

## Executive Function

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
Akerlund et al., 2013 PEDro score: 4 Country: Sweden	55 patients with acquired brain injury – 32 (58%) with subacute/chronic stroke	<p>Computerized working memory training (Cogmed QM) (n=17/25) vs. Delayed Cogmed QM (control group) (n=15/20)</p> <p><b>Treatment details:</b> 30-45 minutes/session, 5 days/week for 5 weeks. Cogmed QM training included a battery of visuospatial and verbal auditory working memory tasks that involved maintenance of multiple stimuli at the same time, short delayed during which the representation of stimuli should be held in working memory, unique sequencing of stimuli order, difficulty level adapting as per performance. All participants received conventional rehabilitation. The intervention was offered to the control group following study completion and 11 patients were enrolled (group C1); 10 patients refused (group C2).</p>	<p><b>At 6 weeks (1 week post-treatment):</b> (-) Wechsler Adult Intelligence Scale-III (WAIS-III) NI – Working memory scaled score (-) WAIS – III-Digit Span Forwards (-) WAIS – III- Digit Span Reversed (-) WAIS – III- Digit Span Scaled (-) WAIS – III- Span Board Forwards (-) WAIS – III- Span Board Reversed (-) WAIS – III-Span Board Scaled (+) Barrow Neurological Institute Screen for Higher Cerebral Functions (BNIS)* (-) The Dysexecutive Questionnaire (-) Hospital Anxiety and Depression Scale (HADS) – Anxiety (+) HADS – Depression**</p> <p><b>At 18 weeks (follow-up):</b> (+) WAIS – III- Digit Span Forwards* (+) WAIS – III-Digit Span Reversed* (-) WAIS – III-Digit Span Scaled (-) WAIS – III-Span Board Forwards (-) WAIS – III-Span Board Reversed (-) WAIS – III- Span Board Scales (-) WAIS-III NI – working memory scaled score (-) BNIS (-) The Dysexecutive Questionnaire (-) HADS – Anxiety (-) HADS – Depression</p>

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Faria et al., 2016 PEDro score: 7 Country: Portugal	18 patients with chronic stroke	Virtual reality (VR)-based cognitive rehabilitation (n=9) vs. Conventional cognitive rehabilitation (n=9)  <b>Treatment details:</b> 12 x 20-minute sessions over 4-6 weeks (weekly frequency not specified). VR-based cognitive rehabilitation used Reh@City 3D virtual simulation of a city (environment) that uses daily routines integrating memory, attention, visuo-spatial and executive functioning abilities. Levels of difficulty were adjustable.	<b>At 24 weeks (follow-up):</b> (-) WAIS – III-Digit Span Forwards (-) WAIS – III-Digit Span Reversed (-) WAIS – III-Digit Span Scaled (-) WAIS – III-Span Board Forwards (-) WAIS – III-Span Board Reversed (-) WAIS – III-Span Board Scales (-) WAIS-III NI – working memory scaled score (-) BNIS (-) The Dysexecutive Questionnaire (-) HADS – Anxiety (-) HADS – Depression * Reflects change scores from baseline **in favor of intervention group vs. group C1. Note: Group C1 had significantly more depressive symptoms at baseline vs. Group C2.  <b>At 4-6 weeks (post-treatment):</b> (+) Addenbrooke Cognitive Examination (ACE) – total (+) ACE – attention (-) ACE – memory (+) ACE – fluency (-) ACE – language (-) ACE – visuospatial (+) Mini-Mental State Examination (-) Trail Making Test – A (-) Trail Making Test – B (-) WAIS III – Picture Arrangement (-) Stroke Impact Scale

