



Supplemental Materials for

Interventions to Improve Cognitive Outcomes in Older Adults with Traumatic Brain Injury and Association Between Social Determinants of Health and Intervention Effectiveness: A Scoping Review

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1 APPENDIX S1. Result Tables

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3 APPENDIX S1 - TABLE S1. Study and participant characteristics.

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First Author, Year, Country	Study Description	n† (*); % Female; Gender	Age [Mean (SD)]; TBI Subgroup Age [Mean (SD)]	Ethnicity; Race; Language; Religion	Education; Occupation	Annual Income (\$); Socioeconomic Status; Place of Residence	Sample Comorbidities Reported; Frailty Reporting	Study Period	Setting; Use of Technology	Mechanism of Injury
NON-PHARMACOLOGIC INTERVENTIONS										
Whitlock, 1992, United States ¹	Acute inpatient rehabilitation (before vs after)	23; 43.75%; NR	27 (14.27); 1 participant with TBI ≥60-year-old (age 75 years)	NR; NR; NR; NR	NR; NR	NR; NR; NR	NR	January 1988 to December 1990	Inpatient brain injury rehabilitation unit; No	MVCs: 69.57%; Motorcycle: 8.70%; Fall: 8.70%; Car-Pedestrian: 8.70%; Car-Bicycle: 4.35%
Cifu, 1996, United States ²	Comprehensive inpatient rehabilitation program (before vs after)	50; 30%; NR	66.8 (9.2)	NR; 66% White, 26% Black, 8% Other; NR; NR	46% ≤11th Grade; 20% High school graduate/trade school, 12% Some college/associate degree, 10% College graduate, 12% Unknown; NR	NR; NR; 90% Private, 2% Nursing home, 2% Homeless, 4% Group home/transitional, 2% Other/unknown;	NR; NR	1989 to 1994	Acute neurotrauma and inpatient rehabilitation services between medical centers initiated in 1987; No	MVCs most common; Falls: 36%; <10% penetrating injuries
Prigatano, 1999, United States ³	Inpatient neuro-rehabilitation (before vs after)	51 (n=9); 39.2%; NR	64.65 (18.0)	NR; NR; English; NR	Mean years (SD) = 12.91 (3.37) years; NR	NR; NR; NR	1 patient reported to have “other diagnosis” (further information not provided); NR	July 1, 1993 to June 30, 1994	Inpatient neuro-rehabilitation; No	NR
De Guise, 2005, Canada ⁴	Integrated reality orientation program vs usual care	38; NR; NR	Intervention group = 52.1 (20.7), Comparator group = 36.7 (13.6); 7 participants with TBI ≥60-year-old	NR; NR; English or French; NR	NR; NR	NR; NR; NR	NR; NR	Treatment Group: 2001 to 2003; Comparator group: 1998 to 2000	Acute care setting (did not specify ED, wards or ICU); No	NR
Frankel, 2006, United States ⁵	Comprehensive inpatient rehabilitation program (before vs after)	3054; 31.1%; NR	66.6 (9.0)	30.3% ethnic minorities; NR; NR; NR	32.3% Did not complete high school, 45.4% Completed high school, 22.3% College grad or higher; NR	NR; NR; NR	NR; NR	1996 to 2002	Acute neurotrauma and inpatient rehabilitation services at 1 of 17 National Institute on Disability and Rehabilitation Research–designated TBIMS centers; No	NR
Graham, 2010, United States ⁶	Inpatient rehabilitation	18413; 47%; NR	79.19 (7.39)	NR; 86.5% White, 5.1% Black, 4.2 %	NR; NR	NR; NR; 32.5% living alone	Number (SD) = 8.02 (2.43); NR	2005 to 2007	Inpatient rehabilitation facilities that	NR

	program (before vs after)			Hispanic, 4.1% Other; NR					subscribe to the Uniform Data System for Medical Rehabilitation; NR	
Chen, 2011, United States ⁷	Goal-directed attention regulation training vs brief education	12 (n=9); 58.3%; NR	48; 3 participants with TBI ≥60-year-old – mean of 61.7-year-old	NR; NR; NR; NR	NR; NR	NR; NR; NR	NR; NR	NR	NR	Falls: 56%; MVCs: 33%; Assault: 11%
Burkard, 2014, Switzerland ⁸	Implementation intention training (before vs after)	12 (n=1); 42%; NR	70.3	NR; NR; NR; NR	NR; NR	NR; NR; NR	NR; NR	NR	Outpatient rehabilitation program; Use of written support for most activities	NR
Li, 2015, United States ⁹	Computer-based cognitive retraining (before vs after)	12 (n=5); 17%; NR	61 (15.8); 62	NR; NR; Fluent in English; NR	NR; NR	NR; NR; NR	NR; NR	NR	Outpatient community-based day program; Use of an interactive Internet cognitive retraining platform (software: Parrot Software)	NR
Spagnolo, 2015, Italy ¹⁰	Cognitive stimulation (before vs after)	36 (n=1); 64%; NR	78.7 (6.3); NR	NR; NR; NR; NR	Mean in years (SD) = 6 (2.5); NR	NR; NR; NR	CIRS-Severity Index 1.5 ± 0.2; CIRS-Comorbidity Index 2.6 ± 1.4; NR	2009 to 2013	Outpatient rehabilitation program; No	NR
Howrey, 2017, United States ¹¹	Inpatient rehabilitation (before vs after)	16583; 34.6%; NR	Two most prominent age groups: <45: 34.94% and >75: 29.70%	NR; White 80.8% Black 6.72% Hispanic 6.85% Other 5.93%; NR; NR	NR; NR	NR; NR; Boston 2.2%; New York 4.6%; Philadelphia 12.6%; Atlanta 14.8%; Chicago 22.9%; Dallas 5.1%; Kansas 7.9%; Denver 8.9%; San Francisco 14.8%; Seattle 6.1%	CMS comorbidity Tier 0 (no comorbidity): 57.92%; Tier 1 (high): 7.66%; Tier 2 (medium): 18.11%; Tier 3 (low): 16.31%	2002 to 2010	Inpatient rehabilitation centers; No	Closed (non-penetrating TBI): 94.63%
Hwang, 2019, Taiwan ¹²	Computerized cognitive training vs Tai Chi vs usual care	96; 55%; NR	CCT 65.8 (10.7); TC 65.8 (9.9); UC 68.1 (11.4)	NR; NR; NR; NR	College or above: CCT 43.8%; TC 37.5%; UC 29.0%; High school: CCT 31.2%; TC 43.8%; UC 48.4; Elementary or below: CCT 25.0%; TC 18.7%; UC 22.6%; NR	NR; NR; NR	Number of chronic conditions: CCT 1.6 ± 1.9; TC 2.4 ± 1.6; UC 2.2 ± 1.9; Depression: CCT 6.3%; TC 3.1%; UC 3.1%; Insomnia: CCT 21.9%; TC 25.0%; UC 28.1%; Visual impairment: CCT 18.7%; TC 12.5%; UC 25.8%	2016 to 2017	Participants' residence with virtual care component; Use of a computerized cognitive training program (software: RehaCom)	NR
Cisneros, 2021, Canada ¹³	Multimodal cognitive training vs usual care	32; 41.6%; NR	Experimental group = 64.90 (7.18); Control group = 63.75 (5.63)	NR; NR; French; NR	12.30 years ±2.66; NR	NR; NR; NR	NR; NR	September 2012 to April 2015	Outpatient rehabilitation program; No	NR
Cisneros, 2021, Canada ¹⁴	Multimodal cognitive	32; 41.6%; NR	Experimental group = 64.90 (7.18); Control	NR; NR; French; NR	12.30 years ±2.66; NR	NR; NR; NR	NR; NR	September 2012 to April 2015	Outpatient rehabilitation program; No	NR

	training vs usual care		group = 63.75 (5.63)							
Oleszkiewicz, 2021, Germany ¹⁵	Intensive (higher frequency) olfactory intervention vs standard intensity olfactory intervention	55 (n=4); 28%; NR	58.2 (11.3); Subgroup of post-traumatic patients = 54.5; 1 participant with TBI ≥60-year-old (age 62 years)	NR; NR; NR; NR	NR; NR	NR; NR; NR	NR; NR	NR	Outpatient specialized clinic (Smell & Taste Clinic); Electrical odor dispenser (cylindrical shape, height 8 cm, diameter 2.3 cm [Aromatic; Sony, Tokyo, Japan])	NR
Kim, 2021, South Korea ¹⁶	Therapist-driven cognitive training vs computerized cognitive training	35 (n=3); Treatment group 50%; Comparator group 28.6%; NR	Total sample = 64.7 (15.2); Treatment group = 66.4 (14.4); Comparator group = 62.5 (16.4)	NR; NR; NR; NR	Treatment group 8.7 years ±5.2; Comparator group = 10.1 ± 3.5; NR	NR; NR; NR	NR; NR	August 2018 to March 2020	Inpatient rehabilitation; Use of a comprehensive computer system for cognitive training (software: RehaCom)	NR
PHARMACOLOGIC INTERVENTION										
Chiu, 2015 Taiwan ¹⁷	Hypnotics (benzodiazepines and non-benzodiazepines sleeping aids) use vs no use	5960; 49.3%; NR	4 groups: hypnotics users with insomnia (TBI-IH, N=599; ≥60-year-old=32%), insomniacs who did not use hypnotics (TBI-I, N=931; ≥60-year-old=26.6%), hypnotics users without insomnia (TBI-H, N=199; ≥60-year-old=52.3%), and people without insomnia who did not use hypnotics (TBI-C, N=4271; ≥60-year-old=27.5%).	NR; NR; NR; NR	NR; NR	NR; NR; NR	NR; NR	January 1, 2000 to December 31, 2007	Administrative data of medical claims and registration files; No	NR
SURGICAL AND NON-SURGICAL NEUROMODULATION INTERVENTIONS										
Ishikawa, 2002, Japan ¹⁸	Burr hole irrigation vs usual care	26; 19%; NR	73	NR; NR; NR; NR	NR; NR	NR; NR; NR	NR; NR	NR	Wards; No	NR
Kang, 2011, South Korea ¹⁹	Transcranial direct current stimulation of the left prefrontal cortex vs sham stimulation	9; 11%; NR	50.4 (7.2); 4 participants ≥60-year-old	NR; NR; NR; NR	NR; NR	NR; NR; NR	NR; NR	NR	NR; A computerized contrast reaction time task (CCRTT) was designed to measure attention using Superlab pro v.4.0 software (Cedrus)	50% falls, 50% traffic accidents

									Corporation, San Pedro, CA, USA)	
Inagawa, 2019, Japan ²⁰	Transcranial direct current stimulation vs sham stimulation	20; 45%; NR	Treatment group = 76.6 (5.7); Control group = 76.2 (7.7)	NR; NR; NR; NR	NR; NR	NR; NR; NR	Treatment group = AD 71.4%; LBD 14.3%; Other forms of dementia 14.3%; Comparator group = AD 84.6%; LBD 7.7%; Other forms of dementia 7.7%	NR	Wards; No	NR

Note: †: sample size is the number of individual participants enrolled in the study at onset; (*) sample size of the TBI subgroup if available. **AD:** Alzheimer's Disease; **AUD:** Alcohol Use Disorder; **CCT:** Computerized Cognitive Training; **CHF:** Congestive Heart Failure; **CIRS:** Cumulative Illness Rating Scale; **CMS:** Centers for Medicare and Medicaid Services; **COPD:** Chronic Obstructive Pulmonary Disease; **CRF:** Chronic Renal Failure; **CVA:** Cerebrovascular Accident; **ED:** Emergency Department; **FDS:** Functional Dependent Status; **ICU:** Intensive Care Unit; **LBD:** Lewy Body Disease; **MPD:** Mental or Personality Disorder; **NA:** Not Applicable; **NR:** Not Reported; **SD:** Standard Deviation; **SUD:** Substance Use Disorder; **TBIMS:** Traumatic Brain Injury Model Systems; **TC:** Tai Chi; **UC:** Usual Care.

