

Supplemental Table 1. Search Strategy

Medline by Ovid Search strategy

1. ('cognitive training' or 'brain training' or 'attention training' or 'reasoning training' or 'memory training' or 'mental training' or 'memory skills training' or 'mental skills training' or 'neurocognitive training').mp.
2. ('cognitive exercise' or 'brain exercise' or 'memory exercise' or 'attention exercise' or 'reasoning exercise').mp.
3. ('cognitive stimulation' or 'memory stimulation' or 'memory enhancement' or 'cognitive enhancement').mp.
4. ('cognitive rehabilitation' or 'cognitive remediation' or 'cognitive restructuring').mp.
5. ('cognitive activit\$' or 'mental activit\$').mp.
6. (speed and processing and training).mp.
7. ('mnemonic\$' or 'method of loci').mp.
8. ('video game\$' or 'videogame\$' or 'wii' or 'computer game\$' or 'virtual reality').mp.
9. ('cognitive intervention\$' or 'neurocognitive intervention\$' or 'neuropsychological intervention\$').mp.
10. ('Aged' or 'Older' or 'Elder\$' or 'Senior\$' or 'aging' or 'ageing' or 'geriatric').mp.
11. ('cognitive impairment' or 'mild cognitive impairment' or 'cognitive decline' or 'neurocognitive disorder' or 'dement\$' or 'cognitive disorder' or 'alzheimer\$').mp.
12. 10 or 11
13. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9
14. 12 and 13

Supplementary Table 2. Categorization of outcomes by cognitive domain

Non Verbal Learning

Benton Visual Retention Test- Revised
CANTAB- Pattern recognition memory
Doors and People Memory Battery- Visual recognition subtest
Delayed Matching Sample Task (DMS48)
Korean Cognitive Functions Test- Immediate recall
Rey-Osterreith Complex Figure- Immediate recall
16-Item free and cued reminding test

Verbal Learning

Visual Verbal Learning Test- Free and cued recall
ADAS-Cog- List Learning Sum
Wechsler Memory Scale- Verbal Paired Associates I
Wechsler Memory Scale- Logical Memory I
Demenz Test- Verbal Selective Reminding
Mini Mental State Exam-recall of 3 words task
Korean- Rey Auditory Verbal Learning Test
Short Story Test
Rey Auditory Verbal Learning Test- immediate recall
Kognition Wortliste: freie Reproduktion
Verbal Story Recall Test
Fuld Object Memory Evaluation- Total encoding
Fuld Object Memory Evaluation- Total recall

Verbal Memory

Prose Memory Test
Rivermead Behavioral Memory Test- Story recall subtest
Korean- Demenia Rating Scale- Memory
Brief Assessment of Prospective Memory-Short
Verbal Story Recall Test
Rey Auditory Verbal Learning Test-Delayed recall
Rey Auditory Verbal Learning Test- Recognition
Visual Verbal Learning Test- Delayed recall
Wechsler Memory Scale- Logical Memory II
Wechsler Memory Scale- Verbal Paired Associates II
Addenbrooke's cognitive examination-cz Memory
Demenz Test Verbal Pictorial Selective Reminding Paradigm
Batterie d'efficence Mnesique (BEM-144)- word list total recall
Hong Kong List Learning
Word list recognition
Fuld Object Memory Evaluation- Delayed recall

Non verbal memory

Rey-Osterreith Complex Figure- Delayed recall
Rey-Osterreith Complex Figure- Recall
Rey-Osterreith Complex Figure- Recognition
Korean Cognitive Functions Test- Delayed recall

Working Memory

Parametric N-Back Task
RBANS-Spatial Span
Reading Span Test
CANTAB-Spatial working memory
Wechsler Memory Scale- Symbol span
Bisyllabic Word Repetition Test
Corsi Block Tapping Test
Digit Span Backwards Test
Digit Span
Zahlenverbindungstest Digit Symbol Span (timed)

Attention

CANTAB-Rapid visual information processing
Digit Cancellation Test
Addenbrooke's Cognitive Examination- Attention
Addenbrooke's Cognitive
Alters-Konzentrations-test- Timed
Korean Wechsler Adult Intelligence Scale Digit span Forward
Korean Wechsler Adult Intelligence Scale Revised- Digit span Forward
Korean-Demenita Rating scale-Attention
Attentive Matrices

Visuospatial Skills

Constructional apraxia
Addenbrooke's Cognitive Examination- Visuospatial
Addenbrooke's Cognitive Examination Revised- Visuospatial
Gollins
Incomplete Picture Test
Korean-Dementia Rating Scale- Construction
Korean-Cognitive Functions Test- Copy
Clock Drawing Test
Rey-Osterreith Complex Figure- Copy

