25) +0.00 (0.00) –0.06 (0.25) –0.50 (0.97) –0.25 (0.58) –0.50 (0.73) –0.06 (0.25) –0.19 (0.75) 0.00 (0.37) 0.00 (0.00) 0.00 (0.00) –1.06 (0.85) –1.19 (5.04) 0.00 (0.37) 0.00 (0.37) 0.06 (0.44) 0.06 (0.44) 0.00 (0.00) 0.00 (0.00) –2.06 (1.39) –0.31 (0.79)	–0.19 (0.66) +0.06 (0.25) –0.13 (0.34) 0.00 (0.00) 0.00 (0.00) –0.13 (0.50) –0.06 (0.25) +0.06 (0.68) 0.00 (0.37) +0.13 (0.34) –0.06 (0.57) 0.00 (0.00) 0.00 (0.00) –0.31 (0.60) –0.13 (0.34) +0.06 (0.25) +0.06 (0.25) +0.06 (0.44) +0.06 (0.44) +0.06 (0.25) +0.06 (0.25) –0.00 (1.03) –0.31 (1.01)	0.004 0.780 0.402 0.100 0.780 0.381 0.361 0.047 0.780 0.423 0.985 1.000 1.000 0.017 0.642 0.780 0.780 1.000 1.000 0.780 0.780 0.001 1.000

Table 3 (continued)

First author, Study year [Ref.]	Study design (quality) ^a	Participants	Intervention	Effect variables	Results	measurement tool	variation from baseline (SD) ^b , intervention group	change from baseline (SD), control group	p value
Orgeta, 2015 [66]	RCT+	UK n = 356 dementia patients Age: 78.2 Age range not specified	<i>Intervention:</i> individual cognitive stimulation by family carer <i>Control:</i> TAU <i>Treatment:</i> three 30-min sessions per week over 25 weeks	Cognition Quality of life Neuropsychiatric symptoms Functioning Depression Quality relationship	ADAS-Cog MMSE QoL-AD DEMQUOL NPI BADLS GDS QCPR		+0.9 -0.44 -0.15 +1.61 +0.36 +10.23 -0.24 +1.71	+0.6 -0.14 -0.25 -0.41 +0.6 +10.07 -0.31 -1.17	0.045 0.23 0.97 0.79 0.79 0.36 0.94 0.02
Polito, 2014 [67]	RCT+	Italy n = 77 cognitively healthy individuals with a family history of dementia (NDFAM) and 44 nondemented individuals with CI Age NDFAM intervention: 73.8±1.2 Age NDFAM control: 73.8±1.3 CI intervention: 74.0±1.4, 74.3±1.7 Age range not specified	<i>Intervention:</i> cognitive stimulation <i>Control:</i> sham intervention <i>Treatment:</i> 10 twice-weekly sessions	Cognition	MMSE MoCa Corsi test scores		NDFAM/CI 0.56 (1.46)/0.68 (1.33) 2.39 (2.34)/1.14 (1.86) 0.08 (1.07)/0.32 (1.13)	NDFAM/CI 0.42 (1.52)/0.83 (1.63) 0.90 (2.57)/1.23 (1.63) -0.33 (0.93)/-0.10 (1.14)	0.698/0.733 0.009/0.864 0.075/0.226
Quintana-Hernández, 2016 [68]	RCT+	Spain n = 120, patients with AD, treated with donepezil and MMSE ≥18 Age range: ≥65	<i>Intervention:</i> cognitive stimulation therapy <i>Control:</i> usual care <i>Treatment:</i> 2 years, 3-weekly sessions of 90 min	Cognition Orientation Language Memory Functions	MMSE CAMCOG Orientation Global language Understanding Expression Global memory Recent memory Remote memory Learning Attention Praxis Calculation Abstract thinking Tactile and visual perception		-4.48 -15.74 -2.14 -3.29 -0.59 -2.66 -3.33 -1.26 -0.34 -1.48 -1.08 -1.71 -0.37 -2.48 -1.40	-7.48 -25.52 -3.12 -6.28 -1.60 -1.60 -4.16 -1.40 -1.20 -0.92 -1.44 -2.88 -0.80 -2.40 -2.24	0.00 0.00 0.15 0.00 0.02 0.05 0.00 0.00 0.47 0.00 0.03 0.00 0.18 0.05 0.13
Van Haitsma, 2015 [69]	RCT+	USA n = 180, moderate to severe cognitive and physical functional impairments Age intervention 1: 87.66±8.37 Age intervention 2: 88.71± 6.13 Age control: 89.12±6.87 Age range not specified	<i>Treatment:</i> <i>Intervention 1:</i> attention control <i>Intervention 2:</i> individualized positive psychosocial intervention <i>Control:</i> usual care	Emotions Psychosocial tasks	Pleasure Sadness Anger Anxiety Alertness Psychosocial tasks General restlessness Null behaviors Eyes closed Aggression Uncooperative Positive touch		Intervention 1/intervention 2 2.93 (0.13)/3.19 (0.13) 1.44 (0.08)/1.23 (0.09) 1.42 (0.07)/ 1.23 (0.09) 2.15 (0.15)/2.04 (0.15) 4.78 (0.13)/4.85 (0.13) 476.31 (29.05)/441.29 (29.56) 5.28 (5.56)/6.50 (5.66) 20.69 (8.64)/13.41 (8.79) 25.88 (19.49)/19.41 (19.82) 0.117 (0.04)/0.061 (0.04) 0.149 (0.04)/0.016 (0.04) 0.741 (0.16)/1.173 (0.16)	Control 1.52 (0.08) 1.24 (0.05) 1.17 (0.04) 1.85 (0.10) 3.92 (0.08) 58.80 (18.83) 23.47 (3.60) 23.13 (5.60) 193.26 (12.63) 0.000 (0.02) 0.006 (0.02) 0.059 (0.10)	0.00/0.00 0.043/0.992 0.002/0.798 0.103/0.293 0.000/0.000 0.000/0.000 0.007/0.012 0.813/0.352 0.000/0.000 0.009/0.175 0.002/0.833 0.000/0.000