APPENDIX S1 - TABLE S2. Study traumatic brain injury characteristics and cognitive deficit diagnostic tools and eligibility criteria.

First Author, Year, Country	Study Description	TBI Diagnosis tool	TBI Severity of Participants [Mean (SD)] or [Mean [95% CI]]	TBI Severity Measurement Tool (i.e. GCS Severity, PTA Duration)	Cognitive Deficit or Concern Diagnosis Tool	Time Since Injury	Follow-up Length	Relevant Participant Inclusion/Exclusion Criteria at Enrollment
NON-PHARMACOLOGIC INTERVENTIONS								
Whitlock, 1992, United States ¹	Acute inpatient rehabilitation (before vs after)	NR	Admission GCS score (1 older adult) = 7	GCS score	FIM; GOS; RLAS;	26 days to admission from injury	End of rehabilitation program, 6 months and 1 year post injury	Inclusion: Principal diagnosis of TBI on admission to the Brain Injury Unit of Northeast Rehabilitation Hospital, total FIM score at admission of 19 or less (lowest possible score = 18), completion a course of acute rehabilitation Exclusion: NR
Cifu, 1996, United States ²	Comprehensive inpatient rehabilitation program (before vs after)	NR	PTA duration = 40% of older adults' sample with unknown PTA duration, 8% with 0 days, 52% with PTA and mean duration of 45.4 days; Mean (SD) admission GCS score = 10.1 (3.9) 6% had increased intracranial pressure	PTA duration, mean admission GCS score, ICP	Disability Rating Scale, FIM, RLAS	Within 8 hours of injury	NR	Inclusion: From 531 rehabilitation inpatients with TBI; Admitted to level I trauma centers between 1988 and 1994; From TBIMS program; Individuals with a history of brain injury, pre-existing neurological condition, or substance abuse were included Exclusion: NR
Prigatano, 1999, United States ³	Inpatient neuro-rehabilitation (before vs after)	NR	Admitting GCS score (number of participants with score ranges): 3-8 (n=5); 9-12 (n=2); 13 to 15 (n=2).	GCS score	BNIS	NR	End of rehabilitation program	Inclusion: Patients referred for inpatient neuro-rehabilitation; Exhibiting an initial, nonprogressive brain disorder; Willingness to engage in all aspects of the research project; Provided signed informed consent; At least 2 weeks of hospital stay; In a medically stable condition; No comorbidities that would hinder the determination of the efficacy of brain injury rehabilitation (such as the presence of a concomitant spinal cord injury); Enough English language proficiency to undergo neuropsychological examination; And age 16 years and older.

								Exclusion: NR
De Guise, 2005, Canada ⁴	Integrated reality orientation program vs usual care	A positive finding on medical imaging of the head, viewed by a radiologist, was sufficient to confirm the diagnosis of TBI	Intervention (GCS) = 9.7 (3.7) Control (GCS) = 9.2 (3.7)	GCS score	GOAT	On current hospital admission, TBI was diagnosed by ED physician or admitting physician	Until end of PTA	Inclusion: Patients admitted to the TBI programme of the MGH/MUHC; Diagnosed with moderate or severe TBI by an emergency room physician and/or by the admitting physician; A positive finding on medical imaging of the head, viewed by a radiologist, was sufficient to confirm the diagnosis of TBI Exclusion: Aphasic; Non-English or French speaker; Visual impairment; History of alcohol abuse or psychiatric problems; Neurological deficits or previous TBI
Frankel, 2006, United States ⁵	Comprehensive inpatient rehabilitation program (before vs after)	NR	NR	Length of coma, admission, GCS score, incidence of ICP complications	DRS, FIM	NR	Upon discharge from inpatient rehabilitation	Inclusion: Age ≥ 16; Presentation to a designated TBIMS hospital emergency department within 24 hours after sustaining a TBI; Receipt of acute medical care and inpatient rehabilitation within the NIDRR-funded TBIMS Exclusion: Incomplete medical records; Those with gunshot wounds
Graham, 2010, United States ⁶	Inpatient rehabilitation program (before vs after)	Uniform Data System for Medical Rehabilitation Impairment Group Codes 02.21 and 02.22	NR	NR	FIM cognitive subscale	NR	Upon discharge from inpatient rehabilitation	Inclusion: Being admitted for initial inpatient rehabilitation services after TBI; Age 65 years or older at the time of admission; Living at home prior to injury; Discharged from rehabilitation in 2005 through 2007 Exclusion: Duration from injury onset to admission greater than 365 days; Program interruption for readmission to acute care; length of stay less than 3 days or greater than 100 days
Chen, 2011, United States ⁷	Goal-directed attention regulation training vs brief education	NR	NR	NR	Attention and executive function: LNS from WAIS, Auditory Consonant Trigrams, DVT, DVFS, Trails B, Stroop Inhibition/Switching; Learning and memory: HVLT, BVMTR; Motor speed of processing: Trails A test, Visual Attention Task	≥ 6 months from TBI	NR	Inclusion: Chronic brain injury (≥ 6 months); Exclusion: NR
Burkard, 2014, Switzerland ⁸	Implementation on intention training vs usual care	NR	NR	NR	MMSE, DRS, Semi-ecological event-based PM tasks, SRT, 1-item PM measure,	NR	12 months after intervention	Inclusion: Aged > 60 years; Attend a memory clinic and to present relatively well-preserved general cognitive functioning (MMSE > 20, DRS > 120); Present substantial prospective memory complaints affecting the patient in their everyday life (mentioned by the participant and/or a close relative). Exclusion: NR
Li, 2015, United States ⁹	Computer-based cognitive retraining vs usual care	NR	NR	NR	MoCA version 7.1 (pre-test), MoCA version 7.2 (posttest),	At least 1 year before study enrollment	Within 1 week after intervention	Inclusion: Diagnosis of ABI for a minimum of 1-year prior to intervention; 18 years of age or older; Demonstrated fluency in the English; Demonstrated deficits in overall cognitive functioning and deficits in both attention and memory as evidenced by scores < 6 on the attention subtest, < 5 on the memory subtest, and a score < 26 on MoCA version 7.1;

					medication-box sorting task to test daily living activities			Participants had to receive a score less than the maximum of 14 on the baseline medication-box sorting task Exclusion: Cognitive deficits secondary to neurodegenerative conditions, disorientation, visual perception, or visual acuity impairments; Individuals with bilateral upper extremity motor impairments that interfered with computer use; Failing the MoCA 7.1 orientation subtest and/or an inability to complete the baseline medication-box sorting task
Spagnolo, 2015, Italy ¹⁰	Cognitive stimulation vs usual care	NR	NR	NR	MMSE, Basic ADL, IADL	NR	7 weeks after intervention	Inclusion: Any diagnosis of dementia; MMSE score >17; Patients with preserved ability to communicate and understand oral and written communications; Caregivers must be present during the group meetings Exclusion: Patients with psychosis diagnosis and very severe behavioural disorders such as patients with severe auditory or visual impairments
Howrey, 2017, United States ¹¹	Inpatient rehabilitation vs usual care	NR	NR	NR	Cognitive FIM	Mean in days ± SD: 18.51 ± 27.43	1 follow-up at duration mean ± SD in days: 103 ± 23 days	Inclusion: Cases within UDSMR data from 2002 to 2010 and with follow-up information; Individuals with defined open or closed TBI Exclusion: Those with multiple injuries; 4 Individuals were excluded as their sex could not be determined
Hwang, 2019, Taiwan ¹²	Computerized cognitive training vs Tai Chi vs usual care	ICD-10 diagnosis codes S02.0-S02.1 and S06.0-S02.9	> 80% sustained a mild TBI; Mean GCS score: CCT = 11.3 ± 8.7; TC = 11.0 ± 7.0; Usual care = 11.0 ± 9.2	GCS, loss of consciousness, positive CT scan findings	MDRS, MMSE, TICS-M, TMT	Mean in months ± SD: CCT = 4.4 ± 5.5; TC = 3.1 ± 4.1; Usual care = 3.0 ± 4.5	2 and 6 months after intervention	Inclusion: 55 years or older; Primary TBI diagnosis; Requiring hospitalization to the inpatient neurosurgery, neurology, or rehabilitation units due to TBI; Score of 38 or less on the modified Telephone Interview for Cognitive Status to indicate the presence of cognitive impairment; Ability to use interactive computer programs Exclusion: Dementia diagnosis or other cognitive impairment before injury; Unable to connect to the internet; Unable to communicate with researchers; Major unstable cardiopulmonary diseases; Contraindications to physical exercise
Cisneros, 2021, Canada ¹³	Multimodal cognitive training vs usual care	World Health Organization criteria	Mild TBI = 6; Complicated Mild = 8; Moderate = 3; Severe = 4	LOC length, GCS score, brain imaging, PTA duration	Face-name association, Word list recall, Text memory measures, SEMQ, PGWBI	Mean in days ± SD: Intervention = 595.75 ± 926.67; Control = 859.33 ± 772.04	1 week and 6 months after intervention	Inclusion: Patients with a TBI diagnosis at least 6 months before study enrolment; Resolved Post Traumatic Amnesia; >55 years of age; Fluency in French; Need for interdisciplinary rehabilitation Exclusion: Participation in any other cognitive intervention that addresses similar cognitive functions; Presence of dementia (documented diagnosis or a MoCA <20); Presence of a psychiatric condition; Alcohol consumption exceeding 5 drinks a day 5 or more days a week or illegal drug consumption
Cisneros, 2021, Canada ¹⁴	Multimodal cognitive training vs usual care	World Health Organization criteria	Mild TBI = 6; Complicated Mild = 8; Moderate = 3; Severe = 4	LOC length, GCS score, brain imaging, PTA duration	SET-A, D-KEFS Sorting test and Stroop four-color version, DEX	Mean in days ± SD: Intervention = 595.75 ± 926.67; Control = 859.33 ± 772.04	1 week and 6 months after intervention	Inclusion: Patients with a TBI diagnosis at least 6 months before study enrolment; Resolved Post Traumatic Amnesia; >55 years of age; Fluency in French; Need for interdisciplinary rehabilitation Exclusion: Participation in any other cognitive intervention that addresses similar cognitive functions; Presence of dementia (documented diagnosis or a MoCA <20); Presence of a psychiatric condition; Alcohol consumption exceeding 5 drinks a day 5 or more days a week or illegal drug consumption
Oleszkiewicz, 2021, Germany ¹⁵	Intensive (higher frequency) olfactory intervention vs standard intensity	NR	NR	NR	MoCA, COWAT, SFT	NR	NR	Inclusion: 1) TDI score (which is a scored assigned to assess olfactory abilities) less than 30.75; 2) idiopathic or post-infectious or post-traumatic olfactory loss Exclusion: Only applied to healthy controls: 1) Sniffin' Sticks score below 30.75 points, regular smoking, pregnancy, and acute or chronic sinonasal diseases and other diseases that would affect sense of smell