Speed

The Trail Making Test A
Symbol Digits Modality Test- Oral version
Delis-Kaplan Executive Function System Test Battery- Number Sequencing
Go/No Go Reaction Time
Tracking A (Numbers in reverse)
Stroop Color Reading
Korean Wechsler Adult Intelligence Scale Revised- Digit Symbol
Tracking A (Numbers in reverse)
The Useful Field of View

Language

Category Fluency
Semantic Verbal Fluency
Denomination
Addenbrooke's Cognitive Examination- Language
Demenz Test- supermarket naming
Der Fragmentier Bilder Test- Token Test (errors)
Boston Naming Test
Phonetic Fluency- Animal Naming

Executive Functions

Wechsler Adult Intelligence Scale III- Similarities
Wechsler Adult Intelligence Scale III - Reasoning
WAIS-III Matrix Reasoning
The Trail Making Test B
Tracking B Months forwards and numbers in reverse
Semantic Fluency- Letter generation
Raven's Coloured Progressive Matrices
Controlled Oral Word Association Test
Delis-Kaplan Executive Function System Test Battery-Number Letter Switching
Letter Verbal Fluency Letter Fluency
Korean-Dementia Rating Scale- Executive function
Addenbrooke's Cognitive Examination- Fluency
Addenbrooke's Cognitive Examination Revised- Fluency
Phonetic Verbal Fluency Test
Dual Task Performance Test
Cognitive Estimation Test
CANTAB- Spatial working memory
Examiner
Color Trails 1 & 2

Global cognition

ADAS-cog
Computerized Assessment of Cognitive Impairment
Demenzstatus Mini Mental Status
Chinese Mattis Dementia Rating Scale
Global Cognition Domain
Korean-Mini Mental State Exam
Mental Status in Neurology
Mini Mental State Examination (MMSE)
Milan Overall Dementia Assessment
Syndrom Kurztest
Addenbrooke's Cognitive Examination-cz Total

Activities Of Daily Living

Barthel Index of Activities of Daily Living strumental Activities of Daily Living (IADL)
Chinese Modified Barthel Index
Rapid Disability Rating Scale

Instrumental Activities of Daily Living

Lawton Instrumental Activities of Daily Living
functional activities Questionnaire
Bayer Activity of Daily Living
Timed Instrumental ADLs
Brief Assessment of Prospective Memory
Informant Questionnaire on Cognitive Decline in the Elderly

Psychosocial Functioning

Depression Anxiety Stress Scale 21
Cognitive Failures Questionnaire
Cognitive Self Report Questionnaire
Revised Memory and Behavior Problems Checklist
Center for Epidemiological Studies-Depression
Lebensqualitat Seelisches Wohlbenfiden Mental QOL
Quality of Life Questionnaire
Neuropsychiatric Inventory Questionnaire
Cornell scale for depresSion in dementia
Geriatric Depression Scale
Multifactorial Memory Questionnaire

Supplementary Table 3. Risk of Bias within individual studies

Author	Sequence generation	Allocation concealment	Assessor blinding	Participant blinding	Selective outcome reporting	Other sources of bias	Risk of Bias
Barban studies 1 & 2 (44)	High	Low	Unclear	High	High	Low	HIGH
Barnes (29)	Low	Low	Low	Unclear	Low	Low	LOW
Boller (42) studies 1 & 2	Unclear	Unclear	Unclear	Unclear	Low	Low	HIGH
Finn (48)	Low	Low	Low	Unclear	Low	Low	HIGH
Finn (49)	Low	Low	Unclear	Unclear	Low	Low	HIGH
Galante (32)	Low	Low	Low	Unclear	Low	Low	HIGH
Heiss (58)	Unclear	Unclear	High	High	Low	Low	HIGH
Herrera (56)	Unclear	Unclear	Unclear	Unclear	Low	Low	HIGH
Hughes (57)	Low	Unclear	Unclear	Unclear	Low	Low	HIGH
Lee (60)	Unclear	Low	Low	Low	Low	Low	HIGH
Lowenstein (52)	Unclear	Unclear	Low	Unclear	Low	Low	HIGH
Man (50)	Low	Unclear	Low	Unclear	Low	Low	LOW
Optale (31)	Low	Low	Low	Unclear	Low	Low	HIGH
Rozzini (51)	Unclear	Unclear	Low	Unclear	Low	Low	LOW
Fiatarone Singh (43) studies 1& 2	Low	Low	Low	Low	Low	Low	LOW
Tarnanas (47)	Unclear	Unclear	Low	Low	Low	Low	HIGH
Tarraga (59)	Unclear	Unclear	Unclear	Low	Low	Low	HIGH
Zhuang (33)	Unclear	Unclear	Low	Unclear	Low	Low	HIGH
Hagovska (45, 46)	Low	Low	High	Unclear	Low	Low	HIGH
Fernandez-Calvo (55)	Unclear	Unclear	Low	Unclear	Low	Low	LOW
Wittelsberger (54)	Unclear	Unclear	Unclear	Unclear	Low	Low	HIGH
Kim 2005	Unclear	Unclear	Unclear	Unclear	High	Low	HIGH
Gooding studies 1 & 2 (30)	Unclear	Low	Unclear	High	Low	Low	HIGH
Barcelos (53)	Low	Unclear	Unclear	High	Low	Low	HIGH
Lin (67)	Unclear	Low	Low	High	Low	Low	LOW