Table 3 (continued)

First author, year [Ref.]	Study design (quality) ^a	Participants	Intervention	Effect variables	Results		
					measurement tool	variation from baseline (SD) ^b , intervention group	change from baseline (SD), control group
Han, 2017 [70]	RCT+	Korea n = 64, with MCI or dementia (CDR = 0.5 or 1) Age: 76.22±5.84 Age range not specified	<i>Intervention:</i> MCET <i>Control:</i> mock therapy Treatments: two 8-week treatments for 3 h, separated by a 4-week washout period	Cognition	MMSE	+0.85 (2.02)	-0.17 (2.32)
					ADAS-Cog	-1.95 (3.86)	-0.64 (3.85)
					RMBPC-F	-1.73 (7.00)	+0.93 (7.12)
				Problematic behavior	Memory	-0.25 (4.59)	-0.40 (4.12)
					Depression	-0.98 (3.41)	+0.82 (3.52)
					Disruption	-0.50 (1.95)	+0.52 (1.98)
				Depression	RMBPC-R	-0.53 (6.29)	-0.70 (6.22)
					Memory	-0.22 (3.77)	-0.87 (3.80)
					Depression	-0.28 (2.08)	+0.03 (1.97)
				Quality of life	Disruption	-0.15 (1.92)	+0.22 (1.52)
					GDS	-1.30 (4.86)	+0.12 (5.51)
					DAD	0.00 (12.48)	-1.60 (6.90)
				Quality of life	ADL	-0.69 (8.04)	+0.20 (4.19)
					IADL	+1.12 (18.22)	-2.14 (11.70)
					QoL-AD (patient)	+1.47 (5.53)	-0.38 (3.97)
					QoL-AD (caregiver)	+1.65 (4.97)	+0.02 (5.67)