	olfactory intervention							
Kim, 2021, South Korea ¹⁶	Therapist-driven cognitive training vs computerized cognitive training	Neuroimaging and clinical data	NR	NR	MMSE, CDRS	Mean in days ± SD: 25.1 ± 18.1	At end of rehabilitation program	Inclusion: ABI diagnosis through brain imaging findings; Time since injury of less than 3 months; MMSE score from 10-26 or clinical dementia rating score greater than 0.5 to indicate cognitive impairment; No sensory alterations that impair activity; >18 years old Exclusion: Needing "adequate" cognitive rehabilitation due to the presence of a severe cognitive comorbidity (e.g. impaired alertness); Presence of a medically unstable condition (e.g., cardiovascular conditions); Illiteracy; Previous severe cognitive, muscular, neurologic, and mechanical problems
PHARMACOLOGIC INTERVENTIONS								
Chiu, 2015 Taiwan ¹⁷	Hypnotics (benzodiazepines and non-benzodiazepines sleeping aids) use vs no use	ICD-9 diagnosis codes	Not available in administrative databases	ICU admission is used as an indicator of TBI severity: 101 patients admitted to ICU	Dementia diagnosis (from ICD-9 diagnosis codes)	NR	1-9 years from 1 st TBI	Inclusion: Primary TBI diagnosis between January 1, 2000 and December 21, 2007; Diagnosis of insomnia on at least two visits after the index date of TBI as the insomnia cohort Exclusion: <20 years old; Prior history of TBI, insomnia, or dementia; History of a psychiatric disorder or a Parkinson's disease
SURGICAL AND NON-SURGICAL NEUROMODULATION INTERVENTIONS								
Ishikawa, 2002, Japan ¹⁸	Burr hole irrigation vs usual care	NR	NR	NR	MMSE, HDS-R, ADL	Mean in days: 84	2 weeks after intervention	Inclusion: Patients undergoing surgery for chronic subdural hematoma between April 1, 1999 and March 31, 2000 with Burr irrigation Exclusion: NR
Kang, 2011, South Korea ¹⁹	Transcranial direct current stimulation of the left prefrontal cortex vs sham stimulation	NR	NR	NR	CCRTT	In older adults group mean in days ± SD: 145.54 ± 72.03	24 hours after intervention	Inclusion: Patients with attention deficit after traumatic closed brain injury Exclusion: Presence of a metallic foreign body implant, pacemaker, artificial cochlear; History of seizures, dementia, cognitive impairment or an unstable medical and/or neurological condition; Unable to perform the behavioural task in the study
Inagawa, 2019, Japan ²⁰	Transcranial direct current stimulation vs sham stimulation	NR	NR	NR	MMSE, ADAS-Cog, FAB, CDR-J	NR	2 weeks after intervention	Inclusion: Aged 55 to 90; Diagnosis of major or mild neurocognitive disorder (DSM-5 criteria); On a stable dose of medications for dementia (e.g., cholinesterase inhibitors or memantine) for at least 2 weeks before enrollment; Ability to walk independently with or without an aid Exclusion: Patients on antipsychotic treatment for severe psychotic symptoms; Patients with severe depression and/or suicidal ideation who may need hospitalization within 6 weeks; Patients with a contraindication to electroconvulsive therapy or transcranial direct current stimulation; Patients with an MMSE score < 18 or > 2 on the clinical dementia rating-Japanese version; MMSE scores of 0 on the following subscales: "write a sentence" or "copy a figure"; Patients unable to commit to more than 2 days of the trial

ABI: Acquired Brain Injury; **ADAS-Cog:** Alzheimer's Disease Assessment Scale-Cognitive Subscale; **ADL:** Activity of Daily Living; **BNIS:** Barrow Neurological Institute Screen for Higher Cerebral Functions; **BNT:** Boston Naming Test; **BVMTR:** Brief Visual Memory Test Revised; **CCRTT:** computerized contrast reaction time task; **CDR-J:** Clinical Dementia Rating-Japanese version; **CDRS:** Clinical Dementia Rating Scale; **COWAT:** Controlled Oral Word Association Test; **CT:** computed tomography; **DEX:** Dysexecutive Questionnaire; **D-KEFS:** Delis-Kaplan Executive Function System; **DRS:** Dementia Rating Scale; **DVFS:** Design and Verbal Fluency Switching; **DVT:** Digit Vigilance Test; **ED:** Emergency department; **FAB:** Frontal Assessment Battery; **FIM:** Functional Independence Measure; **HDS-R:** Hasegawa Dementia Scale-Revised; **HVLT:** Hopkins Verbal Learning Test; **IADL:** Instrumental Activity of Daily Living; **ICD:** International Classification of Diseases; **ICP:** Intracranial Pressure; **ICU:** Intensive Care Unit; **GCS:** Glasgow Coma Scale; **GOAT:** Galveston Orientation and Amnesia Test; **GOS:** Glasgow Outcome Scale; **LOC:** Level of Consciousness; **LNS:** Letter Number Sequencing; **MoCA:** Montreal Cognitive Assessment; **MDRS:** Mattis Dementia Rating Scale; **MMSE:** Mini-Mental State Examination; **NIDRR:** National Institute on Disability and Rehabilitation Research; **NA:** Not Applicable; **NR:** Not Reported; **PGWBI:** Psychological General Well-Being Index; **PM:** Prospective memory; **PTA:** Post Traumatic Amnesia; **RLAS:** Rancho Los Amigos Levels of Cognitive Functioning Scale; **SD:** Standard Deviation; **SEMQ:** Self-Evaluation Memory Questionnaire; **SET-A:** Six Elements Task-Adapted; **SFT:** Semantic fluency test; **SRT:** Selective Reminding Test; **TBI:** Traumatic brain injury; **TBIMS:** Traumatic Brain Injury Model Systems; **TDI:** combined Sniffin' Sticks score for Threshold, Discrimination and Identification; **TICS-M:** Telephone Interview for Cognitive Status; **TMT:** Trail Making Test; **WAIS:** Wechsler Adult Intelligence Scale

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APPENDIX S1 - TABLE S3. Study design and intervention characteristics.

First Author, Year, Country	Study Description	Study Design	Changes to Study Protocol s; Drop Out Rate	Intervention Condition	Intervention Timing	Intervention Frequency and Duration	Intervention Facilitator	Comparator Condition	Comparator Frequency and Duration	Comparator Facilitator	Blinding
NON-PHARMACOLOGIC INTERVENTIONS											
Whitlock, 1992, United States ¹	Acute inpatient rehabilitation (before vs after)	Retrospective cohort study	NR; NR	NR	Following admission to unit	NR	NR	NA: participants were tested before and after intervention	NA given study design	NA given study design	NA
Cifu, 1996, United States ²	Comprehensive inpatient rehabilitation program (before vs after)	Prospective cohort study	NR; NA	Center includes emergency medical services, intensive and acute medical care, inpatient rehabilitation, and community rehabilitation services	Within 8 hours of injury	Mean total length of stay in days \pm SD: 89.38 \pm 68.87	NR	NA: participants were tested before and after intervention	NA given study design	NA given study design	NA
Prigatano, 1999, United States ³	Inpatient neuro-rehabilitation (before vs after)	Retrospective analysis of data obtained in a prospective cohort study	NR; NA	Goal driven rehabilitation program: 3-5 rehabilitation goals were selected for patients by the treating team and attending physician.	Following admission to unit	NR	Interdisciplinary treatment team i.e., nurses, physical therapists, speech pathologists, occupational therapists, recreational therapists, and psychologists)	NA: participants were tested before and after intervention	NA given study design	NA given study design	NA
De Guise, 2005, Canada ⁴	Integrated reality orientation program vs usual care	Retrospective cohort study	NR; NA	Integrated reality orientation program	NR	A minimum of 2 standardized orientations per day for 7 days	Treatment staff and patient's family	Historical sample (before implementation of orientation program)	NR	NR	NA
Frankel, 2006, United States ⁵	Comprehensive inpatient rehabilitation program (before vs after)	Retrospective cohort study	NR; NR	Comprehensive inpatient rehabilitation program	Following acute hospitalization for TBI, mean LOS in days \pm SD: 18.8 \pm 17.3	Mean length of stay in days \pm SD: 27.2 \pm 21.9	Interdisciplinary team members	NA: participants were tested before and after intervention	NA given study design	NA given study design	NA given study design
Graham, 2010, United States ⁶	Inpatient rehabilitation program (before vs after)	Retrospective cohort study	NR; NR	Inpatient rehabilitation program	Following injury onset and admission to inpatient rehabilitation	Mean length of stay in days \pm SD: 14.92 \pm 8.36	NR	NA: participants were tested before and after intervention	NA given study design	NA given study design	NA given study design