Supplementary Table 4. Meta-analyses of individual cognitive domains across dementia studies

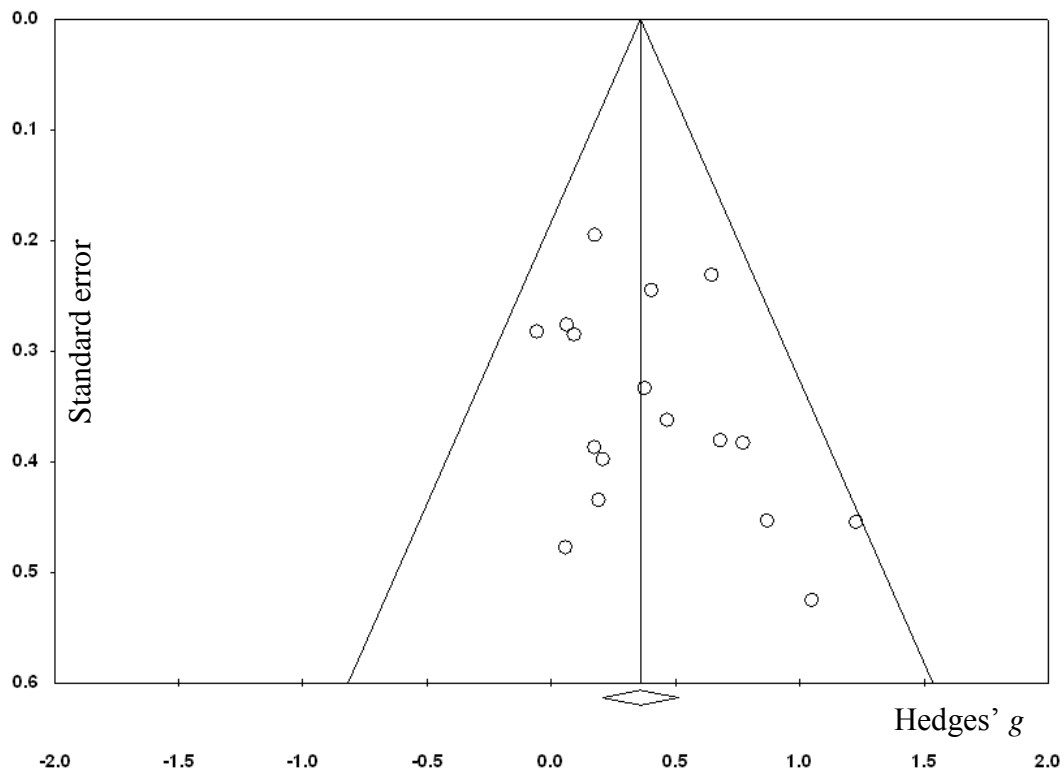
Domain	<i>k</i>	<i>g</i> (95% CI)	P-value	<i>I</i> ²
Overall cognition	11	0.26 (0.01 to 0.52)	0.05	26.48%
Global cognition	7	0.31 (-0.11 to 0.72)	0.15	56.66%
Activities of Daily Living	2	0.06 (-0.51 to 0.64)	0.84	0%
Instrumental Activities of Daily Living	6	-0.24 (-0.50 to 0.02)	0.07	0%
Language	4	0.08 (-0.29 to 0.44)	0.67	0%
Executive function	5	0.02 (-0.46 to 0.51)	0.92	59.81%
Attention	2	-0.19 (-0.77 to 0.39)	0.52	0%
Verbal learning	4	0.42 (-0.14 to 0.97)	0.14	51.22%
Non-verbal learning	2	0.23 (-0.43 to 0.90)	0.50	0%
Verbal memory	9	0.17 (-0.25 to 0.59)	0.42	65.0%
Non-verbal memory	1	-0.06 (-0.49 to 0.38)	0.80	0%
Psychosocial functioning	6	0.60 (-0.05 to 1.25)	0.07	73.4%
Processing speed	2	0.11 (-0.43 to 0.66)	0.69	50.33%
Visuospatial skills	3	0.54 (0.07 to 1.01)	0.02	4.77%
Working memory	4	0.22 (-0.34 to 0.78)	0.45	33.71%

