CANADIAN STROKE BEST PRACTICE RECOMMENDATIONS

Rehabilitation, Recovery and Community Participation Following Stroke

Part Three: *Optimizing Activity and Community Participation following Stroke*

Evidence Tables

Cognitive Rehabilitation

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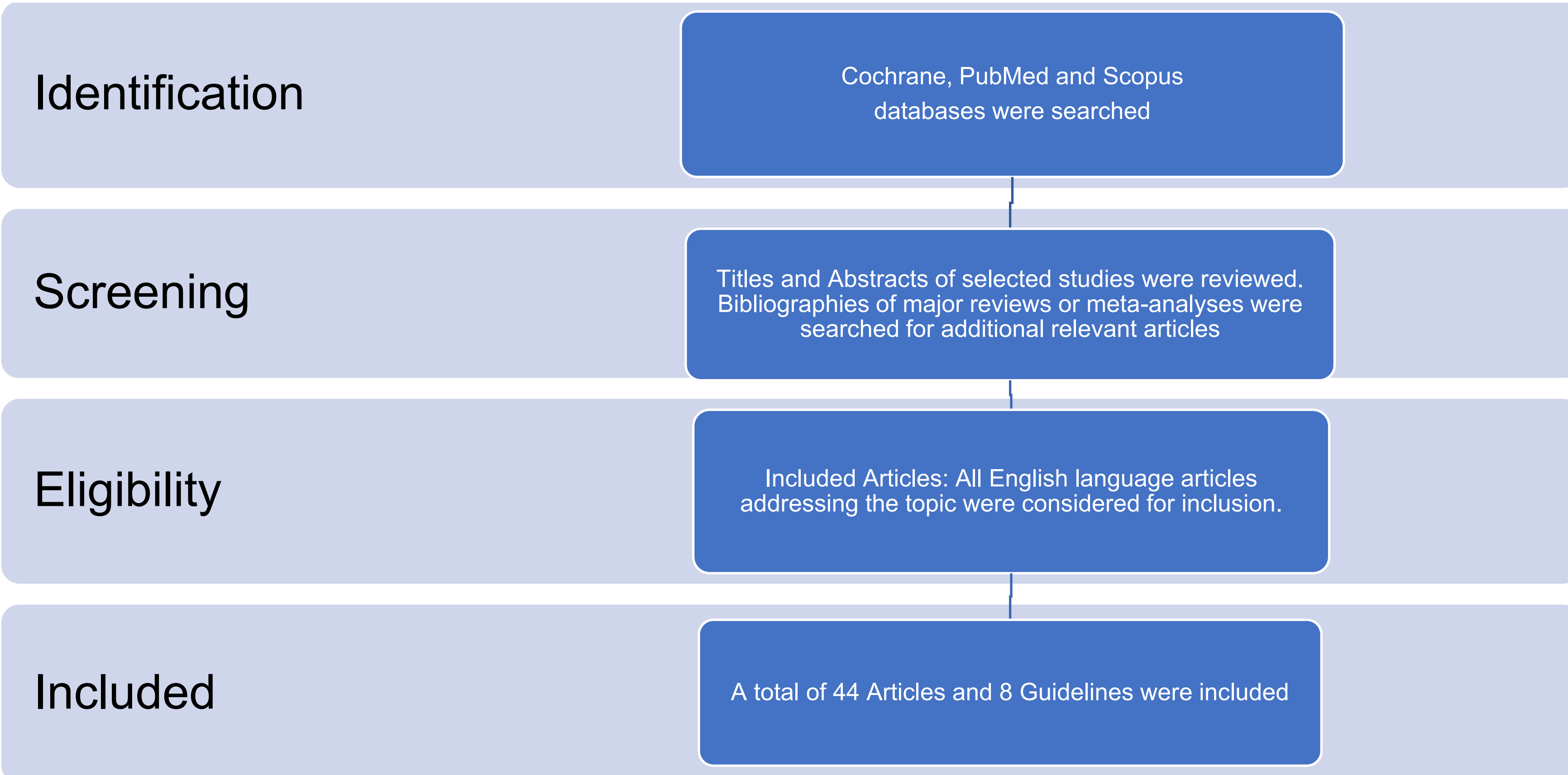
Search Strategy



Cochrane, PubMed and Scopus databases were searched using terms such as stroke AND vascular dementia OR dementia OR cognitive impairment OR small vessel disease AND rehabilitation. Titles and abstract of each article were reviewed for relevance. Bibliographies were reviewed to find additional relevant articles. A total of 8 guidelines and 44 articles were included and were separated into separate categories designed to answer specific questions.

Published Guidelines

Guideline	Recommendations
Management of Stroke Rehabilitation Working Group. VA/DoD clinical practice guideline for the management of stroke rehabilitation. Washington (DC): Veterans Health Administration, Department of Defense; Version 5.0 – 2024. **Available at:** https://www.healthquality.va.gov/guidelines/Rehab/stroke/	33. There is insufficient evidence to recommend for or against the use of selective serotonin reuptake inhibitors to improve cognitive outcomes. Neither for nor against 34. There is insufficient evidence to recommend for or against computer assisted cognitive rehabilitation to improve cognitive outcomes. Neither for nor against
National Clinical Guideline for Stroke for the UK and Ireland. London: Intercollegiate Stroke Working Party; 2023 May 4. **Available at: www.strokeguideline.org.** **(selected)**	**Cognitive Impairment (general)** People with cognitive problems after stroke should receive appropriate adjustments to their multidisciplinary treatments to enable them to participate, and this should be regularly reviewed. People with continuing cognitive difficulties after stroke should be considered for comprehensive interventions aimed at developing compensatory behaviours and learning adaptive skills. **Attention & Concentration** People with impaired attention after stroke should have cognitive demands reduced by: – having shorter treatment sessions; – taking planned rests; – reducing background distractions; – avoiding activities when tired. People with impaired attention after stroke should: – have the impairment explained to them, their family/carers and the multidisciplinary team; – be offered an attentional intervention (e.g. time pressure management, attention process training, environmental manipulation), ideally in the context of a clinical trial; – be given as many opportunities to practise their activities as reasonable under supervision. **Executive Functioning** People with an impairment of executive function and activity limitation after stroke should be trained in compensatory techniques, including internal strategies (e.g. self-awareness and goal setting), structured feedback on performance of functional tasks and external strategies (e.g. use of electronic reminders or written checklists). People with an executive disorder after stroke should have the impairment and the impact on function explained to them, their family/carers, and the multidisciplinary team. **Memory**

Guideline	Recommendations
	People with memory impairment after stroke causing difficulties with rehabilitation should: – have the impairment explained to them, their family/carers and the multidisciplinary team; – be assessed for treatable or contributing factors (e.g. delirium, hypothyroidism); – have their profile of impaired and preserved memory abilities determined, including the impact of other cognitive deficits e.g. attention; – have nursing and therapy sessions altered to capitalise on preserved abilities; – be trained in approaches that help them to encode, store and retrieve new information e.g. spaced retrieval (increasing time intervals between review of information) or deep encoding of material (emphasising semantic features); – be trained in compensatory techniques to reduce their prospective memory problems (e.g. use of electronic reminders or written checklists); – receive therapy in an environment as similar as possible to their usual environment.
Stroke Foundation. Clinical Guidelines for Stroke Management 2022. Melbourne Australia. Part 6: Managing Complications	Weak Recommendation For stroke survivors with cognitive impairment, meta-cognitive strategy and/or cognitive training may be provided. Consensus-based recommendation For stroke survivors with attentional impairments or those who appear easily distracted or unable to concentrate, a formal neuropsychological or cognitive assessment should be performed. Weak Recommendation For stroke survivors with attention and concentration deficits, cognitive rehabilitation may be used. Weak recommendation New For stroke survivors with attention and concentration deficits, exercise training and leisure activities may be provided. Practice statement Consensus-based recommendations New Stroke survivors with identified perceptual difficulties should have a formal perceptual (i.e. neurological and neuropsychological) assessment. Stroke survivors with an identified perceptual impairment and their carer should receive: • verbal and written information about the impairment; • an assessment and adaptation of their environment to reduce potential risk and promote independence; • practical advice/strategies to reduce risk (e.g. trips, falls, limb injury) and promote independence; • intervention to address the perceptual difficulties, ideally within the context of a clinical trial.
Quinn TJ, Richard E, Teuschl Y, Gattringer T, Hafdi M, O'Brien JT et al. **European Stroke Organisation and European Academy Neurology joint guidelines on post-stroke cognitive impairment.** ***Eur J Neurol.* 2021, Vol. 6(3) I–XXXVIII**	PICO question 15: In people with post-stroke cognitive impairments, does cognitive rehabilitation (cognitive skill training or compensation strategies), compared to no rehabilitation, delay cognitive decline or progression to dementia, improve behavioural and psychological symptoms, improve performance in ADL or decrease caregiver burden? Recommendation Due to a lack of methodologically robust trials, for most cognitive rehabilitation interventions, there is continued uncertainty on the benefits and limitations associated with these interventions for stroke survivors. Quality of evidence: Very low ⊕ Strength of recommendation: no recommendation Expert consensus statement Although many of the available studies did not meet our inclusion criteria for this PICO, there is emerging evidence that cognitive rehabilitation, particularly compensatory strategies in the context of individually relevant functional tasks, may be