AD, Alzheimer disease; AD8, Eight-Item Interview to Differentiate Aging and Dementia; ADAS, Alzheimer's Disease Assessment Scale-Cognitive subscale; ADL, activities of daily living; AES, Apathy Evaluation Scale; BADLS, Bayer Activities of Daily Living Scale; CAM, Confusion Assessment Method; CAMCOG, Cambridge Cognitive Examination; CBTC, Computer-Based Cognitive Training; CDR, Clinical Dementia Rating; CDR-SB, Clinical Dementia Rating Scale-Sum of Boxes; CGA-NPI, Caregiver-Administered Neuropsychiatric Inventory; CI, cognitive impairment; CIR, Clinical Insight Rating Scale; CLOX, Clock Drawing Task; CST, cognitive stimulation therapy; DAD, Disability Assessment for Dementia; DEMQOL, Health-Related Quality of Life for People with Dementia; DRS, Dementia Rating Scale; EF, executive function; ESS, Extinction-Smiley Scale; GCI = Group-Based Cognitive Intervention; GDS, Geriatric Depression Scale; HCL, Home-Based Cognitive Intervention; HE, healthy elderly; IADL, instrumental activities of daily living; IGT = Iowa Gambling Task; MCET, Multimodal Cognitive Enhancement Therapy; MCI, mild cognitive impairment; MFE = Memory Failures of Everyday Questionnaire; MMQ, Multifactorial Memory Questionnaire; MMSE, Mini-Mental State Examination; MNA, Mini Nutritional Assessment; MoCa, Montreal Cognitive Assessment; MPI-1N, Multidimensional Prognostic Index Low Risk; MPI-2N, Multidimensional Prognostic Index Moderate Risk; MPI-3N, Multidimensional Prognostic Index Severe Risk; NDFAM, cognitively healthy individuals with a family history of dementia; NPI, Neuropsychiatric Inventory; ns, not significant; n.r., not reported; PB-CT = person-based cognitive therapy; PHQ-9, Patient Health Questionnaire-9; PMT = passive movement therapy; PRMQ, Prospective and Retrospective Memory Questionnaire; QCP, quality of the carer-patient relationship; QoL, Quality of Life; QoL-AD, Quality of Life - Alzheimer's Disease; RCT, randomized control trial; RMBPC-F, Revised Memory Behavior Problem Checklist - Frequency; RMBPC-R, Revised Memory and Behavior Problems Checklist-Reaction; RT, reminiscence therapy; SD, standard deviation; STAI-S, State-Trait Anxiety Inventory; TCT, traditional cognitive training.

^a Quality assessment according to SIGN criteria. ^b Standard deviations were only entered when the authors reported them.

caregiver), and depression. Results showed that cognition did not differ between intervention and control in almost every study [24, 25, 27, 28, 30–33], measured with MMSE and Alzheimer's Disease Assessment Scale-Cognitive subscale (ADAS-Cog), while it did improve in the studies conducted by Bergamaschi [26] and Giuli et al. [29] (for ADAS-Cog, not for MMSE). In these studies [26, 29], cognition improved significantly in the intervention group, while a reduction in cognition was found in the control group. Furthermore, when focusing on individual cognitive skills such as memory skills, most studies found no effect on determinants of cognition [24, 25, 27–33] but some studies found an effect on word recall and naming objects and fingers [25], memory test with interference [26], on percent retention scores on the Rey Auditory Verbal Learning Test and everyday memory questionnaire [28], and on working memory, verbal memory, and attentive matrices [29]. Communication skills improved in the studies that examined this explicitly [25, 26], where most studies did not examine improvements in daily communication.

