MAJOR RESEARCH PROJECT

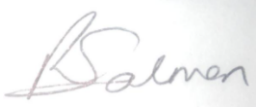
LITERATURE REVIEW: What is the Efficacy of Cognitive Rehabilitation Interventions for Executive Function in Traumatic Brain Injury (TBI)? A Systematic Review

EMPIRICAL PAPER: A Cognitive Intervention for Everyday Executive Function in Female Survivors of Intimate Partner Violence Related Traumatic Brain Injury, A Single-Case Experimental Design (SCED)

Submitted by Ruth Salmon to the University of Exeter

as a thesis for the degree of Doctor of Clinical Psychology, May 2023.

I certify that all material in this thesis which is not my own work has been identified and that any material that has previously been submitted and approved for the award of a degree by this or any other University has been acknowledged.

Signature: 

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Glossary

Term	Definition
Acute Care	A branch of healthcare where a patient received active treatment for a short-term severe episode of illness.
Attention Deficit Hyperactivity Disorder (ADHD)	A condition where the individual experiences behavioural challenges such as ongoing inattention and/or hyperactivity or impulsivity, interfering with everyday functioning.
Assisted Intention Monitoring (AIM)	An intervention approach developed by Gracey et al., (2017) involving a brief version of Goal Management Training.
Autopilot	The ability to perform every day, routine tasks automatically, without thinking.
Backwards Chaining	Searching through the references of articles included within the systematic review to find other relevant material.
Behaviour Rating Inventory of Executive Function- Adult Version (BRIEF-A)	A self and other report questionnaire of executive function for adult populations.
Barrier	A concept executive function coaching relating to challenges that get in the way of reaching individual goals.
Bridge	A concept in executive function coaching relating to strengths and skills an individual has to overcome specific barriers to achieving their goals.
Clinically Significant Change	A change in scores on a standardised outcome measure from below to above a specific, pre-defined threshold where scores below the threshold indicate dysfunction.
Cognitive Orientation to Occupational Performance (CO-OP)	An individualised cognitive rehabilitation approach aimed at occupational performance, guiding clients to learn self-instruction, to identify parts of performance that are incorrect and to create and execute plans to correct performance.
Cognitive Rehabilitation	The systematic delivery of a functional intervention, based on the understanding of underlying brain-behaviour impairments.

Compensatory Cognitive Training (CCT)	A manualised training approach designed by Storzbach et al., (2016) employing compensatory cognitive rehabilitation strategies.
Concussion	Temporary unconsciousness or confusion following a head injury.
Construct-Driven Outcome Measure	Cognitive outcome measures that assess specific areas of function.
Constructionism	An epistemological view that knowledge is constructed by the scientific community.
Critical Realism	An ontology distinguishing the 'real' from the 'observable' world, where the 'real' world cannot be directly observed and exists independently from human perceptions and constructions.
Epistemology	Theories of knowledge and the way in which knowledge is constructed.
Errorless Learning	A method of learning that involves preventing individuals from giving wrong answers.
Executive Function (EF)	A collection of higher-order cognitive skills necessary for the regulation of thoughts, actions, and goal-directed behaviour.
Executive Function Coaching (EF Coaching)	An executive function intervention approach supporting individuals to understand their areas of strength and difficulty, and to develop strategies to overcome challenges.
Forwards Chaining	A technique used in systematic literature reviews, involving researching the sources that have cited articles included within the review.
Functional Outcome Measure	Cognitive outcome measures that assess the daily management of challenges associated with an impairment.
Goal Attainment Scaling (GAS)	A therapeutic method of measuring outcomes related to progress towards individualised goals.
Goal Management Training (GMT)	A manualised cognitive rehabilitation intervention focusing on goal-directed behaviour, aiming to train individuals to monitor progress towards and adjust behaviours in order to reach specific goals.
Goal-Orientated Attentional Self-Regulation Training (GOALS)	A cognitive rehabilitation intervention designed by Novakovic-Agopian et al., (2011) targeting executive functions, involving the application of

	mindfulness-based attention regulation and goal management strategies.
Health-Related Quality of Life (HRQoL)	A standard of comfort, and happiness relating to aspects of physical and mental health.
Hypothalamic-Pituitary-Adrenal (HPA) Axis	A collection of structures within the body that are responsible for responding to stress.
Hypothalamic-Pituitary-Gonadal (HPG) Axis	A collection of structures within the body that are responsible for regulating reproductive activity.
Intention to Treat (ITT) Analysis	A method of analysing data that includes every subject within a study who was randomised.
International Cognitive Group (INCOG)	An international team of researchers and clinicians formed to develop recommendations for the management of cognitive impairments.
Intimate Partner Violence (IPV)	The experience of physical, sexual, or psychological abuse by a current or ex-intimate partner in the context of power and control.
Intimate Partner Violence Related Traumatic Brain Injury (IPV-TBI)	A traumatic brain injury occurring as a result of intimate partner violence.
Mental Whiteboard	A mental workspace where information is temporarily available for manipulation.
Metacognitive Awareness	Having knowledge of how you think, including what you are thinking and the strategies that you are using.
Metacognitive Strategy Training (MST)	A cognitive rehabilitation intervention strategy designed at increasing an individual's awareness of how they manage their thoughts, attention, effort, organisation skills and emotions.
Mild Neurocognitive Disorder	A mild impairment in one or more cognitive domains representing a decline from a previous level of functioning.
Neurodegenerative Condition	A disease which causes cells within the central nervous system to stop working or die.
Non-Overlap of Pairs Analysis (NAP)	A method of analysis in single case experimental designs calculating the percentage of all pairwise comparisons where ethe measurement from the treatment phase exceeds the measurement from the baseline phase.

Ontology	The study of being and existence, understanding how an individual determines if something exists.
PARiConnect	An online assessment platform for instruments published by Psychological Assessment Resources (PAR).
Per-Protocol Analysis	A method of analysing data that includes only the participants who completed their randomly allocated treatment.
Pharmacological Intervention	The administration of medication to treat or prevent a disease.
Post Concussion Syndrome	Persistent symptoms lasting more than 3 months post a mild traumatic brain injury.
Post Traumatic Stress Disorder (PTSD)	A condition of persistent mental and emotional stress resulting from injury or severe psychological shock.
Post Traumatic Stress Symptoms (PTSS)	The symptoms occurring as a result of severe psychological shock.
Problem Solving Training (PST)	A cognitive intervention designed by von Cramon et al., (1991) to support self-management and effective responding toward a problem.
Quality Assessment Tool for Quantitative Studies (QATQS)	A standardised tool used to assess the quality of studies.
Quality of Life After Brain Injury Scale (QOLIBRI)	A self-report measure of health-related quality of life designed for individuals with TBI.
R	A programming language.
Randomisation Tests	A method of statistical analysis used in single case experimental designs where the distribution of tests statistics is computed over all possible variations of data.
Reflexive Thematic Analysis (RTA)	An approach of qualitative analysis that incorporates the researchers subjective experience as a way to understand the data.
Reliable Change Index (RCI)	A method of analysis to understand whether the change between scores on a psychometric instrument on different occasions is larger than reasonably expected due to measurement error alone.