Guideline	Recommendations
	beneficial for people with PSCIs. Methodologically robust trials to support definitive recommendations for clinical practice are needed.
Winstein CJ, Stein J, Arena R, Bates B, Cherney LR, Cramer SCet al; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Quality of Care and Outcomes Research. **Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association.** ***Stroke* 2016;47:e98–e169.**	Enriched environments to increase engagement with cognitive activities are recommended. Class I; LOE A Use of cognitive rehabilitation to improve attention, memory, visual neglect, and executive functioning is reasonable. Class IIa; LOE B Use of cognitive training strategies that consider practice, compensation, and adaptive techniques for increasing independence is reasonable. Class IIa: LOE B Compensatory strategies may be considered to improve memory functions, including the use of internalized strategies (eg, visual imagery, semantic organization, spaced practice) and external memory assistive technology (eg, notebooks, paging systems, computers, other prompting devices). Class IIb; LOE A Some type of specific memory training is reasonable such as promoting global processing in visual-spatial memory and constructing a semantic framework for language-based memory. Class IIb; LOE B Errorless learning techniques may be effective for individuals with severe memory impairments for learning specific skills or knowledge, although there is limited transfer to novel tasks or reduction in overall functional memory problems. Class IIb; LOE B Music therapy may be reasonable for improving verbal memory. Class IIb; LOE B Exercise may be considered as adjunctive therapy to improve cognition and memory after stroke. IIb C Virtual reality training may be considered for verbal, visual, and spatial learning, but its efficacy is not well established. Class IIb; LOE C Anodal tDCS over the left dorsolateral prefrontal cortex to improve language-based complex attention (working memory) remains experimental. Class III; LOE B
Cicerone KD, Goldin Y, Ganci K, Rosenbaum A, Wethe JV, Langenbahn DM et al. **Evidence-Based Cognitive Rehabilitation: Systematic Review of the Literature From 2009 Through 2014.** ***Arch Phys Med Rehabil* 2019 Aug; 100(8): 1515-1533.**	**Remediation of Attention** Treatment of attention deficits should incorporate both direct-attention training and metacognitive strategy training to increase task performance and promote generalization to daily functioning after TBI or stroke during the postacute stages of recovery. Level of recommendation: Practice Standard Direct-attention training for specific modular impairments in WM, including the use of computer-based interventions, should be considered to enhance both cognitive and functional outcomes during postacute rehabilitation for acquired brain injury. Level of recommendation: Practice Standard **Remediation of Visuospatial Deficits** Visuospatial rehabilitation that includes visual scanning training is recommended for left visual neglect after right-hemisphere

Guideline	Recommendations
	stroke. Level of recommendation: Practice Standard The use of isolated microcomputer exercises to treat left neglect after stroke does not appear effective and is not recommended. Level of recommendation: Practice Guideline Left-hand stimulation or forced limb activation may be combined with visual scanning training to increase the efficacy of treatment for neglect after right-hemisphere stroke. Level of recommendation: Practice Guideline Electronic technologies for visual scanning training may be included in the treatment of neglect after right-hemisphere stroke. Level of recommendation: Practice Option Systematic training of visuospatial deficits and visual organization skills may be considered for persons with visual perceptual deficits, without visual neglect, after right-hemisphere stroke as part of acute rehabilitation. Level of recommendation: Practice Option Specific gestural or strategy training is recommended for apraxia during acute rehabilitation for left hemisphere stroke. Level of recommendation: Practice Standard **Remediation of Memory Deficits** Memory strategy training if recommended for the improvement of PM in people with mild memory impairments after TBI or stroke, including the use of internalized strategies (eg, visual imagery, association techniques) and external memory compensations (eg, notebooks, electronic technologies). Level of recommendation: Practice Standard Memory strategy training if recommended for the improvement of recall in the performance of everyday tasks in people with mild memory impairments after TBI, including the use of internalized strategies (eg, visual imagery, association techniques) and external memory compensations (eg, notebooks). Level of recommendation: Practice Standard Use of external compensations with direct application to functional activities is recommended for people with severe memory deficits after TBI or stroke. Level of recommendation: Practice Guideline For people with severe memory impairments after TBI, errorless learning techniques may be effective for learning specific skills or knowledge, with limited transfer to novel tasks or reduction in overall functional memory problems. Level of recommendation: Practice Option Group-based interventions may be considered for remediation of mild to memory deficits after TBI or stroke, including the improvement of PM and recall of information used in the performance of everyday tasks. Level of recommendation: Practice Option **Remediation of Communication and Social Cognition** Cognitive-linguistic therapies are recommended during acute and postacute rehabilitation for language deficits secondary to left-hemisphere stroke. Level of recommendation: Practice Standard Specific interventions for functional communication deficits, including pragmatic conversational skills and recognition of emotions from facial expressions, are recommended for social-communication skills after TBI. Level of recommendation: Practice Standard Cognitive interventions for specific language impairments such as reading comprehension and language formulation are recommended after left-hemisphere stroke or TBI. Level of recommendation: Practice Guideline Treatment intensity should be considered a key factor in the rehabilitation of language skills after left hemisphere stroke. Level of recommendation: Practice Guideline Group-based interventions may be considered for remediation of language deficits after left-hemisphere stroke and for social-communication deficits after TBI. Level of recommendation: Practice Option Computer-based interventions as an adjunct to clinician-guided treatment may be considered in the remediation of cognitive-

Guideline	Recommendations
	linguistic deficits after left-hemisphere stroke or TBI. Sole reliance on repeated exposure and practice on computer-based tasks without some involvement and intervention by a therapist is not recommended. Level of recommendation: Practice Option **Recommendations for Treatment of Executive Function Deficits** Metacognitive strategy training (self-monitoring and self-regulation) is recommended for the treatment of mild-moderate deficits in executive functioning, including impairments of emotional self regulation, during postacute rehabilitation after TBI. Metacognitive strategy training may incorporate formal protocols for problem solving and goal management, and their application to everyday situations and functional activities, during postacute rehabilitation after TBI. Level of recommendation: Practice Standard Metacognitive strategy training should be incorporated into occupation-based treatment for practical goals and functional skills for patients with mild-moderate deficits in executive functioning after TBI and stroke. Level of recommendation: Practice Guideline Explicit (verbal-and-video) performance feedback should be considered as a formal component of metacognitive strategy training during postacute rehabilitation for individuals with impaired self awareness after TBI. Level of recommendation: Practice Guideline Group-based interventions may be considered for remediation of mild-moderate deficits in executive functioning (including deficits in awareness, problem solving, goal management and emotional regulation) during postacute rehabilitation after TBI. Level of recommendation: Practice Option For patients with severe cognitive (executive) deficits after stroke or TBI, including limitations of emergent awareness and independent use of compensatory strategies, the use of skill-specific training including errorless learning may be considered to promote performance of specifically trained functional tasks, with no expectation of transfer to untrained activities. Level of recommendation: Practice Option Metacognitive strategy training may be considered as a component of occupation-based treatment during acute rehabilitation to reduce functional disability for patients with cognitive impairment after stroke. Level of recommendation: Practice Option **Comprehensive-Holistic Neuropsychologic Rehabilitation** Comprehensive-holistic neuropsychological rehabilitation is recommended during postacute rehabilitation to reduce cognitive and functional disability for persons with TBI or stroke, regardless of severity or time postinjury. Level of recommendation: Practice Standard Multimodal, computer-assisted cognitive retraining with the involvement and direction of a rehabilitation therapist is recommended as a component of neurorehabilitation for the remediation of attention, memory, and executive function deficits following stroke or TBI. Computer-assisted cognitive retraining programs should stimulate the cognitive domains of interest, adjust task difficulty based on patient's level of performance, and provide feedback and objective performance data. Level of recommendation: Practice Guideline Integrated treatment of individualized cognitive and interpersonal therapies is recommended to improve functioning within the context of a comprehensive neuropsychological rehabilitation program, and facilitate the effectiveness of specific interventions. Such interventions should be goal directed and emphasize individualized client-centered goal setting to promote enhanced residential independence and occupational functioning. Level of recommendation: Practice Option Group-based interventions may be considered as part of comprehensive-holistic neuropsychological rehabilitation to improve functional awareness, strategy use, functional independence and psychological well-being after TBI or stroke. Level

Guideline	Recommendations
	of recommendation: Practice Option
Gorelick PB, Scuteri A, Black SE, Decarli C, Greenberg SM, Iadecola C, et al. **Vascular contributions to cognitive impairment and dementia: a statement for healthcare professionals from the American heart association/America stroke association.** ***Stroke* 2011;42:2672-2713.**	Only limited evidence exists to support non-pharmacological modalities for management of VCI. No formal recommendations for therapy are offered. More research with rigorous designs to study the effects of nonpharmacological interventions, including cognitive rehabilitation and acupuncture, is needed.
Cappa S, Benke T, Clarke S, Rossi B, Stemmer B, van Heugten C; Task Force on Cognitive Rehabilitation; European Federation of Neurological Societies. **EFNS guidelines on cognitive rehabilitation: Report of an EFNS task force.** ***Eur J Neurol* 2005;12:665–680.**	Memory strategies without electronic aids are possibly effective (Level C recommendation) Specific learning strategies such as errorless learning are probably effective (Level B recommendation) Nonelectronic external memory aids such as diary or notebook keeping are possibly effective (Level C recommendation) Electronic external memory devices such as computers, paging systems, and portable voice organizers are probably effective (Level B recommendation) The use of virtual environments has shown positive effects on verbal, visual, and spatial learning and that memory training in virtual environments is rated as possibly effective (Level C recommendation)

Evidence Tables

Cognitive Rehabilitation Following Stroke

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
General					
O'Donoghue et al. 2022 **Ireland** **Systematic review & meta-analysis**	Using the Cochrane Risk of Bias Tool, 34 trials had a high risk of bias in ≥1 domain	64 RCTs including 4,005 persons with/without cognitive impairment following ischemic or hemorrhagic stroke, in the acute (n=20), subacute (n=12), and chronic (n=18) stages. 14 trials did not provide data on stroke chronicity. Participants were recruited from acute inpatient units (n=24), inpatient rehabilitation units (n=15), outpatient clinics (n=18) and both inpatient and outpatient settings (n=7). Mean age was 62.5 years.	Trials compared cognitive rehabilitation strategies to improve cognitive function with a control group (usual care, active control, waitlist, or no treatment). Among the included trials, 21 were multiple component interventions, 16 were cognitive rehabilitation interventions, 11 were physical activity interventions, 6 were non-invasive brain stimulation (NIBS), 5 were occupational-based interventions, and 5 were other interventions (acupuncture, prism adaptation, TENS, music therapy).	**Primary outcome:** Change in cognitive outcome measures after treatment (general cognition, memory) **Secondary outcomes:** Functional status, depression, QoL, balance	Data from 42 trials were available for pooling. *Multiple component intervention vs. standard care* Pooling data from 3 trials, in persons with stroke ≤3 months previously, the mean MoCA score, (indicator of general cognition) was significantly higher in the intervention group (MD=1.56, 95% CI, 0.69 to 2.43). Pooling data from 4 trials, measures of memory (including the letter-number sequencing test, and the Digital Span), were improved significantly in the intervention group (SMD=0.49, 95% CI, 0.27 to 0.72). Pooling data from 4 trials, measures of functional status (BI and FIM) memory were improved significantly in the intervention group (SMD= 0.33, 95% CI, 0.05–0.62). *Cognitive Rehabilitation Interventions vs. standard care* Pooling data from an unknown number of trials, there were no significant differences between groups in measures of general cognition, memory, executive function, or QoL. There were no significant differences between groups comparing cognitive rehabilitation interventions vs an active control in any of the outcomes assessed (general cognitive functioning, memory, executive function, or attention, nor was there a difference between groups comparing cognitive rehabilitation