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		Conventional cognitive rehabilitation comprised time-matched cognitive training using puzzles, calculus, problem resolution, shape sorting, etc.	
Fish et al., 2008 PEDro score: 5 (cross-over) Country: UK	36 patients with chronic stroke	Paging system - neuropager  vs.  No treatment  <b>Treatment details:</b> Group A (n=24) Group B (n=12) 3-stage trial: T1 – 2 weeks (baseline, no intervention) T2 – 7 weeks (Group A: pager; Group B: no pager) T3 – 7 weeks (Group A: no pager; Group B: pager). Paging system – The NeuroPager sent reminders to assist with memory and planning.	<b>At 9 weeks (post T2):</b> (+) Memory diary - % of tasks achieved At 16 weeks (post T3) (+) Memory diary - % of tasks achieved* * In favour of Group B vs. Group A. Note: At 16 weeks Group A's performance had deteriorated to baseline levels (i.e. participants did not retain the benefits gained immediately post-treatment).
Gamito et al., 2015 PEDro score: 3 Country: Portugal	20 patients with stroke (stage of stroke recovery not specified)	Virtual reality (VR) – based cognitive rehabilitation (n=10) vs. Delayed VR-based cognitive rehabilitation (n=10)  <b>Treatment details:</b> 60-minutes/session, 2-3 times/week for 4-6 weeks. VR-based cognitive rehabilitation: Serious Games application that trained working memory, spatial	<b>At 4-6 weeks (post-treatment):</b> (+) Wechsler Memory Scale – total score (+) Toulouse-Pieron Test – work efficiency (-) Rey Complex Figure – immediate recall

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		orientation, selective attention, recognition memory, calculation. The control group was placed on a waiting list to receive VR cognitive training.	
Lin et al., 2014 PEDro score: 5 Country : China	34 patients with chronic stroke	Computer-assisted executive function and memory training (n=16) vs. No therapy (n=18)  <b>Treatment details:</b> 1-hour/session, 6x/week for 10 weeks. Computer-assisted executive function and memory training was performed using RehaCom® software package.	<b>At 10 weeks (post-treatment):</b> (-) Wechsler Memory Scale (WMS) – information (-) WMS – orientation (-) WMS – mental control* (-) WMS – logical memory* (-) WMS – digits forward/backward* (-) WMS – visual reproduction* (-) WMS – associated learning* (-) WMS – memory quotient* (-) Trail Making Test - A* (-) Trail Making Test - B Note: Between-group statistical analyses not reported. *Within-group improvement from baseline to post-treatment.
Lundqvist et al., 2010 PEDro score: 5 (cross-over) Country: Sweden	21 patients with acquired brain injury (n=11 chronic stroke)	Computer-based working memory training vs. No therapy  <b>Treatment details:</b> 45-60 minutes/session, 5 days/week for 5 weeks. Computer-based working memory training consisted of visuospatial and working memory tasks performed on a	<b>At 4 weeks post-training (short-term follow-up T1):</b> (-) Paced Auditory Serial Attention Test* (-) Delis-Kaplan Executive Function System - Colour Word Interference Test condition 4 – Inhibition/Switching* (-) WAIS-R-NI – Block Span Board forwards* (-) WAIS-R-NI – Block span board backwards*

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		personal computer (sequencing recall, location recall) with adapted level of difficulty.	(-) Listening Span Task* (-) Picture Span* <b>At 20 weeks post-training (long-term follow-up T2):</b> (-) Paced Auditory Serial Attention Test* (-) Delis-Kaplan Executive Function System Colour Word Interference Test condition 4 – Inhibition/Switching* (-) WAIS-R-NI Block-Span-Board forwards* (-) WAIS-R-NI Block-Span-Board backwards* (-) Listening Span Task* (-) Picture Span (-) Canadian Occupational Performance Measure (COPM) – performance* (-) COPM – satisfaction* (-) EQ-5D (-) Health Self-Rating (Visual Analogue Scale)* Note: * results report significant improvements in both groups combined from baseline to T1 and baseline to T2.
Man et al., 2006 PEDro score: 5 Country: Hong Kong	103 patients with acquired brain injury (n=55 chronic stroke)	Online problem solving (PS) training using videoconferencing (n=25) vs. Self-directed computer-assisted PS training (n=28) vs. Therapist-administered PS training (n=30) vs. No therapy (n=20)	<b>At 20 treatment sessions (post-treatment):</b> (-) Category Test (-) Chinese Version of the Lawton Instrumental Activities of Daily Living Scale (+) Problem-solving self-efficacy scale (change score)* *In favor of therapist-administered PS training vs. online PS training; and in favor of therapist-