Research Information System (RIS) Files	A standardised file format enabling data to be exchanged across citation programmes.
Risk of Bias Tool for Randomised Trails (RoB-2)	A standardised tool used to assess the quality of randomised controlled trial studies.
R Studio	An integrated development environment for the programming language R, used for statistical computing.
Strategic Memory and Reasoning Training (SMART) (Vas et al)	A cognitive rehabilitation strategy designed by Gamino et al., (1999) created to train individuals to learn strategies to apply to daily life contexts.
Split Middle Method	A method used in visual analysis used to construct a liner plot.
Single Case Randomization Test (SCRT) Package	A package for R Studio designed to enable the calculation of randomisation tests in single case experimental designs.
Single Case Visual Analysis (SCVA) Package	A package for R Studio designed to enable data from single case experimental designs to be transformed into graphical displays for visual analysis.
STOP!	An acronym for ‘Stop, Think, Organise, Plan’ developed by Fish et al., (2007) which prompts participants to periodically pause, consider their goal, and plan the steps required to achieve this.
Target Measure	Measurements in single case experimental designs that care concerned with problems relevant to the individual.
Traumatic Brain Injury (TBI)	A physiological disruption in brain function resulting from an external force.
Working Memory Training (WMT)	A cognitive rehabilitation intervention designed to support improvement in working memory.

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Acknowledgements

A huge thank you everybody who has supported me! To my research supervisors; Jenny, Anke, and Alicia for their encouragement and advice throughout. Thank you to all of the staff at the IPV charities who helped with recruitment. To my placement supervisors Katrina Chesterman and Adam Bevins for offering to read through this thesis and supporting me to work alongside writing it up, and to Ingram Wright for the final proof read.

Thank you to my husband Ben, all of my family, and friends for consistently being there, and to the most supportive cohort friends; Rhiannon, Becca, and Laura.

LITERATURE REVIEW

What is the Efficacy of Cognitive Rehabilitation Interventions for Executive Function in Traumatic Brain Injury (TBI)? A Systematic Review

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Target Journal	Neuropsychological Rehabilitation
Word Count	5996 words

The current study is registered on the PROSPERO registry.

PROSPERO Registration Number: CRD42021286616.

Abstract

Executive function (EF) impairments are common following traumatic brain injury (TBI). Cognitive rehabilitation strategies can alleviate challenges associated with impairment. This review aimed to expand on previous literature, exploring the question: What is the efficacy of cognitive rehabilitation interventions for EF in individuals with a TBI? Cognitive rehabilitation studies for EF in adults with TBI published between January 2010-January 2022 were selected from OVID and Web of Science databases. Fifteen articles met the inclusion criteria: TBI or Post-Concussion Syndrome (PCS) with EF impairment, 18 years or older, cognitive rehabilitation for EF, use of valid and reliable EF outcome measures, peer reviewed quantitative article, written in English. Narrative data synthesis was used. Methodology was assessed using the Quality Assessment Tool for Quantitative Studies (QATQS), and risk-of-bias tool for randomized trials (RoB-2) where appropriate. Evidence is provided for the efficacy of cognitive rehabilitation for EF impairments in TBI, in particular the use of Goal Management Training (GMT) with adaptations such as Working Memory Training (WMT), errorless learning, and external cueing. Limitations include broad search terms and stringent inclusion criteria, and a lack of research around Metacognitive Strategy Training (MST) and understanding the EF construct. The need for further research into EF, other intervention strategies, and diverse populations is highlighted.

Keywords: cognitive rehabilitation, executive function, brain injury, systematic review, post-concussion syndrome.

Introduction

A traumatic brain injury (TBI) is a physiological disruption in brain function resulting from an external force (McKee & Daneshvar, 2015), often leading to a degree of cognitive, behavioural, or functional impairment (Anderson et al., 2019). TBIs impact roughly 69 million individuals per-year worldwide (Dewan et al., 2019), and impairments can persist for decades (Draper & Ponsford, 2008). They are the top contributor to disability globally (Haag et al., 2017; Rubinao et al., 2015).

Executive function (EF) impairments are common following TBI (Stuss, 2011), and can result in numerous challenges (Cicerone et al., 2006). Previous systematic reviews have highlighted the effectiveness of cognitive rehabilitation in alleviating challenges, combining elements of goal-management and metacognitive strategy training (MST) to support everyday executive outcomes (Cicerone et al., 2019). However, the most recently published review only includes papers up until 2014 and fails to appropriately consider the impact of methodological quality on results. Additionally, there is little evidence considering interventions to increase EF in TBI specifically, resulting in limited clinical guidance for this population. The current systematic review aims to provide an updated understanding of the evidence base for EF interventions, focusing on TBI, and including consideration of methodological quality.

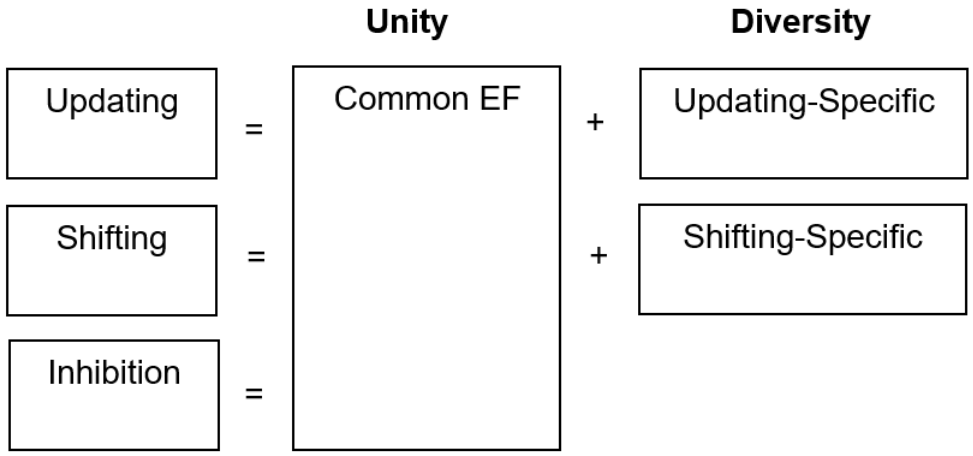
EF and TBI

EF impairments are common following TBI (Stuss, 2011), and can result in reduced quality of life, lower levels of independence (Rabinowitz & Levin, 2014) and decreased occupational and social functioning (Frazier, 2018). EF is considered a collection of higher-order cognitive skills necessary for self-regulation (Snyder et al., 2015) and goal-directed behaviour (Anderson, 2008).

In the Unity-Diversity model (Figure 1; Miyake & Friedman, 2012), EF is split into three areas; ‘Updating’, ‘Shifting’, and ‘Inhibition’, all loading onto a common executive ability (Miyake et al., 2000). ‘Updating’ and ‘Shifting’ each have specific components. ‘Updating’ involves monitoring and coding information relevant to a specific task in mental awareness and ‘Shifting’ entails moving between multiple tasks. ‘Inhibition’, the ability to deliberately suppress a dominant response, does not have a specific component, and can be partly explained by the ‘Common EF’ (Miyake & Friedman, 2012). ‘The Common EF’ reflects the overarching ability to maintain and manage goals (Friedman & Miyake, 2017).