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					interventions vs. wait list control (memory) *Physical activity interventions vs. active control* Pooling the results from 2 trials, including patients <3 months post stroke, measures of memory (Star Cancellation Test) were improved significantly in the intervention group (MD= 13.99, 95% CI, 12.67 to 15.32). Berg Balance Scale scores were also significantly higher in the intervention group (MD=2.97, 95% CI 0.71–5.23). *NIBS vs. active control* Pooling the results from 3 trials, measures of neglect (line bisection test) were significantly better in the rTMS group (MD=20.79, 95% CI 14.53– 27.04). Measures of functional status (mBI and Korean mBI) were also significantly higher in the rTMS group (MD=14.02, 95% CI, 8.41–19.62). *Occupational-based interventions vs. standard care* Pooling data from an unknown number of trials, there were no significant differences between groups in measures of general cognition (MD= 0.45, 95% CI −1.33 to 2.23) or functional status (SMD=0.31, 95% CI −0.03 to 0.65). Pooling the results from 2 trials, prism therapy did not improve neglect compared with an active control (SMD=0.40, 95% CI −0.06 to 0.85).
Saa et al. 2021 **Australia** **Meta-analysis & meta-regression**	Using the *Study Quality Assessment Using the Tools of the National Institutes of Health and*	43 intervention trials (RCT and non RCT) and 79 observation studies (prospective/retrospective cohort) including 28,222 persons recovering from ischemic or hemorrhagic stroke, in which cognitive	Effect sizes for short-term and long-term cognitive recovery were estimated, based on factors that moderate changes over time (eg., age intervention type).	**Primary outcome:** Effect size (Hedge's *g*) for cognitive recovery	Across all moderators including intervention (y/n), intervention type, study quality, recovery stage, cognitive domain, stroke etiology and age, the overall effect size for recovery across all studies was small (*g* = 0.35, CI 0.29-0.42). Effect sizes were greatest for recovery within 61-180 days (*g*=0.43), compared with 1-61 days

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	National Heart, Lung and Blood Institute, 47 studies were rated as good quality, 50 were of fair quality and 25 were of poor quality.	outcomes were reported.			(g=0.36) and 181-729 days (g=0.38). Effect sizes were larger in the intervention studies. The effect size for recovery was greatest among intervention studies compared with observational studies (*g*=0.47 vs. 0.28). Among intervention studies, the effect sizes were 0.57 for nonroutine/alternative intervention studies, 0.52 for pharmacological studies, 0.46 for therapist-led studies, and 0.28 for usual care studies. When assessing the interaction between chronicity of stroke and therapy type, the largest effect sizes were for nonroutine therapy provided at 1-60 days (*g*=0.89) and at 61-180 days (*g*=0.82), pharmacological interventions provided at 61-180 and 181-729 days (*g*=0.7) and therapist-led interventions provided at 61-180 days (*g*=0.7). The effect sizes for different cognitive domains used to assess overall cognitive recovery were small (ranging from 0.53 [praxis] to 0.40 [consciousness] and were higher in intervention studies. Effect sizes for cognitive recovery were highest for persons aged 65 to 70 years (*g* = 0.43). Effect sizes were higher for all age groups (<65; 65-70; >70-81 years) in intervention studies
Rogers et al. 2018 **Australia** **Systematic review & meta-analysis**	Mean PEDro score was 7.8.	22 RCTs including 1,098 persons with cognitive deficits following stroke. Mean age was 62 years (range 48–78 years). The average time post stroke ranged from 3 days to 6.7 years. 10 studies were conducted	Trials compared cognitive remediation (CR) strategies vs. treatment as usual, placebo, or a waitlist control. Non-inferiority trials were excluded. Types of interventions included computer training (n=8), therapist led	**Primary outcome:** Cognitive outcomes assessed at the impairment level	CR was associated with a small overall effect (Hedge's *g*=0.48, 95% CI 0.35–0.60). Where outcomes were assessed at the end of the intervention, effect sizes were higher in trials that provided interventions earlier following stroke, and trials that provided an intervention for a longer duration. Lower-quality trials were associated with higher effect sizes. Factors that were not effect size moderators included

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
		during the sub-acute stage (≤ 3 months) and 12 studies were conducted during the chronic stage (> 3 months).	interventions (n=7), pen/paper or workbook (n=3), and group therapy (n=4). Cognitive domains targeted in the intervention were memory (n=3), language (n=6), attention (n=4), visuo-spatial (n=4), general function (n=2), executive function (n=2), and processing speed (n=1) Mean frequency of therapy provided was 3.5 sessions per week (range: 1-6), mean duration of a session was 63 minutes (range: 15 minutes-2.5 hours) and mean duration was 8 weeks (range: 2-26 weeks).		generalizability to trained or untrained processes, control group type, remediation approach, and intervention frequency. In 9 trials, outcomes were assessed at follow-up (ranging from 2 weeks to 12 months), the effect size on cognitive outcomes was lower and remained small (*g*=0.27, 95% CI 0.04–0.51). Variations in study quality, frequency, duration, recovery stage, remediation type, control group, or generalizability to trained or untrained processes were not found to be effect size moderators. *Domain specific outcomes at the end of the intervention (Hedge's g, 95% CI)* Attention: 0.40, 0.55-0.59 (10 trials) Language: 0.66, 0.35-0.96 (8 trials) Memory: 0.47, 0.03-0.92 (5 trials) Visio-spatial: 0.75, 0.18-1.31 (4 trials) Processing speed: 0.37, 0.06-0.68 (3 trials) Executive function: 0.47, 0.21-0.73 (6 trials)
Feng et al. 2017 **China** **RCT**	CA: ☒ Blinding: Patient ☒ Assessor ☒ ITT: ☒	80 patients with first-ever stroke with vascular cognitive impairment with no dementia, who were admitted to hospital. Mean age was 66 years, 57% were men.	Participants were randomized 1:1 to receive a 12-week systematic cognitive training program (30 minutes, 2x per day), with training gradually becoming more difficult or to a control group that received standard rehabilitation. When the patients were discharged from the hospital, the cognitive training was performed by a trained and eligible family caregiver. The cognitive training program also included 3	**Primary outcomes:** Rey-Osterrieth Complex Graphics Test (CFT), Clock Drawing Test (CDT), Logic Memory Test (LMT), Auditory Verbal Learning Test (AVLT), Stroop Color-Word Test (SCWT), Trail Making Test (TMT), Verbal Fluency Test (VFT), Digit Span Test, Picture-Naming Test Assessments were completed 3 months prior to the intervention and at	There were 4 dropouts in the intervention group and 3 in the control group. Mean change scores from baseline were significantly greater among persons in the intervention group for all outcomes assessed, except for the SCWT.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
			months of telephone follow-up, provided every 2 weeks. Specific content included training of attention, memory, orientation, visual spatial perception and retelling and naming training.	the end of the intervention.	
Attention Deficits					
Loetscher et al. 2019 **Australia** **Cochrane Review**	All trials were at low risk of attrition and reporting biases. 50% of trials were at unclear risk of selection bias; 100% of trials were at unclear risk of performance bias and 50% of trials were at unclear/high risk of detection bias.	6 RCTs (n=223), including patients with attentional deficits following stroke. Trials that included >25% of participants with conditions other than stroke were excluded unless subgroup analyses were reported. The sample sizes ranged from 18-78. Timing of recruitment from stroke onset to study entry varied from within 3-4 months up to 4 years.	Trials compared cognitive rehabilitation to usual care. Interventions aimed to either restore attentional functions (n=5), provided compensatory strategies (n=1) or both (n=1) and were provided for 3-11 weeks.	**Primary outcome**: Subjective and objective measures of global attention **Secondary outcomes**: Objective reports of domains of attention	At the end of the treatment period, cognitive rehabilitation was not associated with significantly greater improvement in measures of subjective reports of global attention (SMD=0.53, 95% CI -0.03 to 1.08, p=0.06). Results from 2 trials included. Cognitive rehabilitation was not associated with significant long-term effects (>3 months following the end of treatment) on global attention functions (SMD= 0.16, 95% CI -0.23 to 0.56, p=0.41. Results from 2 trials included. No studies reporting objective measures of global attention, either immediately after treatment, or long-term. Cognitive rehabilitation was associated with significantly greater improvement on divided attention, measured using the Paced Auditory Serial Addition Test (SMD= 0.67, 95% CI 0.35 to 0.98, p<0.001). Results from 4 trials included. There were no significant effects on other domains of attention associated with cognitive rehabilitation.
Barker-Collo et al. 2009 **New Zealand** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor☑	78 patients admitted to hospital within 2 weeks of incident stroke with attention deficits identified through neuro-psychological assessment. Patient with	Participants were randomized to receive standard care plus Attention Process Training (APT; n=38) or standard care (n=40). APT is a	**Primary outcome:** The Integrated Visual Auditory Continuous Performance Test (IVA-CPT) Full-Scale Attention Quotient (FSAQ).	Participants in the ATP group demonstrated significantly greater improvement on the IVA-CPT FSAQ at both the 5-week (Mean difference in change = 2.76, 95% CI 1.31 to 4.21, p<0.001) and 6-month follow-up (mean difference in change = 2.49, 95% CI 1.24 to 3.74, p<0.001).