Supplementary Table 5. Long-term outcomes for MCI and Dementia studies

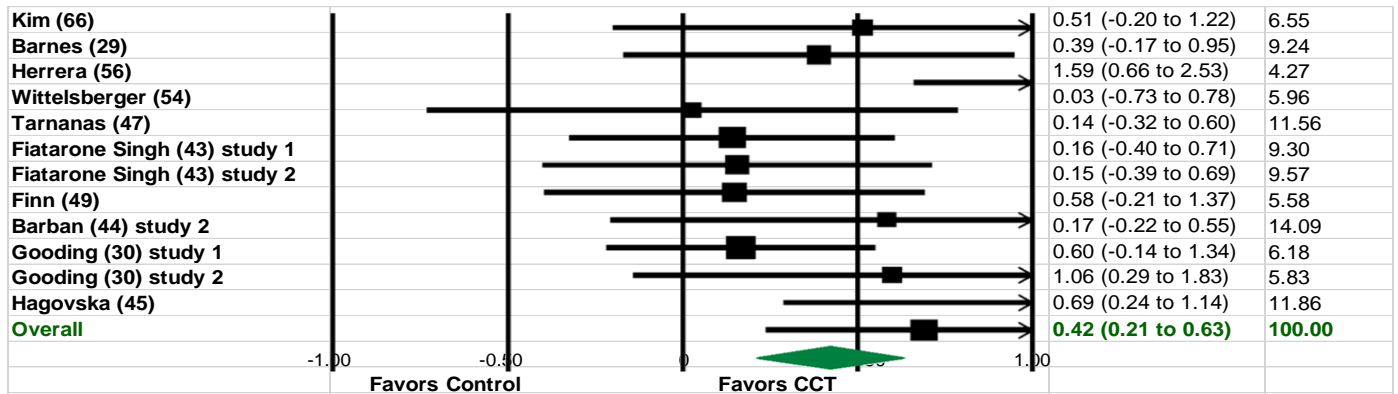
Study	Population	Follow-up 1	Follow-up 2	Follow-up 3
Galante 2007 (32)	Dementia	4 (wks from baseline) g= -0.13 CI[-1.26 to 1.00]	8 (wks from FU1) g= -0.37 CI[-1.52 to 0.79]	24 (wks from FU2) g= 0.83 CI[-0.35 to 2.01]
Heiss 1994 (58)	Dementia	8 (wks from baseline) g= -0.01 CI[-0.65 to 0.64]	8 (wks from FU1) g= 0.02 CI[-0.63 to 0.67]	8 (wks from FU2) g= 0.07 CI[-0.59 to 0.72]
Tarraga 2006 (59)	Dementia	12 (wks from baseline) g= 0.11 CI[-0.58 to 0.8]	24 (wks from FU1) g= 0.09 CI[-0.60 to 0.78]	
Herrera 2012 (56)	MCI	12 (wks from baseline) g= 1.23 CI[0.34 to 2.12]	12 (wks from FU1) g= 0.86 CI[0.01 to 1.71]	
Hughes 2014 (57)	MCI	24 (wks from baseline) g= 0.19 CI[-0.66 to 1.05]	28 (wks from FU1) g= 0.01 CI[-0.86 to 0.88]	
Lee 2013 (60)	Dementia	6 (wks from baseline) g= -0.06 CI[-1.08 to 0.96]	6 (wks from FU1) g= -0.27 CI[-1.29 to 0.76]	
Fiatarone Singh 2014 study 1 (43) (CT + PRT vs Sham CT Sham + PRT)	MCI	24 (wks from baseline) g= -0.06 CI[-1.08 to 0.96]	48 (wks from FU1) g= -0.08 CI[-0.64 to 0.47]	

Fiatrone Singh 2014 study 2 (43) (CT + Sham PRT vs Sham + Sham)	MCI	24 (wks from baseline) $g = -0.06$ CI[-0.48 to 0.61]	48 (wks from FU1) $g = 0.05$ CI[-0.49 to 0.59]
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Supplementary Figure 1. Funnel plot of overall cognition in mild cognitive impairment