					mean in days ± SD: 12.98 ± 19.43						
Chen, 2011, United States ⁷	Goal-directed attention regulation training vs brief education	Randomized crossover trial	NR; 4	Training in goal- oriented attentional self-regulation (goals training) - small group format with 2–5 patients and two instructors per group	Chronic acquired brain injury (≥6 months)	10 2-h sessions of group-based training, three individual 1-h training sessions and ~20h of home practice over 5 weeks	Clinicians experienced in working with individuals with brain injury (occupational therapists, neuropsycholog ist), trained in administering research intervention and were supervised by one of authors of instruction manual	Comparison educational activity (education) - didactic educational instruction on brain injury (causes, symptoms and effects) and resources for assistance in a 2-h session	Once; 2 hours	Clinicians experienced in working with individuals with brain injury (occupational therapists, neuropsychol ogist), trained in administering research intervention and were supervised by one of authors of instruction manual	NR
Burkard, 2014, Switzerland ⁸	Implementati on intention training vs usual care	Pre-post study	NR; 2	Programs was administered in groups of 4 individuals: 5 modules and booster sessions	After consultation at the memory clinic, if presenting with PM complaints	10 one-hour sessions, twice a week for five weeks	Neuropsycholog ist and assisted by a psychology student	NA: participants were tested before and after intervention	NA given study design	NA given study design	NA given study design
Li, 2015, United States ⁹	Computer- based cognitive retraining vs usual care	Pre-post study	NR; 1 Drop-out (difficulti es with completi on of modules)	Parrot Software program: interactive Internet rehabilitation platform that is commercially available through Internet access or by CD software. It contains modules targeting cognitive reasoning, memory and attention, reading, speech and language, vocabulary and grammar, and word recall	>1 year after TBI	8 sessions (1 hour per session) of CBCR over 8 weeks	NR	NA: participants were tested before and after intervention	NA given study design	NA given study design	NA given study design
Spagnolo, 2015, Italy ¹⁰	Cognitive stimulation vs usual care	Pre-post study	NR; None	Group meetings: each group is composed of 4 persons with their caregivers	Following diagnosis of dementia	2 times a week for a total of 14 group meetings	Neuropsycholog ist	NA: participants were tested before and after intervention	NA given study design	NA given study design	NA given study design
Howrey, 2017, United States ¹¹	Inpatient rehabilitation vs usual care	Prospective cohort study	NR; None	Freestanding inpatient rehabilitation hospitals or acute hospital-based rehabilitation units	Following acute hospitalizatio n for TBI	Mean length of stay in days: 16.30 ± 12.44 days	NR	NA: participants were tested before and	NA given study design	NA given study design	NA given study design

								after intervention			
Hwang, 2019, Taiwan ¹²	Computerized cognitive training vs Tai Chi vs usual care	RCT	NR; 25	CCT: RehaCom software (require computer and Internet use)	After admission to inpatient neurosurgery, neurology or rehabilitation unit with TBI diagnosis	CCT: 45 minutes per session, once per week for 6 months	Study nurse or TC instructor	Yang-style TC: 5-minute warm-up, 40 minutes of TC practice, and a 5-minute cooldown UC: social visits by study nurse	TC: 50 minutes per session, once per week for 6 months UC: visits every 2 weeks for 6 months	Study nurse	NR
Cisneros, 2021, Canada ¹³	Multimodal cognitive training vs usual care	Semi-randomized pre-post study	NR; Intervention group: 4; Control group: 5	Cognitive enrichment program that is delivered in small groups of 5 or 6 participants	After 6 months from initial TBI diagnosis	24 sessions of 90 min – twice per week in 12 weeks	Clinical neuropsychologist	Usual care: no cognitive rehabilitation	Mean 2-4 hours per week, for 3-6 months	No neuropsychologist	NR
Cisneros, 2021, Canada ¹⁴	Multimodal cognitive training vs usual care	Semi-randomized pre-post study	NR; Intervention group: 4; Control group: 5	Cognitive enrichment program that is delivered in small groups of 5 or 6 participants	After 6 months from initial TBI diagnosis	24 sessions of 90 min – twice per week in 12 weeks	Clinical neuropsychologist	Usual care: no cognitive rehabilitation	Mean 2-4 hours per week, for 3-6 months	No neuropsychologist	NR
Oleszkiewicz, 2021, Germany ¹⁵	Intensive (higher frequency) olfactory intervention vs standard intensity olfactory intervention	RCT	NR; 10	5 odours (grapefruit, lavender, lemon grass, ylang-ylang, peppermint) are dispensed and changed to 5 different odours (menthol, thyme, tangerine, green tea, and bergamot) after 3 months	NR	Mean intervention duration in days \pm SD = 208.6 \pm 64.3 Range = 108-340 days with a frequency of 4 times (30 seconds each time) a day - before or at least 30 minutes after a meal at intervals of 6 hours)	NR	5 odours (grapefruit, lavender, lemon grass, ylang-ylang, peppermint) are dispensed and changed to 5 different odours (menthol, thyme, tangerine, green tea, and bergamot) after 3 months	Mean intervention duration in days \pm SD = 208.6 \pm 64.3 Range = 108-340 days with a frequency of 2 times (30 seconds each time) a day - before or at least 30 minutes after a meal at intervals of 6 hours)	NR	NR
Kim, 2021, South Korea ¹⁶	Therapist-driven cognitive training vs computerized cognitive training	RCT	NR; 3	Therapist driven cognitive rehabilitation: routine rehabilitation with physical and occupational therapy, 30 minutes of cognitive training with a restorative approach	>2 weeks after injury	5 times a week (60 minutes PT + 30 minutes of OT + 30 minutes of cognitive training, for 2 weeks	Occupational therapists delivered cognitive rehabilitation	Cognitive training using RehaCom (training using modules on divided attention, working memory, calculation, and planning)	5 times a week (60 minutes PT + 30 minutes of OT + 30 minutes of cognitive training, for 2 weeks	Occupational therapist for supervision and help using study program	NR
PHARMACOLOGIC INTERVENTIONS											

Chiu, 2015 Taiwan ¹⁷	Hypnotics (benzodiazepines and non-benzodiazepines sleeping aids) use vs no use	Retrospective cohort study	NR; NR	Hypnotics: benzodiazepines and non-benzodiazepines	NR	Cumulative use of least 30 times defined daily dose	NA	No use of hypnotics	NA given study design	NA given study design	NA given study design
SURGICAL AND NON-SURGICAL NEUROMODULATION INTERVENTIONS											
Ishikawa, 2002, Japan ¹⁸	Burr hole irrigation vs usual care	Pre-post study	NR; NR	Burr hole irrigation	Mean of 84 days after injury	Once; NR	Neurosurgeon	Burr hole irrigation with closed system drainage	NA given study design	NA given study design	NA given study design
Kang, 2011, South Korea ¹⁹	Transcranial direct current stimulation of left prefrontal cortex vs sham stimulation	Double-blinded, cross-over trial	NR; NR	Transcranial direct current stimulation (2 mA for 20 min)	In older adults group mean in days \pm SD: 145.54 \pm 72.03	1 session; 20 minutes	NR	Sham transcranial direct current stimulation (2 mA for 1 min)	1 session; 1 minute	NR	Yes
Inagawa, 2019, Japan ²⁰	Transcranial direct current stimulation vs sham stimulation	Primary single arm for safety, secondary a two-arm, parallel, randomized, and sham-controlled trial for potential efficacy	NR; 0% in intervention group, 7.69% in sham group	tDCS using battery-driven constant 1 \times 1 low-intensity (Model 1300A; Soterix Medical Inc., New York, NY, United States): delivers direct current through two saline-soaked surface sponge electrodes (35 cm ²) with a maximum output of 2 mA – “switch off allocation”	NR	2 sessions (20 minutes each session) per day; 5 consecutive days	NR: administrator was not blinded	tDCS using battery-driven constant 1 \times 1 low-intensity – “switch on allocation” for sham stimulation	2 sessions (60 seconds each session) per day; 5 consecutive days	NR, administrator was not blinded	Yes

FIM: Functional Independence Measure; **mA:** Milliampere; **MMSE:** Mini-Mental State Examination; **PM:** Prospective memory; **RCT:** Randomized Controlled Trial; **NA:** Not Applicable; **NR:** Not Reported; **TBI:** Traumatic Brain Injury; **TCR:** Therapist-Driven Cognitive Rehabilitation; **tDCS:** Transcranial Direct Current Stimulation; **SD:** Standard Deviation

APPENDIX S1 - TABLE S4. Study outcomes and results.

First Author, Year, Country	Study Description	Primary Outcome	Secondary Outcome	Outcome Assessment Frequency	Outcome Assessor (s)	Intervention Condition	Mean Cognitive Outcome Score – Intervention Group [Mean ± SD] or [Mean (95% CI)]	Comparator Condition	Mean TBI Cognitive Outcome Score – Comparator Group [Mean ± SD] or [Mean (95% CI)]
NON-PHARMACOLOGIC INTERVENTIONS									
Whitlock, 1992, United States ¹	Acute inpatient rehabilitation (before vs after)	Total FIM score, FIM subtotal scores and GOS	NR	Total FIM and FIM subtotal scores at discharge, GOS at 6- and 12-months post-injury	NR	NR	FIM score pre vs post intervention =18 vs 99; GOS 6 months = 4; GOS 12 months = 4	NA given study design	NA given study design
Cifu, 1996, United States ²	Comprehensive inpatient rehabilitation program (before vs after)	DRS, FIM, RLAS, LOS, acute care and rehabilitation charges, and discharge disposition	NR	T0: Admission T1: Discharge	NR	Comprehensive inpatient rehabilitation program: nursing, occupational therapy, psychiatry and other medical services, physical therapy, psychology and neuropsychology, recreation therapy, social services and speech-language pathology	Disability Rating Scale pre vs post intervention = 13.56 ± 4.77 vs 7.21 ± 4.09; FIM pre vs post intervention = 52.18 ± 25.44 vs 90.60 ± 27.55; RLAS pre vs post intervention = 5.17 ± 1.15 vs 6.40 ± 1.26	NA given study design	NA given study design
Prigatano, 1999, United States ³	Inpatient neuro-rehabilitation (before vs after)	Number of treatment goals attained, BNIS	NR	At admission and discharge	Staff clinical neuropsychologists or a post-doctoral fellow in clinical neuropsychology	Goal driven rehabilitation program: 3-5 rehabilitation goals were selected for patients from a list of 24 that was created by senior rehabilitation therapists trained in brain dysfunctional and spinal cord injured patients. Examples of	BNIS pre vs post intervention for those who did not achieve goals, Total = 9.10 ± 13.11 vs 16.98 ± 16.22; Speech/ Language Subscale: 6.96 ± 5.41 vs 9.49 ± 5.51; Orientation Subscale: 1.27 ± 1.22 vs 1.94 ± 1.20; Attention/ Concentration Subscale: 0.73 ± 0.90 vs 1.02 ± 0.94; Visual Spatial Subscale: 2.08 ± 2.03 vs 3.16 ± 2.36; Memory Subscale: 1.45 ± 1.86 vs 2.18 ± 1.99; Affect	NA given study design	NA given study design

						goals included ambulation with minimal assistance, independence in self-communication skills.	Subscale: 1.25 ± 1.25 vs 1.88 ± 1.32; Awareness Subscale: 0.20 ± 0.39 vs 0.22 ± 0.46		
De Guise, 2005, Canada ⁴	Integrated reality orientation program vs usual care	PTA duration	GCS score	Assessed daily for PTA until resolution	Occupational therapist	Integrated reality orientation program	Mean duration of PTA (days) = 18.4 ± 7.3 p-value = 0.19	Historical sample (before implementation of orientation program)	Mean duration of PTA (days): 23.0 ± 10.8 p-value = 0.19
Frankel, 2006, United States ⁵	Comprehensive inpatient rehabilitation program (before vs after)	Acute care LOS, inpatient rehabilitation LOS, admission and discharge FIM instrument and DRS scores, FIM and DRS efficiency, acute and rehabilitative charges, and discharge disposition	NR	T0: within 72 hours of admission; T1: at discharge from inpatient rehabilitation	Interdisciplinary team members; Data collected by experienced study clinicians and research assistants	Comprehensive inpatient rehabilitation program: nursing, occupational therapy, physiatry and other medical services, physical therapy, psychology and neuropsychology, recreation therapy, social services and speech-language pathology	Disability Rating Scale pre vs post intervention = 11.9 ± 5.3 vs 6.7 ± 3.8; FIM pre vs post intervention = 53.6 ± 23.1 vs 87.8 ± 23.8	NA given study design	NA given study design
Graham, 2010, United States ⁶	Inpatient rehabilitation program (before vs after)	LOS, Discharge FIM motor and cognitive ratings, discharge setting, and scheduled home health services at discharge	NR	Admission and discharge from inpatient rehabilitation	NR	NR	FIM cognitive subscale pre vs post intervention = 18.94 ± 7.77 vs 23.28 ± 7.35	NA given study design	NA given study design
Chen, 2011, United States ⁷	Goal-directed attention regulation training vs brief education	Attention and executive function domain: LNS from WAIS, Auditory	Learning and memory and motor speed of processing	T0: prior to intervention T1: after 5 weeks (end of first study)	NR	1st Half: mindfulness-based attention regulation + goal management strategies, 2 nd	Supplementary results tables not accessible; Goals training: 12/12 participants improved in	Didactic educational instruction on brain injury (causes, symptoms	Education: 7/12 participants improved in attention and executive domain tests