Figure 1

The Unity-Diversity Model of EF (Miyake & Friedman, 2012)



Within the Unity-Diversity model, each area of executive ability is both independent and shows some underlying commonality. This indicates the distinct, yet interconnected role of the frontal lobes (Snyder, 2015) and reflects the heterogenous nature of EF impairments (Frazier, 2018). Consequently, EF interventions targeting all areas of the model, such as Goal Management

Training (GMT; Levine et al., 2000, 2011), and interventions targeting specific areas, such as working memory training (WMT; Smith, 2013) can be effective.

Cognitive Rehabilitation for EF

Cognitive rehabilitation interventions can reduce the impact of impairments on an individual's level of disability (Cicerone et al., 2006), and quality of life (Prince & Bruhns, 2017). They involve the systematic delivery of a functional intervention, based on the understanding of the underlying brain-behaviour impairments, and can be divided into either restorative or compensatory strategies (Cicerone et al., 2006). Whilst there is limited evidence supporting restorative approaches (Cicerone et al., 2006), compensatory approaches may be promising for EF rehabilitation within TBI (Snyder et al., 2015).

There are several cognitive rehabilitation strategies for EF. In their review Cicerone et al., (2019) found interventions typically used an integrated approach, focusing on either self-regulation or metacognitive awareness. A commonly reported strategy for promoting self-regulation is GMT (Levine et al., 2000, 2011), a standardised programme supporting individuals to identify, plan for, and evaluate goals (Stamenova & Levine, 2019). It is based on the theory of vigilant attention, where executive deficits arise from the disruption of attention systems (Robertson & Garavan, 2000) resulting in the inability to keep higher-order goals in mind, causing autonomic processes to dominate (Robertson & O'Connell, 2010). Numerous studies have used adapted versions of GMT, through altering the length/frequency of sessions or adding content. For example, Novakovic-Agopian et al., (2011; 2018; 2019) studied Goal-Orientated Attentional Self-Regulation (GOALS) training, combining GMT with additional attention, mindfulness, and problem-solving interventions. In terms of the Unity-

Diversity model, GMT may load onto the common EF through identifying, planning, and evaluating goals. ‘Updating’ may be supported through facilitating the ability to hold goals in awareness, ‘Inhibition’ by the suppression of dominant autonomic processes, and ‘Shifting’ through using prompting strategies to refocus attention to individual goals. GMT has shown positive outcomes in individual (Spikman et al., 2010) and group settings (Novakovic-Agopian et al., 2011).

MST focuses on improving metacognitive awareness to support individuals to identify areas of impairment, and develop goals to reduce disability (Skidmore et al., 2011). It is based on theoretical models of metacognition such as Crosson et al’s (1989) hierarchical model of awareness and the Cognitive Awareness Model (Morris & Hannesdottir, 2004) and suggests that poor self-awareness may prevent goal attainment (Ownsworth et al., 2006). In their review, Cicerone et al., (2019) found increasing support in studies applying MST to functional task performance, with treatment protocols such as the Cognitive Orientation to Occupational Performance (CO-OP). According to Ownsworth et al., (2006) metacognition is a key aspect of EF, in terms of the Unity-Diversity model, MST may map onto the overarching common EF. MST has shown positive outcomes in everyday EF for individuals with TBI (Schmidt et al. 2013).

Virtual reality (VR) has also been used to target EF through simulated, interactive environments to support rehabilitation (Rose et al., 2005). Whilst VR can be beneficial for EF outcomes (Alashram et al., 2019; Gómez-Cáceres et al., 2022), there are limited studies available (Cicerone et al., 2019) often with small sample sizes, limiting their generalisability (Gómez-Cáceres et al., 2022).

Interventions targeting problem-solving and emotional regulation have also been reported (Cicerone et al., 2019), although Cicerone found that they are less common, with fewer robust findings.

Previous Systematic Reviews

The cognitive rehabilitation for EF evidence base has been explored a number of times, as part of wider reviews by the Cognitive Rehabilitation Task Force (Cicerone et al., 2000, 2005, 2011, 2019). In their most recent review, the task force advised that EF interventions should be meaningful, applicable to everyday life, and combine elements of both MST and either goal-management or problem-solving protocols. Whilst helpful, Cicerone et al., (2019) only included papers published between 2009-2014. It is likely that since this study, further advancements in EF interventions have been made. Additionally, formal methodological quality assessment was not included, limiting their conclusions.

Aim of The Current Review

The current review aims to update and expand upon Cicerone et al's., (2019) review, specifically targeting EF outcomes in individuals with a TBI between 2010-2022.

Research Question

'What is the efficacy of cognitive rehabilitation interventions for EF in individuals with a TBI?'

Methods

The systematic review follows the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P; Shamseer et al., 2015; Appendix A). It was registered on the PROSPERO; Registration Number: CRD42021286616.

Eligibility Criteria

The study inclusion criteria (Table 1) were based on the PICOS (Participants, Intervention, Comparator, Outcome, Study Type) criteria. Papers were included if participants had a TBI; defined as a physiological disruption in brain function resulting from an external force (McKee & Daneshvar, 2015), post-concussion syndrome (PCS), or mild neurocognitive disorder. PCS is defined as persistent symptoms lasting more than 3 months post mild TBI (McInnes et al., 2017). It has recently been updated to 'mild neurocognitive disorder' in the International Classification of Diseases-11 (ICD-11; World Health Organisation, 2022). As PCS can result in EF impairment (Ackerman & Banks, 2003), and the mechanism of impairment is a TBI, it was included in the review. TBI severity definitions are outlined in Appendix B. Records were included if participants had mild, moderate, or severe TBIs, reporting definitions from Level 1 (strictest), 2, or 3 (most lenient).

Participants were required to have an EF impairment, operationally defined as either a score below specified cut-off points on a standardised neuropsychological assessment, or self/other report of difficulties lasting at least 3 months. Participants were 18 years or older to ensure that they were not in secondary education and more likely to be independent.

Papers examining participants in acute care, or with neurodegenerative conditions were excluded. This is due to the potential confounding impact of recovery in acute care or cognitive decline in neurodegenerative conditions. Where neurodegenerative conditions were not explicitly screened for, papers were excluded if participants were 66 years old and over, due to the increased risk after this age (Hou et al., 2019).

Table 1

Study Inclusion and Exclusion Criteria

PICOS	Inclusion Criteria	Exclusion Criteria
Participants	With a TBI or PCS Community or rehabilitation settings With executive function impairment 18 years or older.	Individuals with neurodegenerative conditions such as dementia OR individuals aged 66 and older where neurodegenerative conditions are not controlled for. Participants in acute care e.g., intensive care unit.
Intervention	Cognitive rehabilitation for any aspect of executive function e.g., goal attainment, working memory, planning, and organisation.	Pharmacological interventions Non-intervention studies.
Comparator	Studies with any comparison group Studies with no comparison group.	N/A
Outcome	Include a reliable and valid measure of executive function outcomes such as standardised neuropsychological assessments and questionnaires.	No executive function impairment reported or identified.
Study Type	Peer reviewed journal articles. Randomised or non-randomised design. Experimental design, pre-post quasi experimental design, single case experimental design, single case design or randomised controlled trial. Written in English.	Review articles. Meta Analyses. Qualitative Designs. Grey Literature.