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
	ITT: ☑	severe cognitive impairment (MMSE<20) and medical instability, were excluded. Mean age was 69 years, 60% were male. 23.4% of those screened for eligibility were included in the study.	hierarchical, multilevel intervention that focuses on sustained, selective, alternating, and divided attention. APT was administered by clinical neuropsychologists for a maximum of 30 hours provided in hour sessions over 4 weeks.	**Secondary outcomes:** IVA-CPT Auditory attention and IVA-CPT visual attention	Participants in the ATP group demonstrated significantly greater improvement on the IVA-CPT (Auditory attention) at 5-weeks (p=0.011), but not 6 months (p=0.208). There were no significant differences in change scores between groups at either 5 weeks or 6 months, for IVA-CPT (Visual attention).
Winkens et al. 2009 **The Netherlands** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor☑ ITT: ☒	37 patients ≥18 years, referred for cognitive rehabilitation for mental slowness following a stroke, onset of at least 3 months. Patients were recruited as both inpatients and outpatients. Mean age was 52 years, 57% male. Mean time since stroke was 19.3 months (intervention) and 6.9 months (control group).	Patients were randomized to a Time Pressure Management (TPM) group (n=20) or a usual care group (n=17). Persons in the intervention group received 10 hours of treatment teaching patients a strategy to compensate for mental slowness in real-life tasks. Teaching was conducted in three stages and focused on preventative and management strategies	**Primary outcomes:** Attention outcomes included Information Intake Task, Mental Slowness Observation Test, Mental Slowness Questionnaire, Paced Auditory Serial Addition Test (PASAT), simple reaction time, Symbol Digit Modalities Test, and Trail Making Test parts A and B. Outcomes were assessed at baseline, at the end of treatment (at 5–10wk), and at 3 months**.**	At the end of treatment, the mean Information intake task (no. of used strategies) was significantly higher from baseline, for the TPM group (0.4 vs. -0.3, p=0.03). There were no other significant differences between groups. At the end of treatment, there was significant improvement in mean Mental Slowness Observation Test (time in seconds) in both groups, but no significant differences between groups (p=0.20). At follow-up, the mean Mental Slowness Observation Test (time in seconds) was significant better from baseline, for the TPM group (p=0.01). There were no other significant differences between groups There were 2 losses to follow-up in TPM group and 1 in the usual care group.
Westerberg et al. 2007 **Sweden** **RCT (pilot)**	CA: ☑ Blinding: Patient ☒ Assessor☒ ITT: ☒	21 stroke patients, aged 30-65 years, residing in the community an average of 20 months post stroke, with self-reported attention deficits. Mean age 54 years, 71% were male.	Participants were randomized 12-36 months post-stroke to receive computerized working memory training (n=11) or control (n=10). Participants completed training at home using the RoboMemo® software program in 40-minute	**Primary outcome:** A neuropsychological test battery (including the Stroop test, Claeson-Dahl, span board, digit span, RUFF 2&7, PASAT, and delayed recall) and the Cognitive Failure Questionnaire (CFQ).	At the end of treatment, participants who received computerized working memory training demonstrated significantly greater improvement in the CFQ scores (Mean 43.0 vs. 29.2, p<0.005), span board (mean 6.2 vs. 5.7, p=0.05), digit span (mean 7.3 vs. 5.7, p=0.005), PASAT (mean 53.6 vs. 47.0, p<0.001) and RUFF 2 & 7 (mean 130.3 sec vs. 112.7 sec, p=0.005).

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
			sessions, five days per week, for a total of five weeks.		Lost to follow-up: intervention group=18% (n=2), control=10% (n=1).
Memory Deficits					
das Nair & Lincoln 2016 **UK** **Cochrane Review**	100% of trials were at high risk of performance bias, 25% at high risk of detection bias, and 15% were at high risk of reporting bias. All trials were at low or unclear risk of selection bias, attrition bias and other biases.	13 RCTs (n=514) including participants with memory problems following stroke. Trials that included >25% of participants with conditions other than stroke were excluded unless subgroup analyses were reported. Sample sizes ranged from 4-153. Mean age ranged from 31-68 years. Mean time since stroke ranged from <1 month to 91 months.	Trials compared various memory rehabilitation strategies, with a control group that received either an alternative form of treatment or no memory intervention. Interventions included computerized memory training (n=5), strategy training (n=2), the use of external memory aides (n=2), imagery mnemonics (n=1). Duration of treatment ranged from 2-10 weeks.	**Primary outcome**: Subjective memory reports **Secondary outcomes**: Objective memory reports	Short-term effects (i.e., assessed immediately following the intervention): Memory training was associated with significant improvements in *subjective* memory measures (SMD= 0.36, 95% CI 0.08-0.64, p=0.01). Results from 7 trials included. Long-Term effects (3-7 months following treatment): Memory training was not associated with significant improvements in *subjective* memory measures (SMD= 0.31, 95% CI -0.02-0.64, p=0.063). Results from 3 trials included. Short-term effects (i.e., assessed immediately following the intervention): Memory training was not associated with significant improvements in *objective* memory measures (SMD= 0.25, 95% CI -0.36 to 0.86, p=0.43). Results from 10 trials included. Long-Term effects (3-7 months following treatment): Memory training was not associated with significant improvements in *subjective* memory measures (SMD= -0.17, 95% CI -0.74-0.41, p=0.57). Results from 3 trials included.
Aben et al. 2013, 2014 **The Netherlands** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor☑ ITT: ☑	153 participants, aged 18-80 years, living independently at least 18 months following stroke, with reported subjective memory complaints years. Mean age 58 years, 55% male. Mean time post-stroke was 53.9 months.	Participants were randomly allocated to either Memory Self-Efficacy (MSE) training program (n=77) or active control group (n=76). MSE - 9 twice-weekly group sessions of 1 hour, with ~30 minutes of homework per session. Training consisted of	**Primary outcomes:** MSE - Metamemory-In-Adulthood questionnaire (MIA) - validated for Dutch. Measures subjective memory experiences in daily living. Memory capacity - Dutch version of Auditory Verbal Learning Test (AVLT) and parallel versions	**Immediate outcomes (2013)** At the end of treatment, improvement of MSE was significantly greater in the MSE training group (p=0.019). There were no significant differences between groups in mean change scores from baseline to end of treatment for AVLT (p=0.802) or RBMT (p=0.378). **Long-term outcomes (2014)** Improvements in MSE among participants in the

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
			discussions about general information regarding memory and stroke, training in internal and external memory strategies, psycho-education on influence of beliefs and anxiety on memory performance, and realistic goal setting for memory tasks. Control - 9 twice-weekly group sessions of 1 hour, no homework. The control group participated in a peer support group and learned general information about the causes and consequences of stroke. Patients were assessed within 3 weeks prior to intervention, and within 10 days following intervention.	(before/after) of Story Recall from Rivermead Behavioural Memory Test (RBMT). Specifically used delayed recall for both measures as outcomes.	training group remained significantly greater compared with control group at both 6 and 12 months after the intervention. 15% of the patients in the training group improved by ≥ 1 standard deviation on the MSE scale vs. 4% in the control group.
das Nair and Lincoln 2012 **UK** **RCT** ***Rehabilitation of Memory in Neurological Disabilities (ReMiND)***	CA: ☑ Blinding: Patient ☒ Assessor☑ ITT: ☑	72 patients ≥18 years, with reported memory problems due to a traumatic brain injury (n=16), stroke (n=17) or multiple sclerosis (n=39). Mean age was 48 years, 44% male. Mean time since stroke onset was 73 months. 50.7% of those screened for eligibility were included in the study.	Participants were randomized to one of three study arms: Compensation (n=24), Restitution (n=24), and Self-help (n=24). Each study arm consisted of 10, 1.5-hour sessions administered by research assistants. The use of internal memory aids and errorless learning techniques were taught in both memory programmes. The compensation program additionally taught	**Primary outcome**: The Everyday Memory Questionnaire (EMQ). **Secondary outcomes**: Rivermead Behavioural Memory Test-Extended version (RBMT), General Health Questionnaire-12 (GHQ), and the Nottingham Extended Activities of Daily Living Scale (NEADLS).	No significant between group differences were reported with respect to the primary outcome at either 5 or 7 months. Mean EMQ scores at 5 months were 37.1 (compensation), 42.6 (restitution) and 45.5 (self-help). Mean EMQ scores at 5 months were 36.6 (compensation), 41.0 (restitution) and 44.1 (self-help) Participants in both the compensation and restitution study arms used significantly more internal memory aides than did those in the self-

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			external memory aides whereas the restitution program additionally included encoding and retrieval exercises. The self-help program consisted of relaxation training with no memory training.		help group ($p<0.05$). The groups did not differ significantly on measures of mood, adjustment, or activities of daily living. Lost to follow-up: Compensation=16.7%, Restitution=4.2%, Self-help=4.2%.
Westerberg et al. 2007 **Sweden** **RCT (pilot)**	CA: ☑ Blinding: Patient ☒ Assessor☒ ITT: ☒	21 stroke patients, aged 30-65 years, residing in the community an average of 20 months post stroke, with self-reported attention deficits. Mean age 54 years, 71% were male. (Trial was included in Cochrane review of executive function)	Participants were randomized to receive computerized working memory training (n=11) or control (n=10). Participants completed training at home using the RoboMemo® software program in 40-minute sessions, five days per week, for a total of five weeks.	**Primary outcome:** Subjective memory outcome was the Cognitive Failure Questionnaire (CFQ).	At the end of treatment, participants who received computerized working memory training demonstrated significantly more improvement in the CFQ scores (Mean 43.0 vs. 29.2, $p<0.005$, effect size 0.80). Lost to follow-up: intervention group=18% (n=2), control=10% (n=1).
Executive Functioning and Problem Solving					
Fishman et al. 2021 **Canada** **RCT**	CA: ☑ Blinding: Patient ☑ Assessor ? ITT: ☑	72 persons with chronic stroke (≥3 months) who were attending a secondary stroke prevention clinic. Mean age was 68 years, 69% were men. Baseline general cognitive status was not reported, but patients with aphasia or dementia were excluded.	Participants were randomized 1:1 to receive a single 60-minute session using goal-setting instructions or standard instructions. In the goal setting group participants were asked to improve their performance on each task by 20%.	**Primary outcomes:** Executive function **Secondary outcomes:** Attention and working memory	There was significant improvement in measures of verbal executive function in the goal setting group after the intervention, compared with the standard instructions group, after adjusting for age and education. There were also significant improvements in measures of attention/working memory and verbal learning in the goal-setting group.
Rozental-Iluz et al. 2016 **Israel** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor☑ ITT: ☑	39 participants who had a stroke ≥6 six months prior to the study, could walk 10-meters with or without assistance, and with executive dysfunction. Mean age was 60 years, 59% male. Mean time since stroke was 3.5 years.	Secondary analysis from Virtual Reality for Stroke Rehabilitation Trial, in which participants were randomized to an interactive video-game group intervention (n=20) or a traditional group intervention for motor	**Primary outcomes:** The Executive Function Performance Test (EFPT) (Bill payment sub score), Executive Function Route-finding Task (EFRT), Trail-Making Test Part B (TMT-B).	Mean EFRT scores at baseline, post-intervention and at follow-up were: Intervention group: 3.3, 3.6 and 3.4 Control: group: 3.4, 3.3, and 3.7 There were no significant differences between groups Mean EFPT scores at baseline, post-intervention and at follow-up were:

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
			recovery (n=19). The intervention included two, 1-hour group sessions per week for 3 months, either playing videogames or performing traditional exercises/activities.	Assessments were completed at baseline, after the intervention and at 3 months.	Intervention group: 5.7, 3.9 and 2.8 Control: group: 7.2, 5.0 and 5.0 There were no significant differences between groups. Mean TBT-B time (sec) at baseline, post-intervention and at follow-up were: Intervention group: 145.2, 130.8 and 116.9 Control: group: 178.8,187.5 and 165.7 There were no significant differences between groups. There were 3 losses to follow-up in each group
Poulin et al. 2017 **Canada** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor☑ ITT: ☑	9 persons who had a stroke within the previous 12 months with executive function deficits. Mean age was 53 years, 78% were men. MMSE scores at baseline ranged from 24-30.	Participants were randomized to receive 16 hours of occupation-based strategy training using an adapted version of the Cognitive Orientation to daily Occupational Performance (CO-OP) approach or to computer based executive function training. Sessions were provided 2x/week (60 minutes each) for 8 weeks.	**Primary outcome:** Canadian Occupational Performance Measure (COPM**)** **Secondary outcomes:** Trail Making Test (TMT) A and B, Colour-Word Interference Test (CMIT), Digit Span, satisfaction with treatment Assessments were conducted at baseline, post intervention and one-month follow-up	At post-intervention and follow-up assessments, all participants were very satisfied with the interventions, except for one participant in each group who indicated they were 'neither satisfied nor dissatisfied'. Both treatment groups showed large improvements in self and significant other-rated performance and satisfaction with performance on their goals immediately post-intervention and at follow-up (CO-OP: effect sizes (ES) ranged from 1.6–3.5 vs. computer 0.9–4.0). Within group differences were significant for the CO-OP group only. The COMPUTER group also showed large improvements in some areas of EF impairment targeted by the computerized tasks (ES= 0.9–1.6); the CO-OP group demonstrated large improvements in self-efficacy for performing everyday activities (ES =1.5)
Chung et al. 2013 **UK** **Cochrane Review**	4 trials described adequate mechanisms to ensure concealed allocation	19 RCTs (n=907) including participants ≥16 years, with stroke (n=304) or other non-progressive acquired brain injuries.	Trails examined strategies restoring components of executive function. 13 interventions were described; 7 restorative (self-awareness training, intensive	**Primary outcome**: Measures of global executive function, such as the Behavioural Assessment of Dysexecutive Syndrome (BADS) and the Hayling	*Cognitive rehabilitation vs. standard care*: None of the included trials reported the primary outcome. On the basis of a single RCT (n=86), results significantly favoured cognitive rehabilitation compared to sensorimotor therapy in terms of concept formation (MD= 0.43, 95% CI -0.76 to -0.10) and ADLs (MD=28.3, 95% CI

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
	(unclear in the remaining trials); one trial was at high risk of bias for failure to blind the outcome assessor and 4 trials were at high risk for incomplete outcome data reporting.		neurorehabilitation, neurorehabilitation including cognitive remediation problem-solving/goal management training, autobiographical memory cueing, working memory training, and verbal feedback), 5 compensative interventions (intensive neurorehabilitation, standard neurorehabilitation, video-feedback, verbalization, chunking and pacing and directive feedback). There were no trials of adaptive interventions. Control groups included no intervention, standard care and alternative forms of cognitive therapy)	and Brixton Tests. **Secondary outcomes**: Measures of components of executive function, functional ability in ADLs and extended ADLs, and quality of life.	-33.50 to -23.06). *Cognitive rehabilitation vs. placebo/no treatment:* 4 RCTs (n=184) were included in the meta-analyses. None of the included trials reported the primary outcome. No significant treatment effects were reported with respect to concept formation, planning, flexibility, working memory, or extended ADLs. *Comparison of two types of cognitive rehabilitation:* 2 RCTs (n=82) reported measures of global executive function: no significant treatment effects were reported (SMD= -0.41, 95% CI -0.85 to 0.03). On the basis of 8 RCTs (n=404), no significant treatment effects were reported for any of the secondary outcomes.
Poulin et al. 2012 **Canada** **Systematic Review**	NA	10 studies (2 RCTs) including 186 persons recovering from stroke or mixed etiology (if stroke comprised >50% of sample) experiencing executive function deficits.	Studies examined cognitive rehabilitation strategies to remediate executive function impairments or to improve functional tasks compromised by impairments in executive function, compared to alternative or no treatment. Results were summarized according to stage of recovery and intervention type.	**Primary outcome:** Measures of some aspect of executive functioning, assessed through neuropsychological or psychological tests or performance of daily activities.	No studies were identified that examined cognitive rehabilitation for executive function during the acute stage of care. In the sub-acute stage of stroke, results from a single pre-post study (n=18) provided limited evidence that computerized dual-task training is associated with significant improvement in executive functioning, compared to no treatment (p<0.05). 9 studies (n=186) examined an intervention during the chronic phase of care. The authors concluded that there is limited evidence to suggest that paging systems are associated with significant improvement in performance on functional tasks that involve executive control, compared to no treatment (p<0.05).

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Westerberg et al. 2007 **Sweden** **RCT (pilot)**	CA: ☑ Blinding: Patient ☒ Assessor☒ ITT: ☒	21 stroke patients, aged 30-65 years, residing in the community an average of 20 months post stroke, with self-reported attention deficits. Mean age 54 years, 71% were male.	Participants were randomized to receive computerized working memory training (n=11) or control (n=10). Participants completed training at home using the RoboMemo® software program in 40-minute sessions, five days per week, for a total of five weeks.	**Primary outcome:** A neuropsychological test battery, including the Stroop test, Claeson-Dahl, span board, digit span, RUFF 2&7, PASAT, and delayed recall) and the Cognitive Failure Questionnaire (CFQ).	At the end of treatment, participants who received computerized working memory training demonstrated significantly more improvement in the CFQ scores (Mean 43.0 vs. 29.2, p<0.005), span board (mean 6.2 vs. 5.7, p=0.05), digit span (mean 7.3 vs. 5.7, p=0.005), PASAT (mean 53.6 vs. 47.0, p<0.001) and RUFF 2 & 7 (mean 130.3 sec vs. 112.7 sec, p=0.005). There was no significant difference between groups in mean Stroop raw scores (99.1 vs. 97.8, p<0.05) Lost to follow-up: intervention group=18% (n=2), control=10% (n=1).

Physical Activity

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Liu-Ambrose et al. 2022 **Canada** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor ☑ ITT: ☑	120 participants, ≥55 years, living in the community with chronic stroke (>12 months) who were able to walk 6 meters, without dementia and a baseline MMSE of ≥20. Mean age was 70 years, 62% were men. Mean MoCA score was 22.	Participants were randomized to receive twice-weekly supervised 60-minute classes of a multicomponent exercise program (n=34) or ENRICH, a program of cognitive and social enrichment activities (n=34) or a balance and tone (BAT) group (n=52) that comprised the control group, for 6 months	**Primary outcomes:** ADAS-Cog-Plus, which included the 13-item ADAS-CogTrail Making Test Parts A and B, Digit Span Forward and Backward, Animal Fluency, and Vegetable Fluency **Secondary outcomes:** 13-item Alzheimer Disease Assessment Scale-Cognitive, Stroop Interference Ratio, Instrumental Activities of Daily Living, Short Physical Performance Battery, gait speed, and 6-Minute Walk Test (6MWT)	17 patients withdrew during the 6-month intervention and another 7 during the 6-month follow-up. At the end of treatment, participants in the exercise group had significantly better ADASCog-Plus performance compared with the BAT group (estimated MD=−0.24, 95% CI−0.43 to −0.04; p= 0.02), but did not at 6 months follow-up (estimated MD= −0.08; 95% CI −0.29 to 0.12). There were no differences in ADAS-Cog-Plus performance between the ENRICH group and the BAT group at the end of the intervention (estimated MD= −0.11, 95% CI −0.30 to 0.09) or at the end of the 6-month follow-up (estimated MD= −0.08, 95% CI −0.28 to 0.12). There were no significant differences in mean scores between groups for the comparisons of exercise vs. BAT or ENRICH vs. BAT, with a few exceptions. At the end of the treatment period, persons in exercise group had significantly greater improvement in the 13-item Alzheimer Disease Assessment Scale-Cognitive scores compared with the BAT group (estimated MD=−2.44, 95% CI -4.36 to −0.52) and persons in the BAT group performed significantly better on the 6MWT compared with the ENRICH group (estimated MD=−25.70 meters, 95% CI −50.70 to −0.73 meters, p= 0.04). At the end of 6-month follow-up, there were no significant mean differences in change scores for any of the secondary outcomes (exercise vs. BAT or ENRICH vs. BAT) There were 42 adverse events, 19 in the