		Consonant Trigrams, DVT, DVFS, Trails B, Stroop Inhibition/ Switching		T2: after 5 weeks (end of second study)		Half: stepwise goal management and execution strategies	attention and executive function domain tests; p-value for goals training with more improved scores post-test <0.0001	and effects) and resources for assistance	
Burkard, 2014, Switzerland ⁸	Implementation intention training (before vs after)	Semi-ecological event-based PM tasks, GDBS, 1-item PM measure, standardized interview	HAD scale, SES, QoL-AD, MMSE, DRS, SRT	4 assessment sessions: 2 pre-tests at one-week intervals before the intervention, one post-test the week following the end of the intervention and a follow-up assessment five weeks later	2 neuropsychologists who had not taken part in the intervention sessions.	5 modules: 1- Psycho-educational introduction session, 2- Training the verbal component of implementation intentions, 3- Training the visual component of implementation intentions, 4- Controlled application of implementation intentions, 5- Generalization exercises	MMSE pre vs post intervention = 26.6 ± 2.1 vs 27.1 ± 2.5 p-value = 0.72 DRS pre vs post intervention = 134.3 ± 6.5 vs 136.1 ± 3.7 p-value = 0.95 SRT pre vs post intervention = 16.7 ± 4.7 vs 17.0 ± 5.8 p-value = 0.61 Ecological tasks pre vs post intervention = 6.1 ± 2.8 vs 6.8 ± 2.7 p-value = 0.61 PM-1 item pre vs post intervention = 58.9 ± 18.9 vs 53.4 ± 20.4 p-value = 0.58	NA given study design	NA given study design
Li, 2015, United States ⁹	Computer-based cognitive retraining (before vs after)	MoCA score (out of 30)	Medication-box sorting task score (out of 14)	T0: 2-3 weeks before; T1: 24 hours-1 week after intervention	1 investigator conducted all outcome assessments	8 modules of the Parrot Software (4 on attention, “visual instructions”, “attention perception and discrimination”, “concentration”, and “visual attention training” + 4 on memory, “remembering written directions”, “remembering	MoCA version 7.1 pre vs post intervention MoCA version 7.2 = + 3.25 ± 2.90 p-value = 0.03 Medication-box sorting task pre vs. post intervention = - 0.5 p-value = 0.3	NA given study design	NA given study design

						visual patterns”, “remembering written letters”, and “remembering written Numbers”); Each module had repetitive practice exercises with increasing difficulty			
Spagnolo, 2015, Italy ¹⁰	Cognitive stimulation (before vs after)	MMSE, IADL, ADL, GDS, NPI	NR	Prior and following intervention	Neuropsychologist	14 group meetings, each group is composed of 4 patients with their caregivers, conducting “3R” (reality orientation, reminiscence therapy and remotivation therapy)	Mean MMSE before vs after intervention: 21.5 ± 2.6 vs 22.3 ± 3.1 p-value before vs after adjustment to pharmacological therapy = 0.048 vs 0.377 ADL score: 4.7 ± 1.1 vs 5.0 ± 1.0 p-value before vs after adjustment to pharmacological therapy = 0.048 vs 0.231 IADL score before vs after intervention = 3.6 ± 2.0 vs 3.5 ± 1.8 p-value before vs after adjustment to pharmacological therapy = 0.6 vs 0.095	NA given study design	NA given study design
Howrey, 2017, United States ¹¹	Inpatient rehabilitation (before vs after)	FIM: Cognitive FIM and Motor FIM	Days from the date of injury to the date of admission to inpatient rehabilitation, length of stay in rehabilitation, days to follow up assessment	3 time points: 1-Admission to inpatient rehabilitation, 2-Discharge, 3-Follow-up (3-6 months)	Trained staff	10 inpatient rehabilitation centers for Medicare and Medicaid Services regions	FIM cognitive at admission vs discharge vs follow-up 17.00 ± 7.92 vs 24.06 ± 6.73 vs 31.14 ± 5.19 , p-value < 0.03	NA given study design	NA given study design

Hwang, 2019, Taiwan ¹²	Computerized cognitive training vs Tai Chi vs usual care	MDRS, MMSE, TICS-M, TMT	Handgrip strength, 5 sit-to-stands, balance, ADLs, disability, and depressive symptoms	At baseline, 6 months and 12 months	Blinded assessors	CCT: cognitive training program focused on 4 domains: 1- Attention, 2- Memory, 3- Speed of processing 4- Executive functioning	CCT: MDRS: 6-month change = 3.5 ± 7.0 ; 12-month = 2.5 ± 7.6 ; MMSE 6-month = 1.0 ± 1.8 , 12-month = 0.8 ± 2.4 ; TICS-M: 6-month = 2.8 ± 3.8 ; 12-month = 2.3 ± 4.8 ; TMT-A: 6-month = 0.3 ± 12.2 ; 12-month = 2.9 ± 22.4 ; TMT-B: 6-month = -7.0 ± 12.9 ; 12-month = -9.6 ± 19.0 ; p-value < 0.05 for CCT at 6 months on total MDRS, MDRS-memory, MMSE, TMT-B and GOSE and at 12 months for TMT-B and GOSE (with more important changes in scores); p-value < 0.05 for TC at 6 months on total MDRS, MDRS-conception, MMSE and at 12 months on total MDRS, MDRS-initiation/perseveration and GOSE.	Yang-style Tai Chi Usual care	TC: MDRS: 6-month change = 3.5 ± 6.8 ; 12-month = 4.2 ± 5.6 ; MMSE: 6-month = 0.8 ± 1.8 ; 12-month = 1.0 ± 2.4 ; TICS-M: 6-month = 1.8 ± 3.1 ; 12-month = 2.5 ± 4.0 ; TMT-A: 6-month = -2.8 ± 16.2 ; 12-month = -2.1 ± 16.8 ; TMT-B: 6-month = -7.4 ± 30.0 ; 12-month = -14.8 ± 37.1 ; UC: MDRS: 6-month = 0.0 ± 6.1 ; 12-month = 1.1 ± 8.1 ; MMSE: 6-month = 0.5 ± 2.4 ; 12-month = 0.2 ± 3.3 ; TICS-M: 6-month = 0.9 ± 4.9 ; 12-month = 0.5 ± 4.3 ; TMT-A: 6-month = 2.7 ± 20.5 ; 12-month = 1.2 ± 33.0 ; TMT-B: 6-month = 1.2 ± 34.0 ; 12-month = -1.0 ± 52.3 ;
Cisneros, 2021, Canada ¹³	Multimodal cognitive training vs usual care	Face-name association, Word list recall, Text memory measures, SEMQ, PGWBI	NR	T0: 1 week before intervention; T1: 1 week after intervention T2: 6 months after intervention	Blinded trained assessors not involved in intervention	Cognitive enrichment program: combination of General Planning Approach, Problem-Solving Method, Goal Management Training, and self-awareness strategies	Face-name association: $5.94 (3.78)$; p-value = 0.001 ; Word list recall: $8.18 (3.07)$; p-value = 0.448; Text memory measures $7.53 (3.37)$; p-value = 0.336; SEMQ: $2.83 (0.81)$; p-value = 0.003 ; PGWBI: $70.41 (20.79)$; p-value = 0.297	Usual care	Face-name association: $3.86 (3.39)$; Word list recall: $7.14 (2.64)$; Text memory measures: $8.40 (3.91)$; SEMQ: $2.33 (0.71)$; PGWBI: $84.17 (21.47)$
Cisneros, 2021, Canada ¹⁴	Multimodal cognitive training vs usual care	SET-A, D-KEFS Sorting test and Stroop four-color version, DEX, Similarities sub-test	NR	T0: 1 week before intervention; T1: 1 week after intervention T2: 6 months after intervention	Blinded trained assessors not involved in intervention	Cognitive enrichment program: combination of General Planning Approach, Problem-Solving Method, Goal Management Training, and self-awareness strategies	Six Elements Task-Adapted – total score: $1081.65 (346.53)$; p-value = 0.333 ; Sorting test: measure: $30.67 (10.82)$ p-value = 0.096; Stroop: $145.21 (30.13)$ p-value = 0.420; DEX: $0.25 (0.54)$ p-value = 0.049 ;	Usual care	Six Elements Task-Adapted – total score: $912.71 (306.91)$; Sorting test: measure: $41.47 (22.08)$; Stroop: $153.75 (54.33)$; DEX: $0.01 (0.68)$;