As previous systematic reviews have concentrated on records up until 2014 (Cicerone et al., 2000; 2005; 2011; 2019), studies were only included if they were published between January 2010 - July 2022. The decision to include a four year overlap with Cicerone et al., (2019)'s review, comes from the updated definition of TBI provided by the International Interagency Initiative toward Common Data Elements for Research on TBI and Psychological Health

(Menon et al., 2010). Here, a concise definition was provided to support clarity in TBI research, supporting understanding of challenges presenting a significant time period after the injury has occurred, which may have been discounted in previous research. This overlap allows a broader understanding of the TBI evidence base.

Information Sources

Relevant records were identified through electronic searches on Ovid and Web of Science databases. These were chosen as they encompass a number of core neuroscience and psychology databases (University of Exeter Library, 2023). Supplementary searches included forwards chaining; finding articles citing the included papers, and backwards chaining; finding relevant articles in the citations of the included papers. Grey literature was not included due to time and resource limitations. Databases were searched from January 2010 - January 2022.

Search Strategy

The search strategy (Table 2) used key terms representing the PICOS framework. Search terms (including * for truncated terms) were chosen based on previous systematic reviews of cognitive rehabilitation (Cicerone et al., 2011;2019) and a preliminary scoping review. Terms were combined using Boolean operators ‘OR’ or ‘AND’. Only titles and abstracts were searched to ensure that the papers found were relevant to the review question.

Table 2

Systematic Review Search Strategy

	Population ***Section 1***	**Intervention** ***Section 2***	**Outcome** ***Section 3***
Individual Search Term (in title or abstract)	brain injur* OR 'traumatic brain injur*' OR TBI OR mTBI OR concuss* OR 'post-concussion syndrome' OR PCS OR 'neurocognitive disorder due to traumatic brain injury' OR 'neurocognitive disorder due to TBI' OR 'mild neurocognitive disorder'	cognit* OR aware* OR insight OR executive OR EF OR dysexecutive OR DES OR 'problem solv*' OR reason* OR goal* OR attent* OR 'working memory' OR regulat* OR plan* OR 'self-monitor*' OR 'self-aware*' OR 'self-regulat*' OR 'metacognit*' OR shift* OR inhibit*	executive* OR function* OR ability OR outcome* OR behaviour OR behavior
Combined Search (in title or abstract)		All intervention search terms combined with 'intervention OR rehabilitat* OR remediat* OR train* OR psychoed*' Section 1 AND Section 2 AND Section 3	

Study Records

Study records were managed using Rayyan systematic review manager (Ouzzani et al., 2016). Research Information Systems files, including study titles and abstracts were exported from Ovid and Web of Science into Rayyan. Titles and abstracts were then evaluated against the inclusion and exclusion criteria (Table 1) and relevant records read and assessed for eligibility in full. For full text review, records were evaluated using a Microsoft Excel spreadsheet. Following guidelines outlined by the National Institute for Health and Care Excellence (NICE, 2012), forwards and backwards chaining of the included studies was completed. This ensured relevant papers had not been missed in the original searches. These additional studies followed the same process as records identified through online database searching. No additional papers were

found. Record evaluation was performed independently by one assessor. An independent rater reviewed six records for eligibility. Inter-rater reliability was excellent (*k*=1.0).

Data Extraction and Synthesis

Data regarding the authors, year of publication, study design and aims, setting, population, intervention, comparison, outcome variables, results, effect sizes and quality evaluations were systematically extracted and synthesised by one reviewer. Comments about the studies' strengths and limitations are also included. EF outcomes were prioritised, as these were most relevant to the research question.

The quality of all studies was evaluated using the Quality Assessment Tool for Quantitative Studies (QATQS) designed by the Effective Public Health Practice Project (EPHPP, 2009). Risk of bias in Randomised Controlled Trials (RCT) were also evaluated using the risk-of-bias tool for randomised trials (RoB-2; Sterne et al., 2019).

Results

A total of 7872 records were identified. After deleting duplicates, 5125 records remained. Following title and abstract screening, 48 full text records were assessed for eligibility based on the inclusion and exclusion criteria (Table 1). Thirty-three of these records either did not meet the criteria (n=29) or were not available through either the University of Exeter Library or contacting the authors (n=4). A flow chart describing this process is shown in Figure 2. A total of fifteen records were included in the qualitative synthesis. Record evaluation was performed independently by one assessor. An independent rater reviewed three records for eligibility. Inter-rater reliability was excellent (*k*=1.0).