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
					exercise group, 2 in the ENRICH group, and 21 in the BAT group.
Oberlin et al. 2017 **Australia** **Systematic review**	NA	14 RCTs including 736 persons ≥18 years, recovering from ischemic or hemorrhagic stroke. Mean age was 62.5 years, 59% were men. Mean time from stroke onset was 1.9 years. In 7 trials persons with dementia or significant cognitive impairment, were excluded. In 3 trials persons with mild cognitive impairment were included. Baseline cognitive status was not reported in the other 4 trials.	Trials compared a control condition vs. an experimental condition that included a component that aimed to increase physical activity (PA) through aerobic exercise, resistance training, or physiotherapy), and which had a duration of training >4 weeks. The experimental condition in 5 trials involved stretching and toning/physiotherapy, 3 trials consisted only of aerobic exercise training, and 6 trials included a combined PA training program (aerobic exercise + stretching.	**Primary outcome:** Pooled analyses of validated neuropsychological test of cognition, assessed from pre- to -postintervention	Using the results from all 14 studies, PA was associated with a small to moderate mean effect size (Hedges' g =0.304, 95% CI 0.14–0.47, p<0.001). In subgroup analysis, statistically significant effect sizes were observed for chronic stroke (> 3 months), combined PA and stretching/toning programs and for attention/processing speed domains of outcome measures.
Tang et al. 2016 **Canada** **RCT (secondary analysis)**	CA: ☑ Blinding: Patient ☒ Assessor ☑ ITT: ☒	50 adults aged 50-80 years, living in the community > one-year post stroke. Mean age was 65 years, 42% were men. Mean MoCA score at baseline was 25/26	Participants were randomized into a high-intensity aerobic exercise (AE) or low-intensity non-aerobic balance/ flexibility (B/F) program lasting 6 months. 60-minute sessions were provided 3 x/week.	**Primary outcomes:** The Verbal Digit Span (forwards/backwards), Trail Making Part B, and Stroop Test Assessments were conducted at baseline and post intervention	There were 3 losses to follow-up in the AE group. Class attendance was 81.4% and 80% for the BF and AE groups, respectively. There were no significant differences between groups in change scores over time for any of the outcomes. There was significant improvement over time for the outcome of Verbal Digit Span (forward), but not for any of the other outcomes. There was no correlation between pre-exercise cognitive function and post-exercise improvement.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Cumming et al. 2012 **Australia** **Systematic Review**	Among the 10 RCTs, CA was conducted 5, and not reported in 5; outcome assessors were blinded in 7 trials, and reasons for dropouts were not reported in 2 trials.	12 RCTs and controlled clinical trials (n=907) including persons recovering from stroke. Studies with mixed population were included provided that stroke represented at least one-third of the sample. Cognitive status (impaired vs. intact of participants at admission not reported)	Trials examined the effect of exercise or physical activity on cognition. Trials compared different levels and intensities of movement rehabilitation with a standard care or no treatment control group (n=5), 6 vs. 7 days a week of inpatient rehabilitation (n=1), and a specific exercise program with a placebo treatment control group (n=6).	**Primary outcome:** Change in cognitive performance on a range of tests, including FIM-Cog, MMSE, Trail making, Symbol Digit, PASAT, WCST, Stroop, SRTT, FIM problem solving, SIS cog domains. In most studies, cognition was not the primary outcome.	9 of the 12 included studies provided sufficient data for pooling. Exercise or activity was associated with a significant improvement in cognitive function (SMD=0.2, 95% CI 0.04 to 0.36; p=0.015).

Multicomponent Interventions for the Rehabilitation of Cognition Post Stroke

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Bo et al. 2019 **China** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor☑ ITT: ☒	225 patients with vascular cognitive impairment associated with a stroke sustained within the previous 6 months, recruited from the outpatient department of a university-affiliated hospital. Mean age was 65 years, 44% were women.	Patients were randomized to one of 4 groups: (1) physical exercise (n=56; (2) cognitive training (n=57); (3) physical exercise + cognitive training (n=55), or (4) control groups, who watched video documentaries (n=57). All participants received training for 36 sessions, 3 day/week for 12 weeks. Session lasted for 45-60 minutes.	**Primary outcomes:** Trail Making Test Part B, Stroop test, forward digit span, and mental rotation tests. Assessments were conducted at baseline, post intervention and at 6-months follow-up	179 patients completed the trial. From baseline to post intervention, there was a significant reduction in time to complete the TMT Part B within all the intervention groups. There was a significant difference in time to completion between the combined intervention group and the control group. From baseline to post intervention, there was a significant reduction in time to complete the Stroop test within the combined intervention group only. There was a significant difference in time to completion between the combined intervention group and the control group. From baseline to post intervention there was significant improvement in digit span scores in the combined intervention group and the cognitive training groups. The improvement was significantly greater for the combined intervention group compared to the control group, and exercise group. Improvement was also significantly greater in the cognitive training group vs. the control group. From baseline to post intervention, only persons in the combined intervention improved their scores on mental rotation tests. The improvement was significantly greater in the combined intervention group compared with the 3 other groups. From baseline to follow-up, cognitive improvements remained significant for all outcomes measures in the combined intervention group. For all other groups, there were no significant differences from baseline to follow-up for any of the outcomes.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Cheng et al. 2018 **China** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor☑ ITT: ☑	168 inpatients with ischemic stroke. Patients with obvious cognitive impairment were excluded. Mean age was 63 years, 49% were men. Mean MoCA score at baseline was 25, mean MMSE score was 27.2.	Patients were randomized to a comprehensive rehabilitation training (CRT) group, which included patient and family member education, cognitive training, rehabilitation training, and regular check + conventional treatment or conventional treatment (control group). Patients in both groups received treatment for 12 months.	**Primary outcomes:** MoCA, MMSE **Secondary outcomes:** HADS depression score and Zung self-rating depression scale Assessments were conducted at baseline, 3, 6 and 12 months.	69 patients in the CRT group and 67 patients in the control group completed follow-up. Mean MoCA scores were significantly higher in the CRT group at 6 and 12 months. At 12 months, the percentage of patients with cognitive impairment (MoCA ≤26) was significantly higher in the control group (54.8% vs. 32.1%, p=0.003). There was no significant difference in mean MMSE scores between groups at any point. The change in score from baseline to 12 months was significantly greater in the CRT group 0.44 vs. -0.24, p=0.004). There was no significant difference between groups in the percentage of patients with cognitive impairment (MMSE ≤26) at 12 months (22.6% vs. 35.7%, p=0.062). There were no significant differences between groups in mean HADS or Zung scores at any of the 4 assessment points. There were significant declines in mean depression scores, assessed using both measures from baseline to 12 months.
Cho et al. 2015 **Korea** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor ☑ ITT: ☒	25 patients with hemiparesis associated with stroke of onset of 3 months to 1 year, with MMSE scores of 18-23. Mean age was 63 years, 64% were men.	Patients were randomized to receive computer assisted cognitive rehabilitation (CACR) + traditional rehabilitation (OT/PT) or traditional rehabilitation (control) group. Traditional rehabilitation was provided for both groups 30-minutes, 5x/week for 6 weeks. Persons in the CACR group received extra CACR training for half an hour 5x/week for 6 weeks.	**Primary outcomes:** Memory: Digit span test (DST), visual span test (VST) Attention: the visual continuous performance test (VCPT) and auditory controlled continuous performance test (ACCPT)	From baseline until the end of the intervention, patients in the CACR group improved significantly on all outcomes, while there were no significant improvements in the control group. (No between group tests of significance were performed).

Cognitive Rehabilitation to Improve Functional Ability

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Hoffmann et al. 2010 **Australia** **Systematic review**	NA	4 RCTs including 376 persons ≥18 years with cognitive impairment (including attention and concentration, memory, orientation, and/or executive functions) following stroke, in which any non-pharmacological intervention was provided and where either basic or instrumental ADL was assessed.	Interventions included Attention process training (APT), provided for up to 30 hrs; Cognitive skills remediation training administered on an individual basis for 30–40 minutes, 3x per week for an average of 3–4 weeks; feedback of the results from an extensive battery of cognitive assessments to assess specific cognitive functions, including a summarized report with specific recommendations, which was provided to professionals involved in their rehabilitation; and time pressure management (TPM), provided for 10 hours. Control conditions were routine or standard care	**Primary outcome:** Basic or instrumental ADL	There were no significant differences between groups on any of the ADL measures assessed using the Barthel Index (3 trials) or the modified Rankin Scale (1 trial). There was no significant difference between groups in the single trial that assessed instrumental ADLs using the Extended Activities of Daily Living scale.
Donkervoort et al. 2001 **The Netherlands** **RCT**	CA: ☒ Blinding: Patient ☒ Assessor ☑ ITT: ☑	113 persons with left hemisphere stroke and apraxia, sustained an average of 100 days previously. Mean age was 65 years, 57% were men.	Patients were randomized 1:1 to receive 15 hours of strategy training (25 sessions) integrated into their usual occupational therapy, using internal/external compensatory strategies or usual occupational therapy only for 8 weeks.	**Primary outcome:** ADL observations, based on 4 standardized tasks (score of 0-3) **Secondary outcomes:** Barthel Index, extended ADL judgement, based on Rivermead Activities of Daily Living Scale, apraxia test based on DeRenzi, motor function tests, standardized tests of verbal comprehension,	Difference between groups in change from baseline to post-intervention for the primary outcome was 0.13; (90% CI 0.00, 0.25) effect size= 0.37 (small-to-medium). Difference between groups in mean change from baseline to follow-up for the primary outcome was not significant (−0.01; 90% CI −0.17, 0.16). Difference between groups in change from baseline to post-intervention for the Barthel Index was 1.30; (90% CI 0.36, 2.24) effect size = 0.47 (medium).

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
				neglect and mental status Assessments were conducted at baseline, at the end of treatment and at 5 months.	Difference between groups in mean change from baseline to follow-up for the Barthel Index was not significant (0.18; 90% CI −1.14, 1.49). There were no significant differences in change scores (baseline to end of treatment or baseline to follow-up on any of the secondary outcomes).