Oleszkiewicz, 2021, Germany ¹⁵	Intensive (higher frequency) olfactory intervention vs standard intensity olfactory intervention vs usual care	TDI, retro-nasal olfaction using grocery items, individual significance of olfaction, MoCA, COWAT, SFT, BDI, PANAS	NR	T0: baseline measures T1: 2 months of interventions (with change of odors at 1 month) No reported follow-up times	NR	Intensive olfactory training: sniffing odors at frequency of four times per day via electrical odor dispenser; Odors are chosen based on 1) pleasantness of the odors, 2) presence of slight trigeminal activation in some of the odors, e.g., peppermint, 3) evaporation characteristics, so that the odors would last for the duration of the experiment, 4) technical issues mostly in terms of compatibility with the odor cartridge, 5) availability, and 6) inspiration from the previous studies	Results provided by authors for the older adult involved in the study: MoCA = 27; SFT = 25; PFT = 30; OT done 4 times a day did not change the scores	Standard olfactory training: sniffing odors at frequency of twice times per day; Usual care (no intervention)	Compared to usual care (no intervention) - Results provided by authors for the older adult involved in the study: MoCA = 26; SFT = 22; PFT = 20
Kim, 2021, South Korea ¹⁶	Therapist-driven cognitive training vs computerized cognitive training	Digit span backward, TMT-B, and COWAT (PFT and SFT)	MMSE, MoCA, MBI, DSC, DSF, SS	T0: time of enrollment; T1: end of treatment sessions	Blinded assessors	Manual tabletop activities that were designed to improve multiple neurocognitive domains including attention and executive functions, therapists were allowed to intervene initiatively to any extent during the session in accordance with	DSB: 3.0±1.0 – p-value pre vs post-intervention = 0.635; TMT-B: 126.9±114.5 – p-value = 0.016 ; DSF: 5.4±1.4 – p-value = 0.437; TMT-A: 56.4±72.1 – p-value = 0.002 ; SS: 11.4±8.9 – p-value = 0.064; DSC: 21.6±16.6 – p-value = 0.082; SFT: 11.9±4.8 – p-value = 0.001 ; PFT : 5.1±3.3 – p-value = 0.004 ; MMSE: 25.1±4.1 – p-value = 0.004 ; MoCA: 19.3±5.1 – p-value = 0.003 ; MBI: 52.6±17.1 – p-value <0.001	RehaCom computer cognitive training program	DSB: 3.3±1.4 – p-value pre vs post-intervention = 0.625; TMT-B: 184.0±130.7 – p-value = 0.016 ; DSF: 5.6±1.1 – p-value = 10; TMT-A: 95.1±113.3 – p-value = 0.005 ; SS: 8.6±10.0 – p-value = 0.023 ; DSC: 23.6±24.4 – p-value = 0.002 ; SFT: 10.6±6.5 – p-value = 0.102; PFT: 5.5±4.5 – p-value = 0.221; MMSE: 24.2±4.3 – p-value = 0.000 ; MoCA: 17.8±5.6 – p-value = 0.006 ; MBI: 46.7±19.4 – p-value <0.001 ;

						occupational and cognitive remediation principles and theories			TCR vs. CCR: p-value = 0.013 for PFT
PHARMACOLOGIC INTERVENTIONS									
Chiu, 2015 Taiwan ¹⁷	Hypnotics (benzodiazepines and non-benzodiazepines sleeping aids) use vs no use	Dementia diagnosis	NR	T0: at TBI diagnosis T1: 1st to 9th year of follow up	NA	Hypnotics: benzodiazepines and non-benzodiazepines	Adjusted HR: 3.98 (2.44–6.47) p-value <0.001 for lower dementia-free survival rates in groups who used hypnotics vs. control group	No hypnotics	Reference
SURGICAL AND NON-SURGICAL NEUROMODULATION INTERVENTIONS									
Ishikawa, 2002, Japan ¹⁸	Burr hole irrigation vs usual care	ADL, MMSE HDS-R, hematoma volume (ml), thickness (mm), and midline shift (mm)	NR	T0: Admission T1: 2 weeks after surgery	NR	Burr hole irrigation with closed system drainage	MMSE pre→post: 15.54 ± 9.87→ 21.31 ± 9.55, p-value = 0.0002 ; HDS-R: 14.23 ± 9.1→ 20 ± 9.8, p-value = 0.0008 ; ADL: 3.15 ± 2.11 → 2.04 ± 1.95, p-value = 0.0026	NA given study design	NA given study design
Kang, 2011, South Korea ¹⁹	Transcranial direct current stimulation of the left prefrontal cortex vs sham stimulation	CCRTT, self-perceived level of attention, fatigue, task difficulty, and sleep quality	NR	T0: pre-intervention; T1: 3 hours after intervention; T2: 24 hours after intervention	NR	1 Session of transcranial direct current stimulation (2 mA for 20 min) of left dorsolateral prefrontal cortex	Self-perceived attention: pre →post: 6.7 ± 1.2→6.6 ± 1.3; Fatigue: 4.6 ± 1.1→6.1 ± 1.2; Task difficulty: NR→6.1 ± 1.1; Sleep quality: 6.6 ± 1.2→NR; Mean reaction time: 1,200.1 ± 223.0 ms →1,001.7 ± 200.8 ms (87.3 ± 7.8% relative to baseline), p-value = 0.056	1 Session of sham transcranial direct current stimulation (2 mA for 1 min)	Self-perceived attention: pre →post: 7.1 ± 1.0→7.0 ± 0.7; Fatigue: 6.1 ± 1.2→ 5.1 ± 1.0; Task difficulty: NR→ 5.6 ± 0.8; Sleep quality: 8.0 ± 0.6→NR; Mean reaction time: 955.7±114.7ms → 1,100.4 ± 148.5 ms (122.4 ± 715.5% relative to baseline)
Inagawa, 2019, Japan ²⁰	Transcranial direct current stimulation vs sham stimulation	Attrition rate (expected <10%)	MMSE, ADAS-Cog, FAB, CDR-J	T0: before intervention; T1: immediately after intervention; T2: 2 weeks after intervention	Assessors blinded to group assignment	Transcranial direct current stimulation (anodal; F3, cathodal, Fp2, 2A, 20 minutes) + 20 minutes of cognitive intervention (calculation and reading tasks)	Immediately after: MMSE = 0.41 (-1.85-2.67), p = 0.705; 2 weeks after: MMSE = 1.08 (1.31- 3.46), p = 0.352; Immediately after: ADAS-Cog scores = -1.61 (-3.19- 2.47), p = 0.205; 2 weeks after: ADAS-Cog = -0.36 (-3.19- 2.47), p = 0.791; Immediately after intervention: FAB = -2.27 (-6.17-1.63), p = 0.233; 2 weeks after: FAB = -3.01 (-6.46-0.45), p = 0.083; 2	Transcranial direct current stimulation (anodal; F3, cathodal, Fp2, 2A, 60 seconds) + 20 minutes of cognitive intervention (calculation and reading tasks)	Reference

							weeks after CDR = 0.06 (-0.09-0.22), p = 0.404		
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ADAS-Cog: Alzheimer’s Disease Assessment Scale–Cognitive Subscale; **BDI:** Beck Depression Inventory; **BNIS:** Barrow Neurological Institute Screen for Higher Cerebral Functions; **CCR:** Computerized Cognitive Rehabilitation; **CCRTT:** Computerized Contrast Reaction Time Task; **CCT:** Computerized Cognitive Training; **CDR-J:** Clinical Dementia Rating-Japanese version; **COWAT:** Controlled Oral Word Association Test; **DRS:** Dementia Rating Scale; **DSC:** Digit Symbol Coding; **DSF:** Digit Span Forward; **DVT:** Digit Vigilance Test; **FAB:** Frontal Assessment Battery; **FIM:** Functional Independence Measure; **GDBS:** Goal Directed Behaviour Scale; **GDS:** Geriatric Depression Scale; **GOS:** Glasgow Outcome Scale; **HAD:** Hospital Anxiety and Depression Scale; **HDS-R:** Hasegawa Dementia Scale–Revised; **LOS:** Length of Stay; **LNS:** Letter Number Sequencing; **MBI:** Modified Barthel Index; **NA:** Not Applicable; **NR:** Not Reported; **NPI:** Neuropsychiatric Inventory; **MDRS:** Mattis Dementia Rating Scale; **MMSE:** Mini-Mental State Examination; **PFT:** Phonemic Fluency Test; **PGWBI:** Psychological General Well-Being Index; **QoL-AD:** Quality of Life in Alzheimer’s Disease; **PANAS:** Positive and Negative Affect Schedule; **PM:** Prospective memory; **SD:** Standard Deviation; **SES:** Self-Esteem Scale; **RLAS:** Rancho Los Amigos Levels of Cognitive Functioning Scale; **SEMQ:** Self-Evaluation Memory Questionnaire; **SFT:** Semantic fluency test; **SRT:** Selective Reminding Test; **SS:** Symbol Searching; **TC:** Tai Chi; **TCR:** Therapist-Driven Cognitive Rehabilitation; **TICS-M:** Telephone Interview for Cognitive Status; **TMT:** Trail Making Test; **WAIS:** Wechsler Adult Intelligence Scale

APPENDIX S1 – TABLE S5. Other study outcomes and results.

First Author, Year, Country	Study Description	Loss of Follow-Up	Confounders (Between Group Differences in TBI Cognitive Outcome)	Association Between SDoH, Access to Cognitive Intervention and Outcomes	Safety Issues and Adverse Effects	Costs Data
NON-PHARMACOLOGIC INTERVENTIONS						
Whitlock, 1992, United States ¹	Acute inpatient rehabilitation (before vs after)	None	Exposure to medications with psychoactive effects	NR	NR	NR
Cifu, 1996, United States ²	Comprehensive inpatient rehabilitation program (before vs after)	NR	NR	Comparison between younger and older adults, not within older adults’ group	NR	Acute care (mean ± SD): Daily = 2743.27 ± 1439.20; Total=78188.86 ± 70743.68 Acute care daily range: 949.77-6681.40 Acute care total range: 6155.00-349957.00 Acute care LOS (mean ± SD) in days: 33.40 ± 35.66; range: 4-201 Rehabilitation: Daily = 1066.74 ± 296.22; Total = 55026 ± 40603 Rehabilitation daily range: 357.98-1937.41 Rehabilitation total range: 9906.00-221966.00 Rehabilitation LOS (mean ± SD) in days: 55.98 ± 48.99; range: 11-237
Prigatano, 1999,	Inpatient neuro-rehabilitation (before vs after)	NA due to study design	NR	NR	NR	NR

United States ³						
De Guise, 2005, Canada ⁴	Integrated reality orientation program vs usual care	NR	NR	NR	NR	NR
Frankel, 2006, United States ⁵	Comprehensive inpatient rehabilitation program (before vs after)	NR	NR	Comparison between younger and older adults, not within older adults' group	NR	Acute care (mean ± SD) in thousands of USD: Daily = 4.8±2.7; Total = 95±114; LOS (mean ± SD) in days: 18.8±17.3 Rehabilitation in thousands of USD: Daily = 1.5±.56; Total = 40±34 LOS: 27.2±21.9
Graham, 2010, United States ⁶	Inpatient rehabilitation program (before vs after)	NR	NR	Differences in outcomes by sex: Women - FIM cognitive subscale pre vs post intervention = 19.90 ± 7.66 vs 23.98 ± 7.15; Men - FIM cognitive subscale pre vs post intervention = 18.08 ± 7.78 vs 22.67 ± 7.47	NR	NR
Chen, 2011, United States ⁷	Goal-directed attention regulation training vs brief education	None	NR		NR	NR
Burkard, 2014, Switzerland ⁸	Implementation intention training (before vs after)	2 (1 drop-out during intervention and 1 drop-out after the post-test)	NR		NR	"The group sessions made the intervention more advantageous in terms of costs (cost-sharing for the participants) and of clinicians' availability (for the institution)."
Li, 2015, United States ⁹	Computer-based cognitive retraining (before vs after)	1 participant	NR		NR	"Low costs" for the Parrot CBCR program