Next, almost every study found that quality of life of the patient or caregiver, or daily functioning, did not improve more than in control conditions in most studies [24, 26, 27, 30, 32], except for Orrell et al. [31, 32]. The first included study by Orrell et al. [31] found an effect for quality of life for Alzheimer disease, whereby patients in the intervention group showed less decline in quality of life than the control. The second study by Orrell et al. [32] found an increase in quality of caregiving relationship for the intervention group and a decrease for the control group. Most studies also examined the effects on depression, but no effects were found, except in the study by Diamond et al. [28], where patients reported a stronger decrease in depression than patients in the control group. The study where most of the outcomes significantly improved was also the one that had the longest intervention period [26]. Bergamaschi et al. [26] found significant effect in cognition, memory, verbal fluency, and everyday functioning. Finally, considering the quality of the studies examining reality orientation interventions, we found no important differences between the different studies. No differences were identified in terms of outcomes when studies were clustered by level of dementia.

Skills Training Trials

Skills training interventions are designed to improve patients' cognitive functioning to stop or slow down the cognitive decline that is strongly related to dementia. Multiple techniques are conducted to treat dementia patients, for example training sessions to match and categorize objects or to conduct exercises to improve daily activities. For the current systematic review, 25 published trials that assessed the effects of skills training were selected that met the inclusion criteria [34–58]. Considering their quality, we found some important differences between the different studies. Of the 25 included trials, 7 were considered RCT- and 18 RCT+ (Table 2).

For skills training trials, a great variation of levels of dementia was found between the studies (Table 2). Most studies included elderly with mild cognitive impairments [35, 36, 41–43, 47, 49–51, 53, 55, 56], some studies included elderly at risk for dementia [38, 52, 58], some other studies patients with mild to moderate dementia [37, 46, 57], moderate to severe dementia [34, 48], diagnosed with Alzheimer disease [39, 40, 44, 45, 48, 51, 54].

Measurement tools to assess cognitive impairment were mostly conducted with the MMSE, but also other measurements were used to assess cognitive functioning.

Sample sizes ranged from 19 to 1,260 patients, whereby groups were not matched by level of impairment. The average age of the patients was above 65 years in all studies. Therapy was heterogeneous in number, duration, and length of the sessions. For example, Amieva et al. [34] conducted treatment for 2 years, starting with weekly sessions (90 min per session), while Gagnon and Belleville [41] only conducted treatment for 2 weeks, 3 times a week (60 min per session). Control conditions varied also between studies, from active music therapy

and neuro-education [42] to pharmacotherapy [45], waitlist [39], or pencil-paper exercises for self-study.

As can be seen in Table 2, different outcome measures were assessed, although most included studies focused on cognition, memory, language, daily functioning, quality of life (patient and caregiver), and depression. Results showed that general cognition, mostly measured by MMSE and ADAS-Cog, differed significantly between intervention and control in almost half of the studies [36, 37, 39, 40, 43, 44, 47, 48, 52, 54], although most studies found an effect for one measurement of cognition and not for the other, except for Förster et al. [40] and Huntley et al. [44]. In these two studies, patients of the experimental group increased their cognition relatively more than the control group after intervention, both for the ADAS-Cog and the MMSE. Other studies showed no significant differences between the conditions with regard to cognition [34, 35, 45, 46, 49, 51, 55, 57, 58]. Studies that used other assessment tools to measure cognitive impairment showed also positive effects. Herrera et al. [43] found an increase for the doors recognition test for the patients in the treatment condition, while the controls showed a decrease. Law et al. [47] found a stronger increase among the patients who were in the intervention group for Neurobehavioral Cognitive Status Examination (NCSE) composite and NCSE normal compared to the control, and Ngandu et al. [52] found the same for the neuropsychological test battery measurement.

Furthermore, focusing on individual cognitive skills that were assessed, like memory (e.g., meta-memory, learning memory, attentional tasks, working memory, recall, executive functioning), most studies found no or only a limited effect on determinants of cognitive functioning [34, 35, 36, 41, 42, 44–46, 50, 55]. In particular, Herrera et al. [43] found an effect on working memory and recall, where patients improved better than controls after the intervention. Law et al. [47] found a positive effect on verbal learning and on the TMT-A, whereby patients in the intervention group showed better functioning than the control, and Mavros et al. [49] found that participants of the intervention group scored relatively better on the BVRT and memory domain than control. Ngandu et al. [52] found that patients scored better at executive functioning, processing speed, and memory after the intervention compared to the control conditions. Olchik et al. [53] compared measurements with healthy controls and found that verbal fluency and behavioral memory improved significantly. Furthermore, Schmitter-Edgecombe and Dyck [56] found that patients improved some of their memory scores better than controls; the same was found by Suzuki et al. [58].