Figure 2

Flow Diagram of the Study Inclusion/Exclusion Process

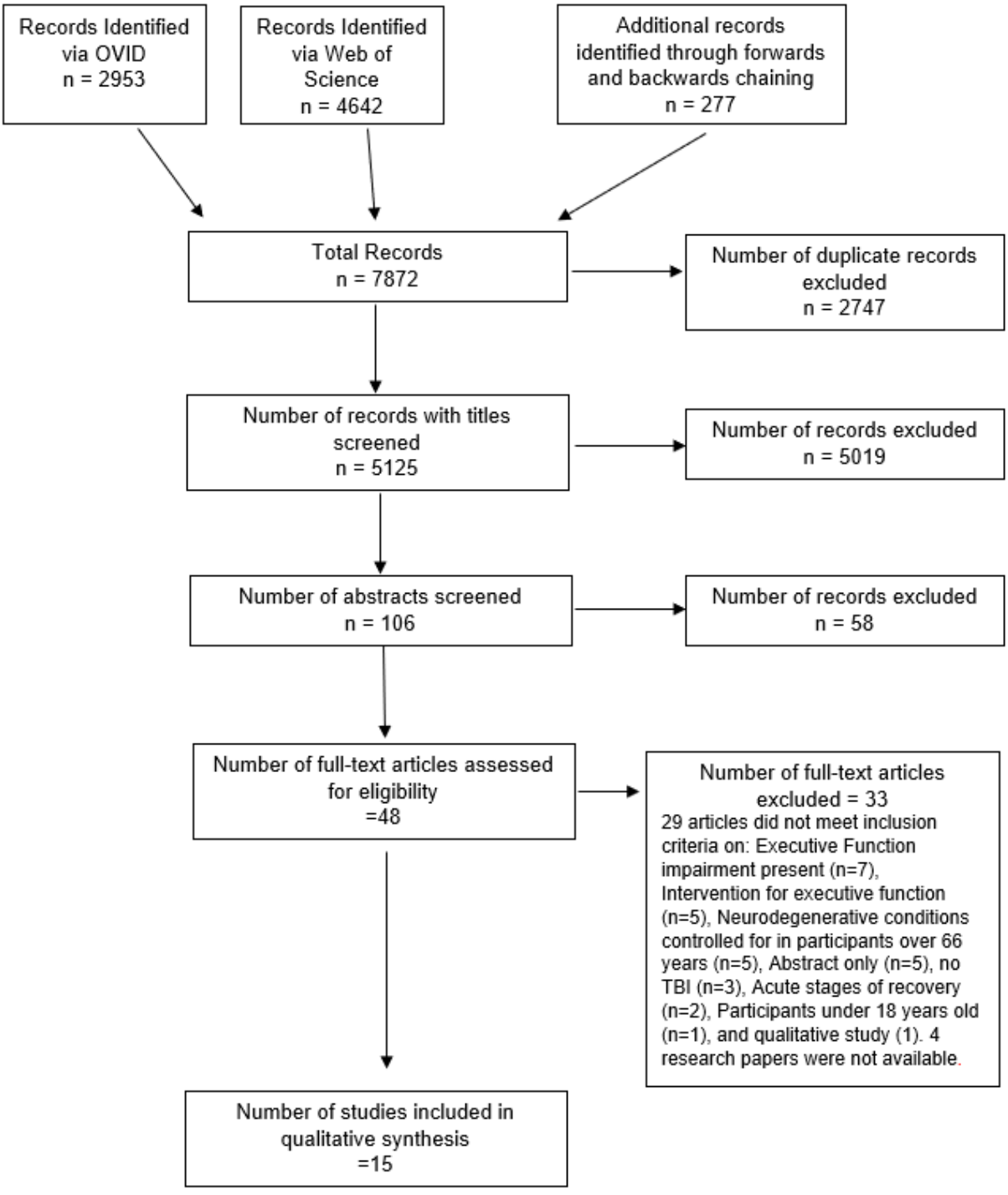


Table 3

Summary of the Studies Included in the Review

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
1 Bertens et al., (2015)	**Design:** RCT **Aim(s):** To investigate whether a combination of errorless learning and GMT is more effective than conventional GMT training in brain injured patients with executive function deficits.	Outpatient clinic and participants home/work environment. **Country:** Netherlands and Italy	60 brain-injured patients with executive function impairments. **Brain Injury:** 26 (43.3%) TBI, 32 (53.3%) Stroke, 2 (3.3%) Other. Severity and mechanisms of TBI not reported. **Other Details:** Errorless Learning GMT Mean age= 49.7 (*SD*=13.6); GMT Mean age= 46.8 (*SD*=14.2); 34 men, 26 women. No ethnicity information reported.	**Intervention:** Errorless Learning GMT. Eight 1-hour sessions administered twice a week. *N*= 30. **Comparison:** Conventional GMT. Eight 1-hour sessions administered twice a week. *N*= 30. Sessions were run by occupational therapists (*n*=4) and psychologists (*n*=7) with a background in neuropsychology.	**Functional Outcome Measures** Everyday task performance filmed and rated on a 3-point rating scale; GAS (self/patient and trainer report).	**Functional Outcome Measures** ***Everyday Task Performance*** (1) Both Errorless Learning and Conventional GMT groups showed significant improvements in everyday task performance post-treatment compared to baseline. Errorless Learning GMT $p<.001$, Cohens $d=1.62$ (large effect); GMT $p<.001$, Cohens $d=0.76$ (medium effect) (2) The Errorless Learning GMT group performed significantly better on everyday task performance post-treatment than the conventional GMT group; $p=.006$;	**Strengths:** Clinical sample, blinding of assessors and participants, based on participant goals (meaningful), everyday task performance likely has high ecological validity, includes power calculations **Limitations:** Only investigates trained tasks, number of participants does not reach power calculations (*n*=32 in each group), relatively high drop out of the intervention (7 participants, 10%), no information about reliability/validity of outcome measures, doesn't control for participants receiving other interventions that may affect outcomes, only per-protocol analysis used with a 10% drop out rate (*n*=7) from randomisation.	(A) Moderate (B) Strong (C) Strong (D) Strong (E) Weak (F) Strong **QATQS Overall Rating: Moderate**	(1) Low (2a) Some Concerns (2b) High (3) High (4) Low (5) Some Concerns **RoB-2 Overall Rating: High**

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
						Cohens *d*= 0.74 (large effect) ***GAS*** (3) Both Errorless Learning and Conventional GMT groups trainer and patient GAS scores were significantly higher post-treatment compared to baseline. All groups *p*<.001. No effect sizes reported. (4) No significant difference in patient post-treatment GAS scores between Errorless Learning and Conventional GMT groups; *p*=.16, Cohens *d*= 0.37 (small effect) (5) Trainer post-treatment GAS scores were significantly higher for the Errorless Learning GMT group than the Conventional GMT group; *p*= .001; Cohens *d*= 0.87 (large effect). **Conclusion:** Support provided			

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
						for both Conventional and Errorless Learning GMT in improving everyday executive task performance and in goal attainment. However, the Errorless Learning GMT group showed more improvements in everyday executive task performance pre-post treatment and were rated able to meet their goals to a larger extent by the trainer GAS scores.			
2 Bertens et al., (2016)	**Design:** RCT follow up of 2015 study looking at additional parameters **Aim(s):** To examine whether errorless GMT also contributes to improvement in cognitive	Outpatient clinic and participants home/work environment. **Country:** Netherlands and Italy	60 brain-injured patients with executive function impairments. **Brain Injury:** 26 (43.3%) TBI, 32 (53.3%) Stroke, 2 (3.3%) Other. Severity and mechanisms of TBI not reported.	**Intervention:** Errorless Learning GMT. Eight 1-hour sessions administered twice a week. *N*= 30. **Comparison:** Conventional GMT. Eight 1-hour sessions administered twice a week. *N*= 30.	**Standardised Construct-Driven Measures** Category Fluency Test, Letter Fluency Test, Go/no-go, Modified Six Elements Test, Zoo Map Test of the BADS, Letter Number Sequencing (WAIS-III), Brixton Spatial	**Standardised Construct-Driven Measures** (1) All participants improved significantly on the Modified Six Elements Test p=.006, η_p^2= 0.14 (large effect size) and the Zoo Map Test p<.001, η_p^2=0.27 (large effect size). (2) Reliable Change Index	**Strengths:** Clinical sample, blinding of assessors and participants, based on participant goals (meaningful), includes measures of everyday executive function as well as standardised tests. **Limitations:** No comparison to group receiving no treatment, only investigates trained tasks, no power calculations included, number of participants does not reach estimated	(A) Moderate (B) Strong (C) Strong (D) Moderate (E) Weak (F) Strong **QATQS Overall Rating: Moderate**	(1) Low (2a) Some Concerns (2b) High (3) High (4) Low (5) Some Concerns **RoB-2 Overall Rating: High**

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
	function, as measured with neuropsychological tests, and subjective cognitive function along with quality of life assessed questionnaires.		**Other Details:** Errorless Learning GMT Mean age= 49.7 (*SD*=13.6); GMT Mean age= 46.8 (*SD*=14.2); 34 men, 26 women. No ethnicity information reported.	Sessions were run by occupational therapists (*n*=4) and psychologists (*n*=7) with a background in neuropsychology.	Anticipation Test. **Functional Outcome Measures** DEX (self and proxy report), Executive Function Index (self-report), EOS.	analysis showed that none of the participants reliably improved on the Modified Six Elements Test after training. (3) Reliable Change Index analysis showed that overall, 20% of participants (18.5% of the Errorless Learning GMT group, 21.7% of the GMT group) improved reliably on the Zoo Map Test after training. **Functional Outcome Measures** (4) Significant overall improvement in everyday executive function as reported by the Executive Function Index *p*=.001, η_p^2=0.22 (large effect size). (5) Significant overall improvement in executive behavioural problems as reported by the	power calculations from previous research (*n*=32 in each group), only per-protocol analysis used with a relatively high drop out of the intervention (*n*=7 participants, 90% adherence), no information about reliability/validity of outcome measures, doesn't control for participants receiving other interventions that may affect outcomes, results potentially influenced by practice effects.		