Spagnolo, 2015, Italy ¹⁰	Cognitive stimulation (before vs after)	None	Treatment with anticholinesterase or NMDA receptor antagonist drugs		NR	NR
Howrey, 2017, United States ¹¹	Inpatient rehabilitation (before vs after)	None	Potential factors that are unmeasured: social support, differences in physical environment		NR	NR
Hwang, 2019, Taiwan ¹²	Computerized cognitive training vs Tai Chi vs usual care	25	Social intervention as study nurse visited participants every week in CCT and TC groups vs every 2 weeks in UC group		NR	NR
Cisneros, 2021, Canada ¹³	Multimodal cognitive training vs usual care	10	NR		NR	NR
Cisneros, 2021, Canada ¹⁴	Multimodal cognitive training vs usual care	10	NR		NR	NR
Oleszkiewicz, 2021, Germany ¹⁵	Intensive (higher frequency) olfactory intervention vs standard intensity olfactory intervention	2 (1 with post-viral olfactory loss and 1 post-traumatic olfactory loss): not able to acquire olfactory performance measurements	Duration of OT training and participants' age		NR	NR
Kim, 2021, South Korea ¹⁶	Therapist-driven cognitive rehabilitation vs computerized cognitive rehabilitation	3	NR		NR	NR
PHARMACOLOGIC INTERVENTIONS						
Chiu, 2015 Taiwan ¹⁷	Hypnotics (benzodiazepines and non-benzodiazepines sleeping aids) use vs no use	NA	Age, sex, comorbidities (DM, hypertension, hyperlipidemia, and stroke), ICU admission, number of visits to ED and use of NSAIDs or antidepressants		NR	NR
SURGICAL AND NON-SURGICAL NEUROMODULATION INTERVENTIONS						
Ishikawa, 2002, Japan ¹⁸	Burr hole irrigation vs usual care	0	NR		NR	NR
Kang, 2011, South Korea ¹⁹	Transcranial direct current stimulation of the left prefrontal cortex vs sham stimulation	0	NR		No adverse events; only included closed head injury patients	NR
Inagawa, 2019, Japan ²⁰	Transcranial direct current stimulation vs sham stimulation	1 in control group	NR		No severe adverse events, no need for medications	NR

					caused by adverse events; Mild reaction such as headache, neck pain and burning sensation that are not statistically different between intervention and control group	
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CBCR: Computer-Based Cognitive Retraining; **CCT:** Computerized Cognitive Training; **DM:** Diabetes Mellitus; **ED:** Emergency Department; **ICU:** Intensive Care Unit; **LOS:** Length of Stay; **NR:** Not Reported; **NSAIDs:** Non-Steroidal Anti-Inflammatory Drugs; **SD:** Standard Deviation; **TC:** Tai Chi; **USD:** United States Dollar

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APPENDIX S2. Preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews (PRISMA-ScR) checklist

Section	Item	PRISMA-ScR checklist item	Reported on page #
Title			
Title	1	Identify the report as a scoping review.	1
Abstract			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility	2

Section	Item	PRISMA-ScR checklist item	Reported on page #
		criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	
Introduction			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	3
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	3,4
Methods			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a web address); and if available, provide registration information, including the registration number.	4
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	4,5
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	4
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	4, Appendix 3
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	5
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was	5

Section	Item	PRISMA-ScR checklist item	Reported on page #
		done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	5
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	not applicable
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	5
Results			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	6, figure 1
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	6
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	not applicable
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	7,8
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	7,8
Discussion			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	8,9
Limitations	20	Discuss the limitations of the scoping review process.	10

Section	Item	PRISMA-ScR checklist item	Reported on page #
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	10
Funding			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	see declaration of sources of funding

Jbi = joanna briggs institute; prisma-scr = preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews.

* where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and web sites.

† a more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ the frameworks by arksey and o'malley (6) and levac and colleagues (7) and the jbi guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ the process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: tricco ac, lillie e, zarin w, o'brien kk, colquhoun h, levac d, et al. Prisma extension for scoping reviews (prismascr): checklist and explanation. *Ann intern med.* 2018;169:467–473. [31,47,47

APPENDIX S3. Sex and gender equity in research

Recommendations per section of the article		Page #
Title and abstract	If only one sex is included in the study, or if the results of the study are to be applied to only one sex or gender, the title and the abstract should specify the sex of animals or any cells, tissues and other material derived from these and the sex and gender of human participants.	N/a, all genders Included
Introduction	Authors should report, where relevant, whether sex and/or gender differences may be expected.	4
Methods	Authors should report how sex and gender were taken into account in the design of the study, whether they ensured adequate representation of males and females, and justify the reasons for any exclusion of males or females.	5
Results	Where appropriate, data should be routinely presented disaggregated by sex and gender. Sex- and gender-based analyses should be reported regardless of positive or negative outcome. In clinical trials, data on withdrawals and dropouts should also be reported disaggregated by sex.	6
Discussion	The potential implications of sex and gender on the study results and analyses should be discussed. If a sex and gender analysis was not conducted, the rationale should be given. Authors should further discuss the implications of the lack of such analysis on the interpretation of the results.	9

APPENDIX S4. Medline search strategy

Ovid medline: epub ahead of print, in-process & other non-indexed citations, ovid medline® daily and ovid medline® <1946-present>

- 1 exp brain hemorrhage, traumatic/ or exp brain injuries, traumatic/ or exp intracranial hemorrhage, traumatic/ 35870
- 2 brain concussion/ or contrecoup injury/ or post-concussion syndrome/ or head injuries, penetrating/ or intracranial hemorrhage, traumatic/ or brain hemorrhage, traumatic/ or brain stem hemorrhage, traumatic/ or cerebral hemorrhage, traumatic/ or hematoma, epidural, cranial/ or hematoma, subdural/ or hematoma, subdural, acute/ or hematoma, subdural, chronic/ or hematoma, subdural, intracranial/ or subarachnoid hemorrhage, traumatic/ or skull fractures/ or skull fracture, basilar/ or skull fracture, depressed/ [****mesh terms****] 35847
- 3 (trauma* adj (head or brain or "intra-cranial*" or "intra cranial*" or intracranial* or "extra dural*" or "extra-dural*" or extradural* or "epi-dural*" or "epi dural*" or epidural* or "sub-dural*" or subdural* or "sub-arachnoid*" or "sub arachnoid*" or subarachnoid* or "diffuse axonal") adj2 (injur* or damage* or trauma*)).ti,ab,kf. 50341
- 4 (tbi* or dai*).ti,ab,kf. 715929
- 5 or/1-4 [****tbi terms****] 770394
- 6 exp "aged, 80 and over"/ or exp aged/ 3429512
- 7 exp aging/ or exp cognitive aging/ 288443
- 8 exp geriatrics/ 31320
- 9 (geriatric* or elder* or older* or ageing or aging or senior* or older adult* or retired or retiree* or elder* or pensioner* or nursing home* or older people or older patient* or gerontology or sexagenarian* or septuagenarian* or octogenarian or nonagenarian* or centenarian* or sixties or seventies or eighties or nineties).kf,tw. 1080052
- 10 6 or 7 or 8 or 9 [****age restriction to older adults****] 4098518
- 11 limit 5 to "all aged (65 and over)" or (5 and 10) 172877
- 12 exp delirium/ or exp dementia/ or exp cognition disorders/ 284011
- 13 cognition/ or awareness/ or cognitive dissonance/ or cognitive reserve/ or comprehension/ or consciousness/ or metacognition/ or rumination, cognitive/ or executive function/ or higher nervous activity/ or intention/ or learning/ or association/ or association learning/ or avoidance learning/ or memory/ or deja vu/ or memory, episodic/ or memory, long-term/ or memory consolidation/ or memory, short-term/ or mental recall/ or recognition, psychology/ or repetition priming/ or retention, psychology/ or spatial memory/ or neurolinguistic programming/ or probability learning/ or problem-based learning/ or problem solving/ or heuristics/ or spatial learning/ or maze learning/ or elevated plus maze test/ or morris water maze test/ or open field test/ or verbal learning/ or paired-associate learning/ or serial learning/ or thinking/ or concept formation/ or creativity/ or decision making/ or consensus/ or judgment/ or neurocognitive disorders/ or amnesia/ or amnesia, anterograde/ or amnesia, retrograde/ or amnesia, transient global/ or cognition disorders/ or cognitive dysfunction/ or postoperative cognitive complications/ or delirium/ or emergence delirium/ or dementia/ or alzheimer disease/ or dementia, vascular/ or dementia, multi-infarct/ or diffuse neurofibrillary tangles with calcification/ or frontotemporal lobar degeneration/ or frontotemporal dementia/ or lewy body disease/ 823683

14 12 or 13 846887
15 11 and 14 13981
16 exp rehabilitation/ 346632
17 cognitive behavioral therapy/ or "acceptance and commitment therapy"/ or cognitive restructuring/ or mindfulness/35397
18 (compensatory adj2 (skill* or strateg*) adj2 (train* or educat* or learn* or therap*)).ti,ab,kf. 95
19 (metacognitive adj2 (skill* or strateg*) adj2 (train* or educat* or learn* or therap*)).ti,ab,kf. 76
20 ("attention process train*" or "memory train*" or "problem-solving train*" or "problem solving train*" or "goal management train*" or "language train*" or "communication train*" or "computer assisted train*" or "lee silverman voice treatment" or "vision restoration therap*" or "family therap*" or "noninvasive brain stimulation" or "neuropsychological rehab*").tw,kf. 9057
21 16 or 17 or 18 or 19 or 20 or 20 386835
22 15 and 21 5284
23 (dh or th).fs. 2142807
24 15 and 23 1592
25 23 or 24 6179
26 (randomised controlled trial or controlled clinical trial).pt. Or (randomised or placebo or randomly).ab. Or clinical trials as topic/ or trial.ti. 1494138
27 (25 and 26) not (exp animals/ not humans.sh.) 1206
28 exp cohort studies/ or exp epidemiologic studies/ or exp clinical trial/ or exp evaluation studies as topic/ or exp statistics as topic/ 6453321
29 ((control and (group* or study)) or (time and factors) or program or survey* or ci or cohort or comparative stud* or evaluation studies or follow-up*).mp. 8384890
30 or/28-29 11050625
31 (animals/ not humans/) or comment/ or editorial/ or exp review/ or meta analysis/ or consensus/ or exp guideline/ 9471750
32 hi.fs. Or case report.mp. 692398
33 or/31-32 10072932
34 32 not 33 8615844
35 25 and 34 4786
36 27 or 35 4920