Next, almost every study found that quality of life of the patient or caregiver, or daily functioning, did not improve more in the treatment condition than in control conditions in most studies. Bahar-Fuchs et al. [35] found that mood improved more among the patients receiving treatment, Dawson et al. [38] that physical activity and communication with physicians improved more, and Giovagnoli et al. [42] found that some psychosocial aspects improved more among patients, but altogether most studies found no effect. Some studies also examined the effects on depression, but no effects were found, except in the study by Fernández-Calvo et al. [39], where patients reported a decrease in depression compared to patients in the control, who showed an increase. No relationship between the level of dementia and the final outcomes measured was seen when clustering the trials according to risk, mild, moderate, or severe dementia stages.

Mixed Trials

Some studies integrated multiple components of reality orientation and skills training in their intervention; therefore, we have decided to systematically review these trials separately. For the current systematic review, 12 published trials were selected that met the inclusion criteria [59–70] and integrated both interventions. All studies were rated as RCT+.

For the mixed trials, a great variation of levels of dementia was found between the studies (Table 3). Some studies included elderly at risk for dementia [67], elderly with mild cognitive impairments [63, 70], patients with mild to moderate dementia [64, 66], moderate to severe dementia [69], diagnosed with Alzheimer disease [61, 62, 64, 65, 68], or a combination of these patients [59, 60]. Assessment of cognitive impairment was mostly conducted with the MMSE, but also with other measurements (ADAS-Cog, Clinical Dementia Ranking – CDR).

Studies included samples of 32–356 patients, whereby in general groups were not matched by level of impairment. The average age of the patients was above 65 years in all studies. Therapy was heterogeneous in number, duration and length of the sessions. For example, Quintana-Hernández et al. [68] conducted treatment for 2 years, with 3-weekly sessions (90 min per session), while Buettner et al. [60] only conducted treatment for 4 weeks, two times a week (60 min per session). Control conditions varied also between studies, from sham intervention [67] to usual care [68] to a rivastigmine transdermal patch as control condition [61].

As can be seen in Table 3, different outcome measures were assessed, although most of the included studies focused on cognition, memory, daily functioning, quality of life (patient and caregiver), and depression.

Results showed that general cognition, mostly measured by MMSE and ADAS-Cog, differed significantly between intervention and control in most of the studies [60–63, 65, 66, 68, 70], although some studies found an effect for one measurement of cognition and not for the other [63, 66, 67]. All effects found showed better scores for the patients that received intervention, compared to the control group. The 2-year study [68] showed significant efficacy in all measured outcomes, except for orientation, remote memory, calculation, and tactile and visual perception. Shorter studies, like the 2-month study, showed also relevant efficacy in all the measured outcomes. One study showed no significant differences between the conditions with regard to cognition [59].

Furthermore, focusing on individual cognitive skills that were assessed (e.g., memory, executive functioning, language), most studies found no or only a limited effect on determinants of cognitive functioning [59, 60, 62–64]. Some studies focused on the effect of emotions, whereby for example Buettner et al. [60] and Niu et al. [65] found that patients in the intervention group showed a decrease in apathy compared to controls. Van Haitsma et al. [69] found that patients in the intervention group improved more than patients in the control group on pleasure, sadness, anger, and alertness. They also scored better on multiple psychosocial tasks. Next, some studies showed a positive effect on depression scores among patients who received intervention [60], but some studies also showed no effects [70]. The studies that assessed quality of life of the patient and the caregiver found that quality did not improve more than in control conditions in most studies, except for Han et al. [70] that found a positive effect on the quality of life of the patient (but not the caregiver). Finally, considering the quality of the studies examining mixed interventions, we found no important differences between the different studies.