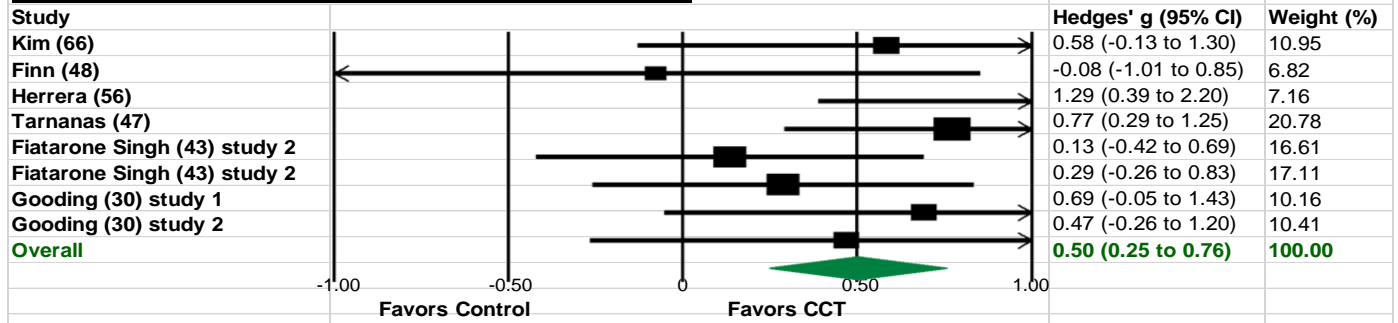


Supplementary Figure 2. Forest plots of cognitive and behavioral domains in MCI and Dementia



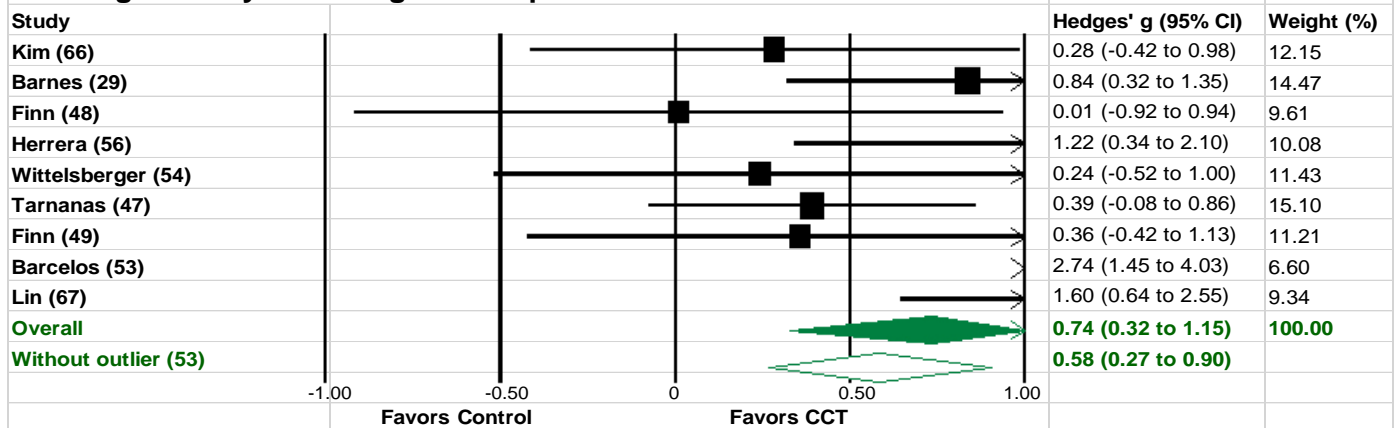
Tests for heterogeneity: $\chi^2=16.42$ df=9, $P=0.13$, $I^2=33.02$
 Test for overall random effect: $Z=3.92$, $P<0.001$

Non-verbal learning: Mild Cognitive Impairment



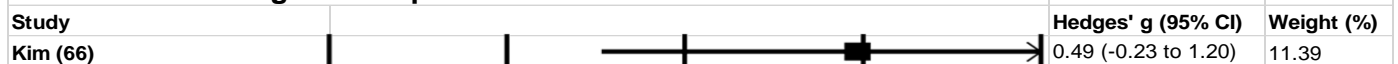
Test for overall random effect: $Z=3.89$, $P<0.001$