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
						proxy-report DEX p=.007, η_p^2= 0.15 (large effect size). **Conclusions:** The study showed beneficial effects for both errorless learning and conventional GMT on executive functioning as measured by neuropsychological tests and everyday executive outcomes. No additional benefits of errorless learning GMT were found compared to conventional GMT.			
3 Dawson et al., (2013)	**Design:** Partially Randomised Pilot Controlled Trial **Aim(s):** To confirm the effectiveness of the CO-OP intervention for real-	Outpatient clinic and participants' homes. **Country:** Canada.	13 brain-injured patients with executive function impairments. **Brain Injury:** 2 (15%) mild TBI, 11 (85%) moderate-severe TBI. Mechanisms of TBI not reported.	**Intervention:** Modified CO-OP involving 20 hours of training, delivered as two 1-hour sessions per week. *N*=7. **Comparison:** Control group receiving no intervention or treatment. *N*=6.	**Functional Outcome Measures** DEX (self-report).	**Functional Outcome Measures** ***DEX*** DEX scores decreased in both CO-OP and control group, with a larger decrease in the CO-OP group. This difference was not significant, p>.10, Cohen's d= 0.35 (small effect)	**Strengths:** clinical sample, control group, includes power calculations, 100% adherence rate. **Limitations:** Small number of participants, number of participants does not reach power calculations, no active control group, no measure of everyday executive functioning, just one, self-report measure of executive function which may be prone to demand	(A) Weak (B) Strong (C) Weak (D) Weak (E) Strong (F) Strong **QATQS Overall Rating: Weak**	-

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
	world executive function challenges and in producing transfer effects.		**Other Details:** 24-60 years old, mean age= 41.55 years; 7 (54%) male, 6 (46%) female. No ethnicity information reported.	Sessions were run by either a trained occupational therapist, or a paraprofessional closely supervised by the occupational therapist.		**Conclusion:** The CO-OP intervention did not significantly improve executive function outcomes, as measured by the DEX, for participants compared to the control group.	effects and recall bias, only one measure of executive functioning, volunteer sample.		
4 Emmanouel et al., (2020)	**Design:** RCT **Aim(s):** To explore the efficacy of GMT combined with WMT.	Outpatient clinic and participants homes. **Country:** Greece.	18 brain-injured patients with executive function impairments. **Brain Injury:** 11 (62%) TBI, 1 (5%) Stroke, 1 (5%) aneurysm, 5 (28%) brain tumour. No information on TBI severity or mechanism. **Other Details:** Aged 20-54 years (Mean age=35, *SD*=9); 12 (67%) men, 6 (33%) women. No ethnicity information reported.	**Intervention:** GMT + WMT, 11, 30-minute sessions administered 3-4 times per week. *N*=9 **Comparison:** WMT, 11, 30-minute sessions administered 3-4 times per week. *N*=9 No intervention healthy control group also included for some results. *N*=12. Sessions delivered by the 'examiner'.	**Functional Outcome Measures** ***Primary Outcome Measure:*** Performance on a multi-step everyday task; ***Secondary Outcome Measures:*** EOS; Corsi Block Tapping Test; DEX (self and proxy rating); **Standardised Construct-Driven Measures** Trail Making Test B/A ratio; Digit B, Stroop	**Functional Outcome Measures** ***Primary Outcome Measure*** (1) The GMT+WMT group performed significantly better than the WMT group on the multi-step everyday tasks 1, $p<.0005$, $\eta_p^2 = 0.96$ (large effect size) and task 2, $p<.0005$, $r= 0.86$ (large effect size) post-treatment. (2) The GMT+WMT group performed significantly better post than pre-treatment on the multi-step everyday tasks 1, $p<.0005$, $\eta_p^2= 0.97$ (large effect size); and 2	**Strengths:** Comprehensive evaluation of executive functions considering ecological validity, strong research design, clinical sample, blinding of assessors,100% adherence rate. **Limitations:** Small number of participants, no GMT only control group, no reporting of healthy control outcomes compared to GMT+WMT and WMT groups, no follow-up, participants 4 months post-injury meaning spontaneous recovery may still be occurring, no power calculations included, results potentially influenced by practice effects, healthy control group only assessed pre-treatment.	(A) Moderate (B) Strong (C) Strong (D) Moderate (E) Strong (F) Strong **QATQS Overall Rating: Strong**	(1) Low (2a) Low (2b) Low (3) Low (4) Low (5) Some Concerns **RoB-2 Overall Rating: Some Concerns**

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
					Interference, WCST (number of categories completed and number of perseverative answer), Verbal Fluency, BADS (rule shifting, action program, key search, zoo map test, modified six elements test), Everyday Description Task (total relevant actions, number of: relevant major/central/trivial actions, relevant intrusions, total errors, irrelevant intrusions, perseverative errors, and sequencing errors).	p<.0005, η_p^2= 0.85 (large effect size). (3) No significant differences were found between pre and post-treatment scores on multi-step everyday tasks for the WMT group. ***Secondary Outcome Measures*** (4) No significant effects were found for the EOS, p>.05 (5) Only significant pre and post training 'time' effects were found for the DEX (other report), and the Corsi Block Tapping Test; p values <.0005; ηp^2= .07-.084 (medium-large effect sizes). **Standardised Construct-Driven Measures** (6) The GMT+WMT group performed significantly better than the WMT group post-treatment on: Digit			

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
						Span Backwards p=.002; the Action Programme p=.09; The Modified Six Elements subtest of the BADS p=.008; and the total number of relevant major actions p=.039, and sequencing errors on the Everyday Description Task p<.0001. No effect sizes were reported. (7) The GMT+WMT group made significantly fewer sequencing errors in the Everyday Description Task post-treatment compared to baseline, p=.043. No effect size reported. (8) Only the WMT group significantly improved from pre to post-treatment on the Digit Span Backwards, p=.005. (9) Both the GMT+WMT and WMT groups showed significant improvements post-treatment			

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
						compared to pre-treatment on Digit Backwards p=.014; Trail Making Test p<.0005; Verbal Fluency/Phonemic Fluency ratio p= .038; BADS Key Search p= .015; BADS total number of relevant actions p=.033; BADS total number of relevant major actions p=.004; BADS total number of central actions p=.021, and Everyday Description Task total number of sequencing errors p=.015. No effect sizes reported. **Conclusion:** Combining GMT with WMT is more beneficial than WMT alone for everyday executive function, with large effect sizes. These is mixed support for GMT+WMT compared to WMT on standardised neuropsychological measures, and the effect sizes of these are unknown.			