Enriched Environments

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Qin et al. 2021 **Australia** **Cochrane review**	CA: ☑ Blinding: Patient ☒ Assessor☑ ITT: ☑	A single RCT* including 103 participants who had been admitted to a neurorehabilitation unit of whom 53 were recovering from stroke. Mean age was 63 years, 63% were men. * Khan F et al. An enriched environmental programme during inpatient neurorehabilitation: A randomized controlled trial. *J Rehabil Med* 2016;48(5):417-25.	Patients were randomized to receive usual neurorehabilitation or rehab plus access to individual and/or communal enriched environment (EE) equipment and an activities programme in a designated area. Additionally, a 2-hour session was provided every weekday where various enriched activities were available for participants to choose from including those with computers with gaming technology to exercise limbs, music stations, reading materials, painting, and board games.	**Primary outcomes:** Depression Anxiety Stress Scale (DASS), Rosenberg Self-Esteem Scale (RSES), Multidimensional Health Locus of Control (MHLC) **Secondary outcomes:** Neurological Impairment Scale (NIS), FIM, MoCA, EQ-5D	At discharge, the mean difference in DASS total scores from baseline was significantly greater in the EE group (-24.1, 95% CI -40.1 to -7.2). The mean difference in MHLC scores was also significantly greater in the EE group (3.7, 95% CI 0.5 to 7.1), but not for RSES scores (mean difference=2.1, 95% CI -0.4 to 4.6). At discharge, the mean difference in FIM motor subscale scores from baseline was significantly greater in the EE group (6.3, 95% CI 0.2 to 13.1). There was no significant difference between groups in MoCA scores (MD=2.1, 95% CI -0.7 to 4.9) or the FIM cognition subscore (MD=1.2, 95% CI -1.6 to 4.1).
Sarkamo et al. 2008 **Finland** **RCT**	CA: ☒ Blinding: Patient ☑ Assessor☒ ITT: ☒	60 patients, ≤75 years, who had been discharged from a single institution following middle cerebral artery stroke. Mean ages among the 3 groups were 56, 59 and 61.5 years, 53% were male. Mean time from stroke onset to study entry was 6 days.	Patients were randomly allocated to music listening, language listening or control groups as soon as possible following discharge from acute care. Patients in the music and language listening groups both received portable CD players and CD's of either music or narrated audio books as appropriate & were instructed to listen to the material by themselves for a minimum of 1 hr/day for a period of 2 months. Patients assigned to the control group received no listening material.	**Primary outcomes:** 10 cognitive domain outcomes including verbal memory (story recall subtest from the Rivermead Behavioural Memory Test), short-term and working memory (digit span subtest from the Wechsler Memory Scale—Revised), focused attention (Stroop subtests). Outcomes were assessed at baseline, 3 and 6 months	The mean changes in verbal memory and focused attention over the study period were significantly more improved among patients in the music listening group (p=0.002 and p=0.012, respectively). There were no other significant changes in mean scores among the groups for any of the other cognitive outcomes. Post hoc analysis of change scores from baseline demonstrated significantly greater improvements in both of these areas associated with music listening at both 3 and 6 months. There were 6 dropouts.

Virtual Reality

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Oliveira et al. 2022 **Portugal** **Prospective study**	NA	30 patients aged ≥18 years admitted to a rehabilitation unit following stroke, which occurred 1-6 months previously. Mean age was 60 years, 60% were men. 45% were ischemic stroke	In addition to usual rehabilitation therapies, patients used a virtual reality programme (computer and mouse), to perform a variety of everyday indoor and outdoor tasks, of escalating complexity (sessions occurred 2x/week for 30 minutes each). On average, patients completed 6 sessions.	**Primary outcomes:** MoCA, Frontal Assessment Battery (FAB) (Portuguese version), Wechsler Memory Scale – WMS-I, Colour Trails Test – CTT	The difference in mean test scores from baseline to end of treatment was significant for all outcomes, except CTT interference index and CTT1 execution time. Effect sizes (Cohen's *d*) were 0.54 (MoCA), FAB total score (0.4), WMS memory quotient (0.39) and CTT2 execution time (0.70). Modified reliable change index (RCIm) analysis showed that 38% of the sample improved global cognitive function, 15% improved memory and attention abilities and 8% improved executive functions above Z > 1.96.
Zhang et al. 2021 **China** **Systematic review**	Using the Cochrane bias assessment tool, all trials had an acceptable risk of bias.	23 RCTs including 894 patients recovering from stroke. Mean age ranged from 49 to 74 years. Sex breakdown not reported.	Trials compared usual care (or non-VR interventions) with VR-based interventions (single, or multiple-component interventions) using a screen or a head-mounted device, including games with immersive, semi-immersive, and non-immersive systems, simulating virtual environments. Interventions were provided for an average of 4 weeks (2-5x/week).	**Primary outcome:** Global cognition **Secondary outcomes:** Executive function, memory, attention, verbal fluency, visuospatial ability, depression, QoL	Pooling the results from 10 trials (323 patients), VR interventions were not associated with significant improvements in global cognition (SMD=0.32, 95% CI–0.43 to 1.06). Pooling the results from 5 trials (133 patients), VR interventions were associated with significant improvements in executive function (SMD=0.88, 95% CI 0.6 to 1.70). Pooling the results from 5 trials (167 patients), VR interventions were associated with significant improvements in memory (SMD=1.44, 95% CI 0.21 to 2.68). Pooling the results from 6 trials (166 patients), VR interventions were not associated with significant improvements in attention (SMD= -0.09, 95% CI–0.39 to 0.22). VR interventions were not associated with significant improvements in verbal fluency, visuospatial ability, depression, or QoL
Faria et al. 2020	CA: ☒	36 persons <75 years old who had sustained their first-ever	Participants were randomized to receive 12	**Primary outcomes:** MoCA, Trail Making Test	There was one dropout in the TG group and 3 in the Reh@City v2.0 group. 9 persons were lost to

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Portugal **RCT**	Blinding: Patient ☒ Assessor☒ ITT: ☒	stroke >6 months previously. Mean age was 63 years, 50% were men. Median time post stroke was approximately 32 months.	adaptive cognitive training sessions using Reh@City v2.0, a virtual reality platform to perform daily tasks (n=17) vs. pencil & paper training of the same tasks using "Task Generator", which automatically generates a set of the 11 personalized cognitive training tasks (n=19).	(TMT) parts A and B, Wechsler Memory Scale-III (WMS-III), Wechsler Adult Intelligence Scale III (WAIS-111) Assessments were conducted at baseline(T1), post intervention (T2) and 2 months follow-up (T3)	follow-up in the Reh@City v2.0 group vs. none in the TG group. Median MoCA scores in the Reh@City v2.0 group were 23, 25 and 28 at T1, T2 and T3, respectively. Corresponding median scores for persons in the TG group were 21, 21 and 23. The median MoCA score, post intervention was significant higher in the Reh@City v2.0 group. *Median TMT A (Time at T1, T2 and T3)* Reh@City v2.0 group: 72.5 sec, 65 and 70 TG group: 84 sec, 72 and 76.5 *Median TMT B (Time at T1, T2 and T3)* Reh@City v2.0 group: 195 sec, 200 and 190 TG group: 209.5 sec, 236 and 202. While there were some significant within-group differences, there were no significant differences between groups in median TMT A or B time to completion. While there were some significant within-group differences, there were no significant differences in median WMS III scores between groups (learning, recognition or retention) While there were some significant within-group differences, there were no significant between-group differences in median WAIS-III scores (Digit Symbol Coding, Symbol Search, Digit Span or Vocabulary)
Torrisi et al. 2019 **Italy** **RCT**	CA: ☒ Blinding: Patient ☒ Assessor☑ ITT: ☒	40 persons with cognitive disorders associated with a stroke sustained 3-6 months previously, admitted to a rehabilitation institute were included. Mean age was 55 years, 21% were men.	Participants were randomized 1:1 to an experimental or control group, which provided treatment for 6 months and included 2 phases (3 months each).	**Primary outcomes:** MoCA, Frontal Assessment Battery (FAB), Weigl Test, Attentive Matrices (AM), Trail Making Test (TMT A, B and B-A), Rey Auditory Verbal Learning Test	In linear mixed-effects analysis, there was an effect of group, which affected the mean scores for the outcomes of MoCA, TMT B-A, phonemic fluency and semantic fluency, and RAVLT-immediate, favouring the experimental group over time, with no group effect for the outcomes of TMT-A, RAVL-delayed, Digit Span, Weigl test or FAB.

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			During the first phase the experimental group underwent cognitive rehabilitation training using the Virtual Reality Rehabilitation System-Evo (VRRS-Evo) vs. standard cognitive training (control group). In the second phase (after discharge), the experimental group was treated with a virtual reality rehabilitation system Home Tablet (50-minute sessions, 3x/week), and the control group continued with dose-equivalent standard cognitive training.	(RAVLT)- immediate and differite, Digit Span and phonemic and semantic verbal fluency Assessments were conducted at baseline (T0), at the end of phase 1 (T1) and at the end of phase 2 (T2)	
Kim et al. 2011 **Korea** **RCT**	CA: ☒ Blinding: Patient ☒ Assessor☒ ITT: ☒	28 patients admitted to an inpatient rehabilitation unit following acute stroke with cognitive impairment, identified by a score of 10-24 on the K-MMSE (Korean version of the Mini-Mental Status Examination). Mean age was 64 years, 39% were male. Mean time since stroke onset was 21 days.	Participants were randomized to receive virtual reality (VR) training (30 minutes, 3x/week for 4 weeks) + computer-assisted cognitive rehabilitation (30 minutes, 2x/weeks, for 4 weeks; n=15) or to a control group (n=13) who underwent computer-assisted cognitive rehabilitation only (same duration as intervention group).	**Primary outcomes:** Visual & auditory continuous performance tests (CPT), word-color test, forward & backward digit span tests (DST), forward and backward visual span test (VST)	Within groups, there was significant improvement at the end of treatment from baseline, in the VR group for several outcomes (Visual CPT, Auditory CPT, Forward DSP, and forward and backward VST), but not for persons in the control group. Between groups, there was significantly more improvement among persons in the VR group for the outcomes of visual CPT (mean change from baseline -0.16 vs. -0.03, p<0.01) and the backward VST (mean change 0.9 vs. -0.1, p<0.05).