APPENDIX S5. Grey literature search

Agency	Strategy (if relevant)	Number screened
Alberta college of family physicians		40
Alberta health and wellness	Searched "brain injury", "traumatic brain injury", and "concussion separately	142
Cadth	Searched "brain injury" and "concussion" separately	325
Dsen	Searched "brain injury" and "concussion" separately	101
Health quality council of alberta		36
Health quality ontario	Searched "brain injury" and "concussion" separately	493
The hospital for sick kids	Not relevant	
Inesss	Searched "brain injury", "concussion", "lésion cérébrale" and "commotion cérébrale" separately	3
Institute of health economics	Searched "brain injury" and "concussion" separately	4
Manitoba centre for health policy	All reports	Nr
Mcgill health university centre	All reports and works in progress	Nr
Nlcahr	All reports and current projects	Nr
Ottawa hospital research institute	Unable to screen, no longer updated	Nr
Programs for assessment of technology in health (canada)	Selected projects page	Nr
Therapeutics initiative	Searched "brain injury" and "concussion" separately	36
Ubc centre for helth services and policy research	Aging and end-of-life subtopic	Nr
Inahta secretariat	Searched "brain injury" and "concussion" separately	77
World health organization europe	Searched "brain injury" and "concussion" separately in search and data	3

Australian government department of health and ageing	Searched "brain injury" and "concussion" separately	Nr
Australian government department of health and ageing. Medical services advisory committee	Searched "brain injury" and "concussion" separately	40
Joanna briggs institute (no access to jbi database via gerstein)	Searched "brain injury" and "concussion" separately	6
Jbi evidence synthesis	Searched "brain injury" and "concussion" separately	165
Monash health centre for clinical effectiveness	Publications (2015-2020 evidence syntheses available)	Nr
National prescribing service	Searched "brain injury" and "concussion" separately	0
Queensland government. Health technology reference group	Link no longer works	
Institute of technology assessment (austria)	Browsed subjects and projects	0
Austrian institute for health technology assessment	Searched "brain injury" and "concussion" separately	93
Kenniscentrum voor de gezondheidszorg / le centre d'expertise des soins de santé. Belgian health care	Searched "brain injury" and "concussion" separately	10

knowledge centre (kce)		
Sundhedsstyrelsen. Danish health and medicines authority (dhma).	Searched "brain injury" and "concussion" separately	44
The committee for evaluation and dissemination of innovative technologies (cedit)	Searched "brain injury" and "concussion" separately	3
Haute autorite de sante (has)	Searched "brain injury" and "concussion" separately disease and conditions in publications	4
Deutsches institut für medizinische dokumentation und information.	Searched "brain injury" and "concussion" separately	3
Health information and quality authority, ireland	Searched "brain injury" and "concussion" separately	6
Health service executive. Irish health repository (lenus)	Searched "brain injury" and "concussion" separately	1127
De gezondheidsraad (gr). Health council of the netherlands	Searched "brain injury" and "concussion" separately	32
Zorginstituut nederland. National health care institute netherlands	Searched "brain injury" and "concussion" separately	2
Agencia de evaluación de tecnologías sanitarias (aets)	Searched "concusión" and " daño cerebral"	68
Agència de qualitat i avaluació sanitàries de catalunya (aquas).	Publications in mental health and neurology	Nr

Sahlgrenska university hospital	Unable to search unable to find reports summary page	0
Swedish council on health technology assessment (sbu).	Publications page, include >=5 years	377
Healthcare improvement scotland	Searched "brain injury" and "concussion" separately	9
National institute for health and care excellence	Searched "brain injury" and "concussion" separately	113
National institute for health research. (nih). Innovation observatory	Searched "brain injury" and "concussion" separately	8
Nhs purchasing and supply agency	Not relevant	
Nihr evaluation, trials and studies coordinating centre	Searched "brain injury" and "concussion" separately	314
International resources for infection control	Searched "brain injury" and "concussion" separately	0
Nhs england	Searched "brain injury" and "concussion" separately	23
Ahrq evidence reports and collection	Searched "brain injury" and "concussion" separately	162
Centers for medicare & medicaid services	Searched "brain injury" and "concussion" separately	0
Ecri	Searched "brain injury" and "concussion" separately	59
Icer	Searched "brain injury" and "concussion" separately	0
Washington state health care authority	Searched "brain injury" and "concussion" separately	388
Hospital for sick kids	Not relevant	
Centre for health economics and policy analysis	Searched "brain injury" and "concussion" separately	2

Phac	Searched "concussion + adult" and "traumatic brain injury + adult"	566
Theta collaborative	Searched "brain injury" and "concussion" separately	0
Australian government department of health. Pharmaceutical benefits scheme - medicine listing (pbs)	Not relevant	
Federal reserve bank of st. Louis	Searched "brain injury and adult" and "concussion" separately	213
National centre for pharmacoeconomics	Searched "brain injury" and "concussion" separately	0
Nhs economic evaluation database (eed)	Searched "brain injury" and "concussion" separately	Nr
University of aberdeen health economics research unit	Reports and publications	Nr
Alberta medical association cpg	Searched "brain injury" and "concussion" separately	5
Bc ministry of health cpg	Topic reports	Nr
Cma cpg	No longer includes clinical tools/services	

Canadian partnership against cancer	Not relevant	
Canadian standards association	Not relevant	
Cpso practice guidelines	Not relevant	
Ontario association of medical laboratories	Searched "brain injury" and "concussion" separately	0
Registered nurses' association of ontario	Searched "brain injury" and "concussion" separately	1
University of ottawa school of rehabilitation science guidelines	Page does not exist	
Winnipeg regional health authority informed practice tools	Searched "brain injury" and "concussion" separately	0
Academic of medicine of malaysia	General guidelines	Nr
Aetna inc. Clinical policy bulletins	Alphabetical listing	Nr
American asociation for clinical chemistry	Precision medicine, not relevant	
Best practice advocacy centre new zealand best practice	Searched "brain injury" and "concussion" separately	15
Cdc public health genomics database	Not relevant	
The regulation and quality authority rqia guidelines	Searched "brain injury" and "concussion" separately	1
Isci guidelines	Guidelines page	Nr
Ecri guidelines trust	Searched "brain injury" and "concussion" separately	Nr
National health and medical research council guidelines	Searched "brain injury" and "concussion" separately	Nr

Nice guidelines	Searched "brain injury" and "concussion" separately	67
Sign guidelines	Searched "brain injury" and "concussion" separately	Nr
Health canada drug and device database	Not relevant	
Australia government department of health. Pharmaceutical benefits scheme	Already searched	
Department of health (uk) medicines and healthcare products	Not relevant	
European medicines agency	Searched "brain injury" and "concussion" separately	9
Nhs scotland medicines consortium	Not relevant	
Pharmaceutical management agency of new zealand	Not relevant	
Us food and drug administration fda	Not relevant	
Canadian pharmacists association e-therapeutics	Cannot be accessed	
Health canada advisories and warnings	Not relevant	
Australian government department of health therapeutic goods administration, advisories and warnings	Not relevant	

European medicines agency, adverse drug reaction	Not relevant	
Medicines and healthcare products regulatory agency, drug safety	Not relevant	
Nhs england patient safety domain patient safety alerts	Not relevant	
New zealand medicines and medical safety authority medsafe	Not relevant	
Us food and drug administration device and adverse event report	Not relevant	
Department of veterans affairs pharmacy benefits management services	Not relevant	
Oregon health & science university center for evidence-based policy: drug effectiveness review	Not relevant	
Saskatoon health region. Rxfiles	Not relevant	

Biomed central, isrctn registry	Searched "brain injury and adult" and "concussion" separately	233
Canadian partnership against cancer corporation trial registry	Not relevant	
National institute of medical statistics, indian council of medical research, clinical trials registry	Searched "brain injury and adult" and "concussion" separately (prospective, interventional)	0

Thomson centerwatch clinical trials listing service	Searched "brain injury and adult" and "concussion" separately applied minimum age 50	238
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Us national institutes of health, clinical trials	Search concussion with cognitive intervention and brain injury + cognitive intervention; applied age 50-100, completed or unknown status	283
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Uk department of health study portfolio	Unable to access registry	0
International clinical trials registry (who)	Searched "concussion" and (brain injury and adult broke the search)	91
Government of canada prescription drug coverage	Not relevant	
Canadian physician fee schedules	Not relevant	
Bandolier knowledge database	Searched "brain injury" and "concussion" separately	38
Health statistics	Not relevant	

United states environmental protection agency	Not relevant	
Alternative medicine foundation	Not relevant	
Memoria sloan-kettering cancer center	Not relevant	
Dentistry	Not relevant	
Diagnostic tests	Not relevant	
Substance abuse & mental services administration	Searched in publications (concussion and brain injury)	1
Centre of evidence-based physiotherapy	Searched "brain injury" and "concussion" separately	69
National rehabilitation information center	Searched "brain injury containing adult" and "concussion" separately	286
University of queensland otseeker	Searched "brain injury containing adult" and "concussion" separately	21

APPENDIX S6. Pre-tested data charting form

Publication characteristics

Publication Characteristics				
Author	Title	Year of Publication	Country of Origin	Journal

Study and participant characteristics

Study Characteristics													
Setting	Study Design	Total sample size	Number of patients with TBI/non TBI	Inclusion Criteria	Exclusion Criteria	Mean age of participants			Number of Older adults	Number of Males	Number of Females	Baseline type of cognitive impairment (if present)	Baseline cognitive score or performance
Comorbidities		Frailty score	Participant place of residence	Race/ethnicity/culture	Immigration status	Occupation	Religion	Language	Education	Socioeconomic status	Participant social capital (e.g., do the participants have caregiver(s))	Other reported social determinant of health characteristics	Comparison Group Intervention

Traumatic brain injury characteristics

TBI Characteristics					
TBI Severity	Time since injury	Mechanism of injury	PTA/TBI related delirium screening tool/cognitive screening tool	TBI biomarkers	Intervention type

Intervention characteristics

Intervention Characteristics								
Intervention Description			Intervention duration	Intervention frequency	Intervention timing	Intervention delivery		
Pharmacological Intervention			Nonpharmacological intervention		Intervention Implementation			
Dosage	Route	Frequency	Strategy Used (e.g., metacognitive training, compensatory strategy training)	Individual(s) needed to administer intervention (e.g., physicians, OT, PT)	Additional resources needed to administer intervention	Costs of intervention	Source of costs	Method of economic data collection

Study participant attrition and outcomes

Study Participant Attrition						
Patient dropouts (#)	Patient deaths (#)	Non-adherence (#)	Data Collection Time Points	Primary outcomes assessed (e.g., ADLs, IADLs)	Secondary outcomes assessed (e.g., QoL)	Outcome Assessment Tool (e.g., MMSE, MoCA, ADAS-Cog; attention)
Outcomes						
Baseline scores based on tool used			Discharge scores based on tool used		Adverse Events	Length of stay in setting of intervention (e.g., hospital length of stay)

Access/implementation considerations

Implementation Considerations					
Adverse Events	Length of stay in setting of intervention (e.g., hospital length of stay)	Barriers to Intervention Implementation	Facilitators to intervention implementation	Study Limitations	Notes