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
5 Gracey et al., (2017)	**Design:** Randomised Control Parallel Group Crossover **Aim(s):** To explore the efficacy of the AIM intervention in improving everyday executive function outcomes.	Community or participant homes. **Country:** United Kingdom.	59 brain-injured participants with executive function impairments. **Brain Injury:** 27 TBI (46%), 21 stroke (35%), 12 (19%) other. TBI severity: 11 severe (41%), 2 moderate (7%), 2 mild (7%). No mechanism of injury data reported. **Other Details:** 42 (71%) male, 17 (29%) female**,** Control first mean age= 49.76 (*SD*=12.94); AIM first mean age= 47.79 (*SD*=14.72). No ethnicity data recorded.	**Intervention:** AIM, consisting of two, 90-120 minute sessions of GMT no more than 5 days apart and 8 SMS messages per day for a total of six weeks, prompting participants to follow the STOP procedure. **Comparison:** Treatment/care as usual, 8 SMS text messages per day reading 'AIM research study. Please ignore'. Interventions were delivered by a qualified occupational therapist.	**Functional Outcome Measures** ***Primary Outcome*** The mean proportion of daily intentions achieved (averaged over the final 2 weeks of each 3-week study phase); and the 'phone task'. The phone task consisted of 3x daily phone calls participants were required to make at pre-scheduled times, scored based on attainment and timing accuracy and one unscheduled phone call made daily scored based on attainment and timing (i.e., at least 30 minutes after a scheduled phone call and at different time of day than the	**Functional Outcome Measures** ***Primary Outcome*** (1) Participants achieved a greater proportion of intentions during the AIM intervention relative to the control condition p=.04, f= 0.28 (medium effect size). (2) A significant difference on intentions in the AIM versus control on the phone task was found using Per-Protocol analysis, p=.047, Cohen's d= 0.53 (medium effect size), but not with Intention To Treat analysis p=.43. (3) A significant increase in proportions of intentions achieved on the phone task was found when STOP! SMS cueing was used, p=.003, f= 0.41 (large effect size).	**Strengths:** strong research design, clinical sample, both intention-to-treat and per-protocol analysis conducted, power calculations included, and sample size meets power calculations, blinding of assessors. **Limitations:** crossover phase only 1 week long may be prone to carryover effects, limited standardised measures of executive function used, relatively high dropout rates, AIM first group had different control phase as SMS messages were stopped, group differences on time post-injury and employment, relatively high drop-out rate with n=16 participants withdrawing and only 78% adherence, results potentially influenced by practice effects.	(A) Moderate (B) Strong (C) Strong (D) Strong (E) Moderate (F) Strong **QATQS Overall Rating: Strong**	(1) Low (S) High (2a) Low (2b) Some Concerns (3) Low (4) Low (5) Some Concerns **RoB-2 Overall Rating: High**

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
					previous days call). ***Secondary Outcome*** The mean proportion of daily intentions achieved without the 'phone task' data. **Standardised Construct-Driven Measures** DKEFS Verbal Fluency, multipart Hotel Test. **Exploratory Analysis** Repeated measures ANCOVA exploring differences between aetiology groups response to intervention.	***Secondary Outcome*** (4) Participants achieved a greater proportion of intentions during the AIM intervention relative to the control condition when phone task data was excluded from analysis, p=.033, f= 0.28 (medium effect size). (5) No significant differences on intentions in the AIM versus control condition were identified with Intention To Treat analysis p=.87. or Per-Protocol analysis p=.688, Cohen's d= .011 (negligible effect size). **Standardised Construct-Driven Measures** (6) No significant interactions were found for the DKEFS Verbal Fluency p= .4; or Hotel Test, p= .78.			

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
						Exploratory Analysis (7) Significant differences between the TBI and 'other ABI' groups were found on the phone task, *p*=.014, with the TBI participants showing a greater proportion of intentions achieved during the AIM intervention than the control phase. **Conclusion:** Mixed results supporting the AIM intervention for improving executive function outcomes. Evidence particularly supporting the benefit of using cueing. Some evidence provided for the intervention in a TBI population specifically.			
6 Ng et al., (2013)	**Design:** Case Study	Skype videoconferencing software,	3 brain-injured participants with executive function	**Intervention:** CO-OP, modified to include 20, 1-hour sessions provided	**Functional Outcome Measures**	**Functional Outcome Measures**	**Strengths:** Follow-up completed, participant identified goals,	(A) Weak (B) Weak (C) Strong (D) Moderate	-

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
	Aim(s): To investigate if a telerehabilitation version of the CO-OP approach can help individuals manage everyday executive dysfunction.	and telephone calls. **Country:** Canada.	impairments and their significant others. **Brain Injury:** all severe TBI resulting from a motor vehicle collision (100%). **Other Details:** 34-55 years old, mean age= 45.33 years**,** all male (100%). No ethnicity data reported.	twice weekly over 10 weeks and participant homework. **Comparison:** N/A. Sessions delivered by a trained occupational therapist.	***Primary Outcome Measure*** Proportion of goals met; DEX (self and other report). **Standardised Construct-Driven Measures** Oral Trail Making Test Part B; FAS Verbal Fluency; Digit Span from the WAIS-III;	(1) Participants showed improvements in a greater proportion of trained than untrained goals at post-intervention and at follow-up compared to baseline. No statistical analysis available. (2) Participants showed improvements in a greater proportion of trained and untrained goals at follow-up compared to post-intervention. No statistical analysis available. (3) All participants DEX scores decreased from pre-intervention to follow-up, these changes were significant for one participant at post-test, and 1 participant at follow-up $p<.05$. **Conclusion:** Partial support provided for the CO-OP intervention in supporting goal	involvement of significant others, clinical sample. **Limitations:** weak study design, heterogenous participant pool (all male, severe TBI from road traffic accident), changes in intervention protocol for one participant from videoconferencing to over the telephone, one participant completing intervention in public community centre, all follow-up data not available for all participants, remote administration of neuropsychological measures, could not observe performance in real-life. No reliable change index calculations included for DEX scores; results potentially influenced by practice effects.	(E) Moderate (F) Moderate **QATQS Overall Rating: Weak**	