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<p>Poulin et al., 2016 PEDro score: 5 (partially RCT) Country: Canada</p>	<p>9 patients with subacute/chronic stroke</p>	<p><b>Treatment details:</b> 20 sessions of 45-minutes/session over a 2 month period. PS consisted of online training through computer video conferencing with interactive software. Computer-assisted PS consisted of interactive patient-directed software use. Therapist-administered PS consisted of face-to-face therapist guided training activities.</p> <p>CO-OP (Cognitive Orientation to daily Occupational Performance) training (n=6) vs. Computer-based executive function training (n=5)</p> <p><b>Treatment details:</b> 1 hour/session, 2 times/week for 8 weeks. CO-OP is a client-centered performance-based, problem solving approach that enables skill acquisition through a process of strategy and guided discovery, where patients selected 3 functional activity goals to work on. Computer-based executive function training consisted of NeuroActive® software use that involved exercises in working memory, cognitive flexibility, divided attention and inhibition, dual-tasking training.</p>	<p>administered training vs. computer-assisted training.</p> <p><b>At 8 weeks (post-treatment):</b> (-) Canadian Occupational Performance Measure (COPM) – performance score – trained goals* (-) COPM – performance score – untrained goals (-) COPM – performance score – all goals* (-) COPM – significant other’s ratings – performance score – all goals (-) COPM – satisfaction score – trained goals* (-) COPM – satisfaction score – untrained goals* (-) COPM – satisfaction score – all goals* (-) COPM – significant other’s ratings – satisfaction score – all goals (-) Trail Making Test (TMT) A (-) TMT B* (-) Delis-Kaplan Executive Function System (D-KEFS) Colour-Word Interference Test (-) Wechsler Adult Intelligence Scale-IV (WAIS-IV) Digit Span</p>

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Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
			(-) Assessment of Life Habits (-) Self-efficacy Scale for Performing Life Activities Post-Stroke * (-) Dysexecutive Questionnaire At 1 month (follow-up): (-) COPM – trained goals* (-) COPM – performance score – untrained goals (-) COPM – performance score – all goals* (-) COPM – significant other’s ratings – performance score – all goals (-) COPM – satisfaction score – trained goals* (-) COPM – satisfaction score – untrained goals* (-) COPM – satisfaction score – all goals* (-) COPM – significant other’s ratings – satisfaction score – all goals (-) TMT A (-) TMT B* (-) D-KEFS Colour-Word Interference Test (-) WAIS-IV Digit Span (-) Assessment of Life Habits (-) Self-efficacy Scale for Performing Life Activities Post-Stroke* (-) Dysexecutive Questionnaire Note: * refers to significant within-group improvements in the CO-OP training group.