Working Memory: Mild Cognitive Impairment

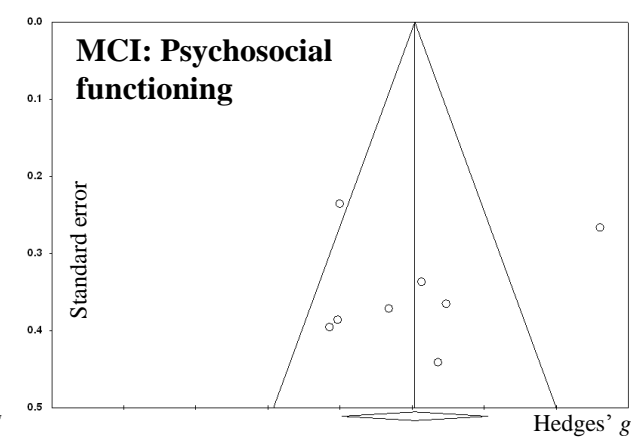
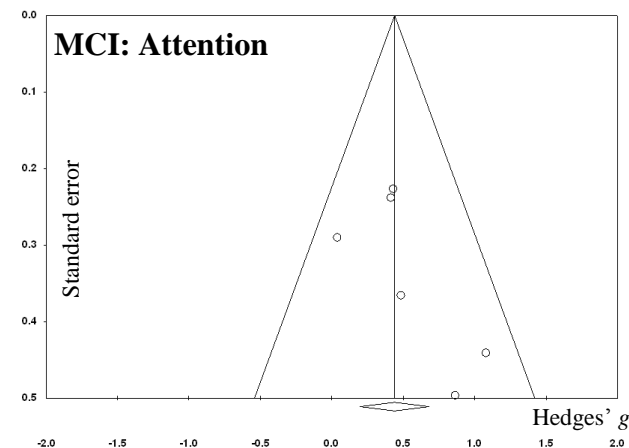
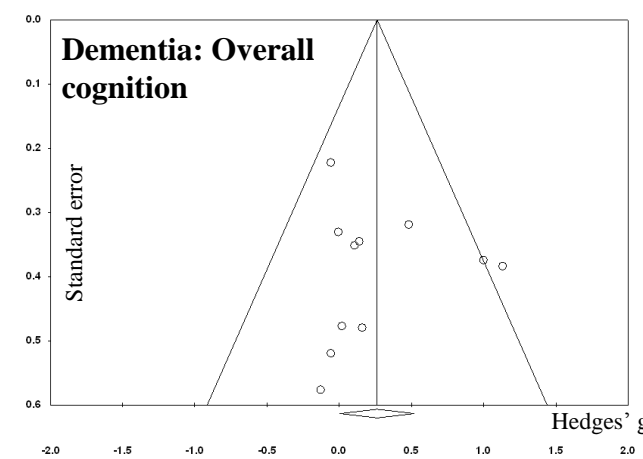