Computer-based Training

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Mingming et al. 2022 **China** **Systematic review & meta-analysis**	Using the Joanna Briggs Institute checklist, 1 trial was considered to be of high quality, the remainder, of medium quality.	10 RCTs including 600 adults with post-stroke cognitive impairments. Mean age ranged from 42.1 to 66 years, 58.5% were men. 7 trials were conducted in the chronic stage of stroke (not defined), 2 were conducted in the acute stage, and in one study, chronicity was not reported.	Trials compared computer-based cognitive training (CBCT), using commercially available systems (e.g., RehaCom) vs. usual cognitive rehabilitation. The duration of therapy ranged from 7 to 60 hours. Training frequency in most studies was 30 min per session with 5 sessions per week.	**Primary outcome:** Effect size (SMD) for overall cognitive function	Pooling the results from 6 trials, CBCT was not associated with significant improvement in overall cognition (SMD=0.59, 95% CI -0.06 to 1.24).
Nie et al. 2021 **China** **Systematic review & meta-analysis**	Overall, the risk of bias was assessed as low using the Cochrane tool	32 RCTs including 1,837 participants with post-stroke cognitive impairment. Mean age ranged from 30 to 85 years.	Trials compared computer-assisted cognitive rehabilitation (CACR) using commercially available systems (e.g., RehaCom) vs. usual cognitive rehabilitation. Training frequency was 5-6x/week in most trials, with sessions lasted from 30-45 minutes, provided for 2-12 weeks (average was 4-8 weeks).	**Primary outcome:** MoCA, MMSE, Loewenstein Occupational Therapy Cognitive Assessment (LOTCA), BI, FIM	Pooling the results from 12 trials (674 patients), CACR was associated with significant improvement in MoCA scores (MD= 2.67, 95% CI 2.21 to 3.13). Pooling the results from 9 trials (476 patients), CACR was associated with significant improvement in MMSE scores (MD= 2.51, 95% CI 1.94 to 3.08). Pooling the results from 6 trials (318 patients), CACR was associated with significant improvement in LOTCA scores (MD= 8.63, 95% CI 4.99 to 12.28). Pooled results from 4 and 3 trials indicated persons who received CACR had significantly better BI and FIM scores at the end of treatment.
Tarantino et al. 2021 **Italy** **RCT**	CA: ☒ Blinding: Patient ☒ Assessor☑ ITT: ☒	37 patients undergoing inpatient rehabilitation following stroke. Mean age was 65 years, 70% were men. Mean MMSE score was 25. Mean time since stroke was 3.5 months.	Patients were randomized to receive usual rehabilitation or rehabilitation + a computer-based program to enhance executive function (10 sessions, 60 minutes each). Training tasks targeted working	**Primary outcomes:** Neuropsychological test battery including measures of short-term and working memory, attention and processing speed, executive function, Barthel Index (BI), FIM	From baseline to end of treatment, the mean change scores for the outcomes of attentional matrices and phonemic fluency improved significantly for patients in the intervention group. There were no significant improvements for any of the other 10 cognition outcomes. There were no significant improvements for patients in the usual rehabilitation group for any

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		(Unclear how many patients were cognitively impaired).	memory, interference control and inhibition task switching, and monitoring. In each task, stimuli consisted of "cards", displayed one at a time in the center of a laptop screen.		of the cognitive outcomes. Patients in both groups improved significantly in BI and FIM scores
van de Ven et al. 2017 **The Netherlands** **RCT**	CA: ☑ Blinding: Patient ☑ Assessor☑ ITT: ☑	97 adults aged 30–80 years who had suffered a stroke within the last 5 years with cognitive impairment, who had received inpatient or outpatient rehabilitation. Mean age was 60 years, 68% were men. Mean time since stroke was 28 months.	Participants were randomized to an intervention group (n=38), active control group (i.e., mock training; n=35), or waiting list control group (n=24). The intervention and mock training consisted of 58 half-hour sessions over 3 months. Persons in the intervention group trained at home (30 minutes, 5x/week) using the braingymmer.com website. The mock training consisted of 4 tasks that were not expected to train executive functions.	**Primary outcome:** Executive function (measures) **Secondary outcomes:** Cognitive flexibility, attention, memory, reasoning, psychomotor speed and inhibition Assessments were conducted at baseline, after treatment and 4 weeks later	From baseline to the end of treatment, persons in all groups improved significantly over time in executive function performance; however, there was no significant time x group interaction for any of the 5 measures. For secondary outcomes, the performance of all 3 groups improved significantly over time but there was no group x time interaction. There was improvement over time (T2-T0) for attention, reasoning and psychomotor speed, but the intervention training did not result in larger improvement compared to either of the control groups.
Bogdanova et al. 2016 **USA** **Systematic review**	Using the instrument developed by Cicerone et al., all studies were deficient in one or more items of methodological quality.	28 studies including 768 adults recovering from acquired brain injury. In 5 studies, only persons with stroke were included. In the remaining studies, the sample was composed of persons with mixed etiology or traumatic brain injury. Mean age ranged from 25.3 to 65.6 years. Approximately 50% were men. Time from injury ranged from 14 days to 7 years.	Narrative synthesis of studies examining computerized cognitive rehabilitation for attention and executive function compared with a control condition (usually conventional rehabilitation). One treatment program was used in 5 studies (Cogmed QM). In the remaining studies, the programs were study unique. Duration, frequency and	**Primary outcome:** None stated a priori	3 studies (all RCTs) included persons in the acute stage of stroke. Study 1. n=11, mean time from stroke was 28 days. The trial compared Korean computer-assisted cognitive rehabilitation with real tDCS vs. same treatment with sham tDCS. At the end of treatment, there were significant differences on auditory and visual measures of attention and executive functioning. Study 2. N=43, time from stroke was ≤14 days. The trial compared computer programs for attention and visual and spatial gnosis vs. conventional rehabilitation. At the end of

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			intensity of the interventions were not described.		treatment, there was significantly better performance in attention and self-reported cognition in the intervention group. Study 3. n=28, mean time from stroke was 20.9 days. The trial compared computer-assisted rehabilitation and virtual reality training vs. computer training only. Both groups improved, but the combined group performed better on some neuropsychological measures. 2 studies (1 RCT, 1 non RCT) included persons in the chronic stage of stroke. Study 1. N=35, mean time from stroke was 14.7 months. The trial examined *Wiener Determinationsgerat* and *Cognitrone*. There was no control group. 6 weeks after the intervention, there were significant improvements on measures of attention. Study 2. n=18. Mean time from stroke was 20.1 months. The study examined an intervention using the RoboMemo software. There was no control group. At the end of the intervention, there was significant improvement on measures of attention and executive functioning.
van de Ven et al. 2016 **The Netherlands** **Systematic review**	CONSORT statement criteria ranged from 7 to 11.5/16	20 studies (9RCTs) including persons who had suffered a stroke or other acquired brain injuries. 5 studies included patients in the postacute phase, 6 in the chronic stage and 9 studies included persons in both the subacute and chronic phase.	Narrative synthesis of studies examining computer training. 4 studies examined interventions to improve working memory, 8 studies examined attention training and 7 studies examined combined working memory and attention training. The median planned number of hours of training was 15.6	**Primary outcome:** Executive function	Four studies reported no improvements, 5 reported improvements in part of the measures and 7 reported improvements in all of their executive function outcome measures.

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			hours (range 4.5-60 hours).		
Wentink et al. 2016 **The Netherlands** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor☑ ITT: ☑	115 patients aged 45-75 years, with self-perceived cognitive impairments 12–36 months after stroke. Participants were identified from a database of rehabilitation centres. Median age was 59 years, 63% were male. Mean time from stroke onset was 25.5 months.	Participants were randomized to an intervention (n=53) or control group (n=57). The intervention was a computer-based training activity that targeted 5 cognitive domains (attention, speed, memory, flexibility and problem solving), which consisted of gaming at home during for 8 weeks, at least 5 days per week, approximately 15–20 minutes per day (600 minutes in total). Persons in the control group received weekly information about stroke from the study's website.	**Primary outcomes:** The Cognitive Failures Questionnaire (CFQ), The Trail Making Test (TMT), The Block Span Task, Digit Span Task, Eriksen Flanker Task, The Raven Standard Progressive Matrices, assessed at baseline (T0), weeks 8 (T1) and 16 (T2)	46 persons in the intervention group completed the computer-based intervention (median duration was 528 minutes). CGQ: From T0 to T1, and T1 to T2, there were no significant differences between groups in median change in total scores. Attention outcomes: From T0 to T1, there were no significant differences between groups in median change scores for TMT-A or TMT-B (time), or median TMT-A or TMT-B (number of correct items). From T1 to T2, there were no significant differences between groups in median change scores for TMT-A or TMT-B (time), or median TMT-A or TMT-B (number of correct items). There were 3 dropouts in the intervention group, 0 in control group
Zucchella et al. 2014 **Italy** **RCT**	CA: ☒ Blinding: Patient ☒ Assessor☑ ITT: ☒	87 patients, 45-80 years, admitted to a neurorehabilitation unit following first-ever stroke of duration < 4 weeks, with MMSE scores >10 and cognitive deficits, identified in relation to population norms. Mean age was 67 years, 47% were male. Mean MMSE score was 22.	Participants were randomized to a study group and performed cognitive training exercises, including therapist-guided computer exercises (1 hour x 4/week for 4 weeks) or to a control group, which met with a psychologist and discussed general topics, news and their recent activities for a total of 16 hours. Outcomes were assessed before and after the intervention period.	**Primary outcomes:** Rey Auditory Verbal Learning Test (RAVLT) Delayed and immediate recall, logical memory delayed and immediate recall	At the end of treatment, participants in the study group demonstrated significant improvement in all measures of memory, while those in the control group did not. Mean RALVT scores (immediate recall) were not significantly different between groups at the end of treatment (30.vs. 27.2, p<0.05). Mean RALVT scores (delayed recall) were significantly higher in the study group at the end of treatment (7.2 vs. 3.9, p<0.0001). Mean immediate and delayed logical memory scores were significantly higher in the study group at the end of treatment (4.5 vs. 3.4, p=0.005 and 4.4 vs. 3.2, p=0.009, respectively).

Abbreviations

ADAS-Cog: Alzheimer's Disease Assessment Scale–Cognition	CA: concealed allocation	CI: confidence interval
FIM: Functional Independence Measure	ITT: intention-to-treat	MMSE: Mini Mental State Examination
MoCA: Montreal Cognitive Assessment	OR: odds ratio	RCT: randomized controlled trial
RR: relative risk	SMD: standardized mean difference	TMT: Trail Making Test

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