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Prokopenko et al., 2013 PEDro score: 6 Country: Russia	43 patients with acute/subacute stroke	Computer-assisted attention and working memory training (n=24) vs. Conventional rehabilitation (n=19)  <b>Treatment details:</b> 30-minutes/session, 7 days/week for 2 weeks for up to 15 hours of treatment. Computer-assisted attention and working memory training consisted of the use of computerized Schulte's tables with biological feedback and assistance possibility; where patients were asked to find scan, find, select, and recall position/recognize location of specific numbers/objects among distractors.	At 2 weeks (post-treatment): (-) Mini-Mental Status Examination (-) Montreal Cognitive Assessment (+) Clock Drawing Test (+) Shulte's Table (-) Hospital Anxiety and Depression Scale – Anxiety (-) Hospital Anxiety and Depression Scale – Depression (+) Frontal Assessment Battery
Skidmore et al., 2015a PEDro score: 6 Country: USA	30 patients with acute/subacute stroke	Strategy training using the Canadian Occupational Performance Measure (COPM) (n=15) vs. Attention training (n=15)  <b>Treatment details:</b> 45-minutes/session, 5 days/week for the duration of rehabilitation (approx.. 1-3 weeks). Strategy training using the COPM consisted of 4 steps: self-selected goals, self-evaluation, strategy development and generalization; 4 – 6 activities were addressed in training. Attention training consisted of nonspecific effects of strategy training where patients identified and prioritized	<b>At 3 months after study admission (follow-up):</b> (+) Functional Independence Measure (-) Delis-Kaplan Executive Functioning System - Color Word Interference Test – inhibition subscale (+) Delis-Kaplan Executive Functioning System - Color Word Interference Test – cognitive flexibility subscale  <b>At 6 months after study admission (follow-up):</b> (+) Functional Independence Measure (-) Delis-Kaplan Executive Functioning System - Color Word Interference Test – inhibition subscale (+) Delis-Kaplan Executive Functioning System –



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		self-selected goals, and reflected on rehabilitation goals using workbook, discussion and journal entries. Both groups received conventional rehabilitation.	Color Word Interference Test - cognitive flexibility subscale
Skidmore et al., 2015b (secondary analysis of Skidmore et al., 2015a) PEDro score: 6 Country: USA	30 patients with acute/subacute stroke	Strategy training using the Canadian Occupational Performance Measure (COPM) (n=15) vs. Attention training (n=15)  <b>Treatment details:</b> 45-minute/session, 5 days/week for the duration of rehabilitation (approx. 1-3 weeks). Strategy training using the COPM consisted of 4 steps: self-selected goals, self-evaluation, strategy development and generalization; 4 – 6 activities were addressed in training. Attention training consisted of nonspecific effects of strategy training where patients identified and prioritized self-selected goals, and reflected on rehabilitation goals using workbook, discussion and journal entries. Both groups received conventional rehabilitation.	<b>At 3 months after study admission (follow-up):</b> (+) Apathy Evaluation Scale <b>At 6 months after study admission (follow-up):</b> (-) Apathy Evaluation Scale
Westerberg et al., 2007 PEDro score: 5 Country: Sweden	18 patients with chronic stroke	Computer-based executive function (EF) training (n=9) vs. No therapy (n=9)  <b>Treatment details:</b> 40-minutes/session, 5 days/week for 5 weeks (total 25 sessions).	<b>At 5 weeks (post-treatment):</b> (+) Wechsler Adult Intelligence Scale-Revised NI (WAIS R-NI) – Digit Span Test (+) WAIS R-NI – Span Board Test (-) Stroop Interference Test (-) Claeson-Dahl Test - Word List Delayed Recall (-) Raven’s Progressive Matrices (+) Paced Auditory Serial Attention Test

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		Computer-based EF training was performed with the RoboMemo© software from the Cogmed Cognitive Medical Systems® and involved working memory and visuospatial exercises. Each session included 90 computerized trials.	(PASAT) Version A (+) RUFF 2&7 (+) Cognitive Failure Questionnaire
Winkens et al., 2009 PEDro score: 7 Country: Netherlands	37 with subacute/chronic stroke	Time pressure management (TPM) training (n=20) vs. Conventional cognitive rehabilitation (n=17)  <b>Treatment details:</b> 10 hours at 1, 1.5, or 2 hours per week. TPM training consisted of 3 stages of 1. Increase awareness of mental slowness and its effects on function; 2. Acceptance and acquisition of TPM strategies (preventative and management); and 3. Generalization of learned strategies. Conventional cognitive rehabilitation consisted of either education about brain damage, speed of information processing and its effects on function; or education of compensatory strategies.	<b>At 10 hours of treatment (post-treatment):</b> (+) Information Intake Task (IIT) – no. of used strategies (-) IIT – reproduction score (-) Mental Slowness Observation Test (MSOT) – no. of used strategies (-) MSOT – no. of correct elements (-) MSOT – time (sec) (-) Mental Slowness Questionnaire (-) Barthel Index (-) Fatigue Severity Scale (-) Center for Epidemiologic Studies Depression Scale (-) EuroQol-5D (-) Symbol Digit Modalities Test (-) Paced Auditory Serial Addition Test (PASAT) (-) Rey Auditory Verbal Learning Test (-) Trail Making Test – A (-) Trail Making Test – B (-) Stroop Color Word Task <b>At 3 months (follow-up):</b> (-) IIT – no. of used strategies (-) IIT – reproduction score (-) MSOT – no. of used strategies