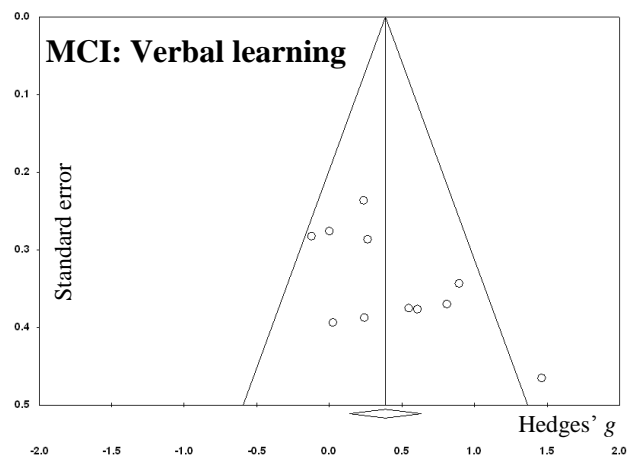
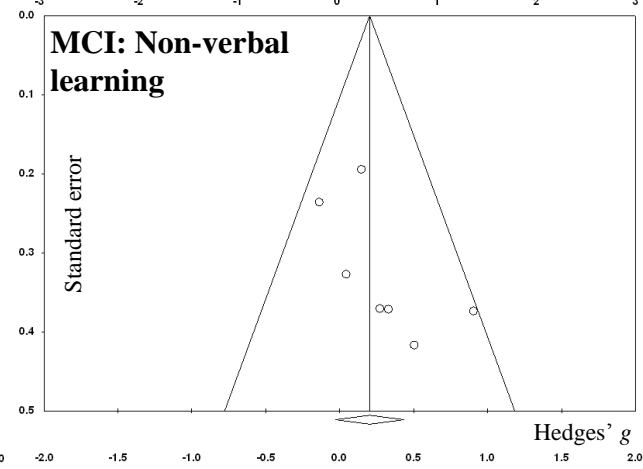
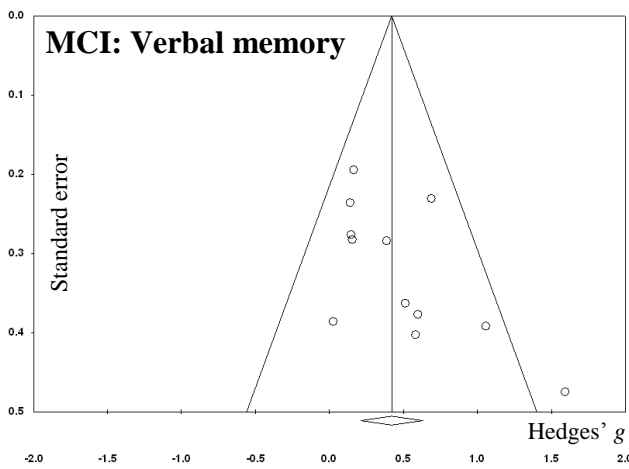
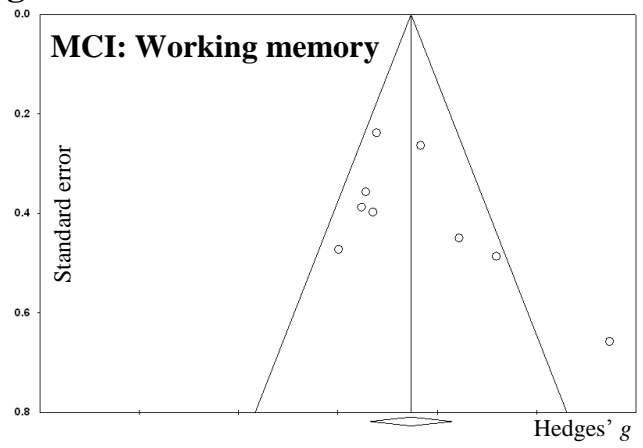
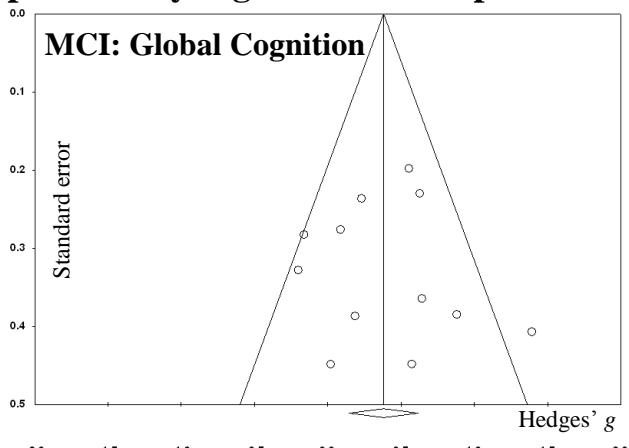