Discussion

Currently, dementia is considered as one of the most prominent global health issues [71]. Cognitive therapy, more specifically reality orientation interventions, skills training programs, or a mix of both interventions, has been used extensively by therapists to treat cognitive impairment and its consequences among elderly with dementia and their caregivers [22]. The aim of the current study was to systematically review the existing evidence of the effect of cognitive therapy on dementia patients. This study is an update of the systematic review that was conducted by Carrion et al. [22].

This systematic research shows that using reality orientation is not effective in slowing down or improving cognitive functioning among people suffering from dementia. It is worthy to mention that only the 1-year trial showed significant effects on increasing cognition and memory, while the rest of the studies, lasting for 6 months or less, did not. In contrast, half of the trials that conducted skills training sessions and mixed interventions showed a positive effect on cognitive functioning compared to control conditions. The evidence in these studies cannot be considered as effective because most studies assessed a large battery of cognitive measurements and only found an effect on some of the measurements used. In addition, existing evidence appears to be inconclusive. It also seems relevant to consider the length of the studies that were included when analyzing skills training trials. Only the 2-year trial seems to be effective in all the assessed outcome variables. The population treated represents people at risk for dementia, so not yet suffering from it. This might also be a relevant aspect to consider, but results are not conclusive because other studies with population at risk for dementia seem not to be effective [35]. Mixed trials are also inconclusive when analyzing the length of the trial. A 2-year trial [68] achieved good final outcomes in several dimensions, but also a 2-week trial [61] seemed to be very effective. On the other hand, some other short trials do not have any efficacy, so the length does not seem to be an important aspect when analyzing intervention efficacy.

A possible explanation for the findings is that it might be that the skills training and mixed trials themselves train patients to answer cognition tests instead of improving general cognition. Compared to the previous systematic review that used the same methodological approach, on which this study was based [22], different results were found. In the previous systematic review, we [22] found an effect of reality orientation therapy but not skills training on cognitive performance, while in this study we found the opposite. It must be said that the current systematic review included more studies, most of which were well-conducted RCTs [23], while Carrion et al. [22] included less RCTs, and a large proportion of them with a great risk of bias.

Next, an increase in functional emotions and psychosocial tasks was found in some studies that focused explicitly on these aspects of dementia. For example, Van Haitsma et al. [69] found that patients in the intervention group improved more than patients in the control group on some emotional measurements and psychosocial tasks. In addition, the great majority of the included studies showed no or little effects on other outcome measurements, like quality of life (patients or caregiver), depression, language, physical activity, mood, or neuropsychiatric tasks. Finally, considering the quality of the studies examined, only RCTs with a great risk of bias were found for the skills training trials, while no important differences in the quality of experimental setup were found between the different studies for the reality-orientated interventions or mixed interventions.

Most studies included in this review had some limitations that increased the possible risk of bias. First, the disadvantage in most studies was that double-blinded randomization was not possible because patients (as well as experimenters) could be aware of the fact that they were being treated differently. Second, randomization procedures were not detailed in all studies, thereby leaving some uncertainties about the exact allocation of the participants. Third, due to the heterogeneity amongst the trials (e.g., length of treatment, duration of sessions, differences between control groups, number of participants, and severity of dementia) it is difficult to establish the exact effects of the cognitive interventions on people suffering from dementia.

In sum, evidence shows that stimulation of cognitive functions among people with dementia by skills training or a mix of reality orientation and skills training is effective in improving cognitive functioning, although the evidence is inconclusive or contradictory in most included studies. Limited evidence is found for the effect of reality orientation on

dementia-related cognitive impairments, whereby most studies showed no effect. Next, because of the important limitations of the included studies, firm conclusions based on this systematic review cannot be drawn, and improved studies are required. Future research should aim to conduct multicenter, large sample-sized, double-blind studies with detailed randomization procedures and comparable control groups.

Disclosure Statement

The authors have no conflicts of interest to declare.

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