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			(-) MSOT – no. of correct elements (+) MSOT – time (sec) (-) Mental Slowness Questionnaire (-) Barthel Index (-) Fatigue Severity Scale (-) Center for Epidemiologic Studies Depression Scale (-) EuroQol-5D (-) Symbol Digit Modalities Test (-) PASAT (-) Rey Auditory Verbal Learning Test (-) Trail Making Test – A (-) Trail Making Test – B (-) Stroop Color Word Task
Wolf et al., 2016 PEDro score: 5 Country: USA	35 patients with acute/subacute stroke	Cognitive Orientation to Daily Occupational Performance (CO-OP) (n=19) vs. Conventional occupational therapy (n=16)  <b>Treatment details:</b> Maximum 10 sessions (duration of sessions and frequency per week not specified). CO-OP is a client-centered performance-based, problem solving approach that enables skill acquisition through a process of strategy and guided discovery, where patients select functional activity goals as per their preference. Conventional occupational therapy consisted of functional rehabilitation (e.g. ADLs training) and task-based training (e.g. grasping objects).	<b>At 10 sessions (post-treatment):</b> (+) Stroke Impact Scale (SIS) – Activities of daily living (ADLs)* (-) SIS – Mobility (+) SIS – Hand function* (+) SIS – Strength* (+) SIS – Recovery* (+) SIS – Physical (+) SIS – Memory* (+) SIE – Emotion* (+) SIS – Communication* (-) Action Research Arm Test (ARAT) (+) ARAT – Impairment* (+) Delis-Kaplan Executive Function System Trail Making substest*

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			<p><b>At 3 months post-treatment (follow-up):</b>            (-) SIS – ADLs            (-) SIS – Mobility            (+) SIS – Hand function*            (-) SIS – Strength            (-) SIS – Recovery            (-) SIS – Physical            (-) SIS – Memory            (-) SIE – Emotion            (+) SIS – Communication*            (-) ARAT            (+) ARAT – Impairment*            (+) Delis-Kaplan Executive Function System Trail Making substest*            Note: Median and non-parametric effect sizes were reported given that outcome variables were not normally distributed.            * Medium to large effect sizes for the CO-OP approach over the control group.</p>
Zucchella et al., 2014 PEDro score: 7 Country: Italy	92 patients with acute stroke	Therapist-guided computer exercises (n=45) vs. Sham intervention (n=47)  <b>Treatment details:</b> 16 x 1-hour sessions over 4 weeks. Therapist-guided computer exercises consisted of training of time orientation, spatial orientation, visual attention,	<p><b>At 4 weeks (post-treatment):</b>            (+) Mini-Mental State Examination            (-) Digit Span            (-) Corsi's Test            (-) Rey Auditory Verbal Learning – immediate recall            (+) Rey Auditory Verbal Learning – delayed recall            (+) Logical Memory – immediate recall</p>

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		local reasoning, memory and executive functions. Each exercise had increasing level of difficulty. Sham intervention consisted of time with a psychologist discussing general topics, news and their recent activities.	(+) Logical Memory – delayed recall (-) Progressive Matrices 47 (-) Frontal Assessment Battery (+) Trail Making Test A (+) Trail Making Test B (+) Attentive Matrices (-) Phonological Fluency (-) Semantic Fluency (-) Rey-Osterrieth Figure Copy (-) Functional Independence Measure