Tests for heterogeneity: $\chi^2=21.7$ df=8, $P=0.006$, $I^2=63.1$
 Test for overall random effect: $Z=3.50$, $P<0.001$

Attention: Mild Cognitive Impairment

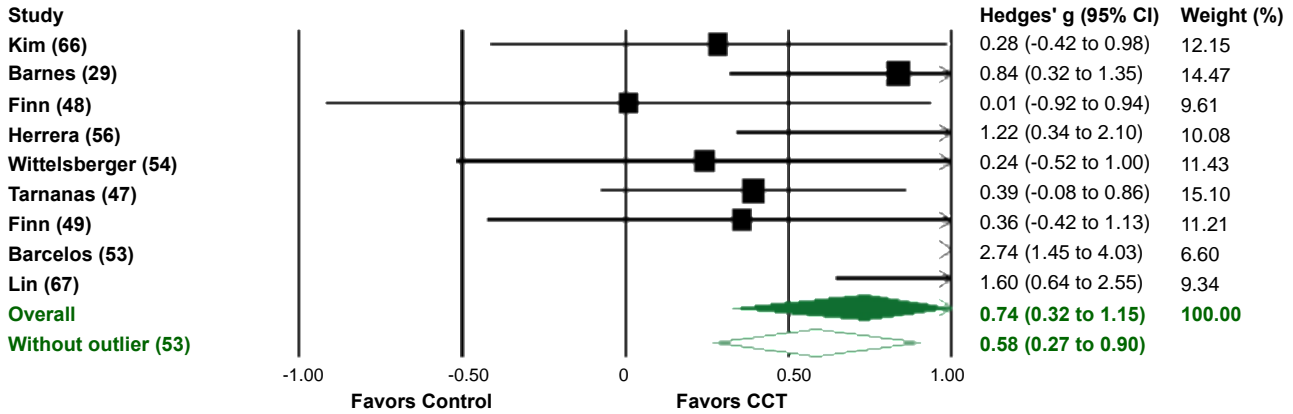


Supplementary Figure 3. Funnel plots of cognitive and behavioral domains



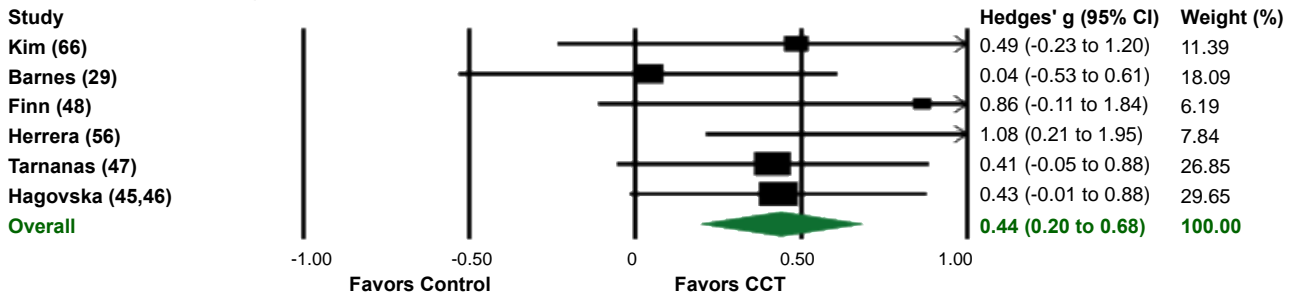
Supplementary Figure 4. Forest plots of cognitive and behavioral domains in MCI and Dementia

Working Memory: Mild Cognitive Impairment



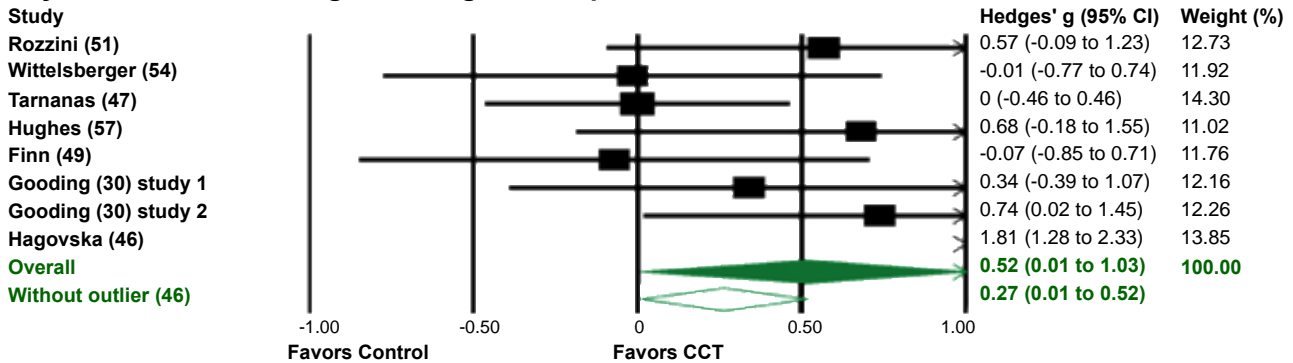
Tests for heterogeneity: $\chi^2=21.7$ df=8, P=0.006, $I^2=63.1$
 Test for overall random effect: Z=3.50, P<0.001

Attention: Mild Cognitive Impairment



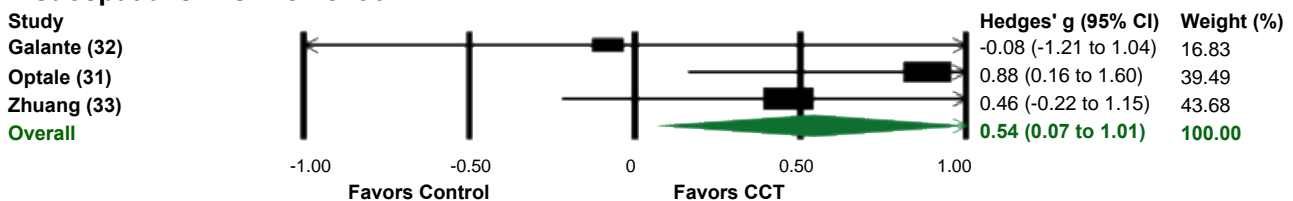
Tests for heterogeneity: $\chi^2=4.76$ df=5, P=0.45, $I^2<0.001$
 Test for overall random effect: Z=3.56, P<0.001

Psychosocial functioning: Mild Cognitive Impairment



Tests for heterogeneity: $\chi^2=32.84$, df=7, P<0.001, $I^2=78.69$
 Test for overall random effect: Z=2.00, P=0.045

Visuospatial skills: Dementia



Tests for heterogeneity: $\chi^2=2.1$, df=2, P=0.35, $I^2=4.77$
 Test for overall random effect: Z=2.26, P=0.024