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
						attainment and executive functioning. However, limited statistical analysis provided, and improvements were typically limited to trained tasks.			
7 Novakovic-Agopian et al., (2011)	**Design:** Pseudo-Random Crossover Design **Aim(s):** To investigate the effects of GOALS training on complex attention and executive function.	Outpatient clinic. **Country:** USA.	16 brain-injured participants with executive function impairments. **Brain Injury:** 11 (69%) TBI, 2 (13%) stroke, 3 (18%) 'other'. TBI mechanisms: 6 fall (55%), 4 motor vehicle collision (36%), 1 assault (9%). No severity information recorded. **Other Details:** Age range 24-63, mean age = 50.38 years, 9 (56%) female, 7 (44%) male. No ethnicity information recorded.	**Intervention:** GOALS training 10, 2-hour group sessions, 3, 1-hour individual sessions, 20 hours of home practice over 5 weeks. *N*=8. **Comparison:** BHE workshop. *N*=8. Sessions delivered by occupational therapists and a neuropsychologist	**Standardised Construct-Driven Measures** ***Working Memory:*** Auditory Consonant Trigrams, Letter Number Sequencing of the WAIS-III; ***Sustained Attention:*** Digit Vigilance test; ***Inhibition:*** DKEFS Stroop Inhibition; ***Mental Flexibility:*** Trail Making Test Part B, DKEFS Design Fluency-Switching,	**Study Period 1 (Baseline-Week 5)** ***Standardised Construct-Driven Measures*** (1) Significant improvement on the overall Attention and Executive Function summary domain for the GOALS-first group compared to the BHE-first group at week 5 compared to baseline, $p<.0001$. No effect size reported. (2) Significant improvements in Working Memory $p<.0001$; Mental Flexibility $p=.009$; Inhibition $p=.005$; and Sustained Attention $p=.01$ for the GOALS-first	**Strengths:** Control group, crossover design more ethical, standardised measures, clinical sample, to reduce practice effects alternative forms of the DKEFS, HVLT-R, BVMT-R and Digit Vigilance test were used, and norms for repeated testing were used for the Auditory Consonant Trigrams. **Limitations:** The results were not analysed together but in group by group analysis, grouping of all attention and executive function domains into one score, no effect sizes reported, small sample size, limited information provided about the BHE workshop, no power calculations included. Only per-protocol analysis used with *n*=3 withdrawing and 84% adherence rate, results on some of the assessments likely to be	(A) Moderate (B) Strong (C) Strong (D) Weak (E) Strong (F) Strong **QATQS Overall Rating: Moderate**	-

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
					DKEFS Verbal Fluency-Switching, DKEFS Stroop Inhibition-Switching; Overall attention and executive function summary domain. **Functional Outcome Measures** Modified MET, Goal Processing Questionnaire (self-report).	group compared to the BHE-first group at week 5 compared to baseline. No effect sizes reported. ***Functional Outcome Measures*** (3) Significantly fewer task failures on the MET for the GOALS-first group compared to the BHE-first group $p<.01$. No effect size provided. **Study Period 2 (Week 5-Week 10)** ***Standardised Construct-Driven Measures*** (4) Significant improvement on the overall Attention and Executive Function summary domain at week 10 compared to week 5 for the BHE-first group $p<.0001$; Working Memory $p=.0008$; Mental Flexibility $p= .0008$; Inhibition $p= .01$,	influenced by practice effects e.g., Letter Number Sequencing and the Trail Making Test,		

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
						and Sustained Attention p=.01. No effect sizes reported. (5) Participants in the GOALS-first group maintained their gains from week 5 in week 10, with significant improvements on the Overall Attention and Executive Function domain p<.04 and Working Memory p<.02. No effect sizes reported. **Conclusion:** Provides support for GOALS training in improving executive function outcomes when compared to a BHE control. These improvements are maintained at 5 weeks post-intervention.			
8 Novakovic-Agopian et al., (2018)	**Design:** RCT **Aim(s):** To investigate the effects of GOALS	Veteran's Affairs (VA) medical centres. **Country:** USA.	33 brain-injured Veterans with executive function impairments.	**Intervention:** GOALS training, 10, 2-hour group sessions, three 1-hour individual sessions, 20 hours of home practice.	**Standardised Construct-Driven Measures** ***Working Memory:***	**Standardised Construct-Driven Measures** (1) The GOALS group performed significantly better on measures of	**Strengths:** Strong study design, Control group, clinical sample, comprehensive evaluation of executive function using standardised measures and considering ecological	(A) Weak (B) Strong (C) Strong (D) Strong (E) Moderate (F) Strong	(1) Some Concerns (2a) Some Concerns (2b) Low (3) Low (4) Low (5) High

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
	training versus BHE in Veterans with TBI who have difficulties in executive function in their daily lives.		**Brain Injury:** 100% TBI, 19 (58%) mild. 7 (21%) moderate, 7 (21%) severe TBI. Injuries sustained from blunt injuries, motor vehicle collisions, and blasts. 18 (55%) multiple TBI. **Other Details:** Age range 25-66 years, mean age 43.3 years (*SD*=11.57); 28 (85%) male, 5 (15%) female; 67% White. No other ethnicity information recorded.	*N*=20. **Comparison:** BHE 10, 2-hour group sessions, three 1-hour individual sessions, 20 hours of home practice. *N*=13. Interventions delivered by two therapists per group.	Auditory Consonant Trigrams, Letter Number Sequencing of the WAIS-III; ***Sustained Attention:*** Digit Vigilance test; ***Inhibition:*** DKEFS Stroop Inhibition; ***Mental Flexibility:*** Trail Making Test Parts A and B, DKEFS Design Fluency-Switching, DKEFS Verbal Fluency-Switching, DKEFS Stroop Inhibition-Switching; Composite Overall Attention and Executive Function Domain Score **Functional Outcome Measures** Goal Processing Scale; Goal	Overall Attention and Executive Function p=.01, η_p^2 = 0.19 (large effect size) and Working Memory p=.02, η_p^2 = 0.17 (large effect size) than the BHE group post-treatment. (2) The GOALS group performed significantly better post compared to pre-treatment on Overall Attention and Executive Function p=.001, η_p^2 = 0.50 (large effect size); Working Memory p=.045, η_p^2 = 0.21 (large effect size); Mental Flexibility p=.003, η_p^2 = 0.39 (large effect size) and Inhibition p=.02, η_p^2 = 0.29 (large effect size). **Functional Outcome Measures** (3) The GOALS group improved significantly more post-treatment compared to the	validity, to reduce practice effects alternative forms of the DKEFS, HVLT-R, BVMT-R and Digit Vigilance test were used, and norms for repeated testing were used for the Auditory Consonant Trigrams, blinding of assessors. **Limitations:** Randomisation methods not described difference in group sizes, only per-protocol analysis used, majority male participants (85%), 18 participants experiencing multiple TBI but not addressed in results, composite attention and executive function score created by authors, reliability and validity of measures not reported, no power calculations included, Only per-protocol analysis used with *n*=2 withdrawing and a 94% adherence rate, results on some of the assessments likely to be influenced by practice effects e.g., Letter Number Sequencing and the Trail Making Test,	**QATQS Overall Rating: Moderate**	**RoB-2 Overall Rating: High**

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
					Processing Questionnaire (self-report).	BHE group on GPS Overall Performance $p<.05$, $\eta_p^2 = 0.20$ (large effect size) and Sequencing/Switching $p<.05$, $\eta_p^2 = 0.13$ (medium effect size). (4) The GOALS group showed significant improvement post compared to pre-treatment on GPS Overall Performance $p=.0001$, $\eta_p^2 = 0.47$ (large effect size); Planning $p=.002$, $\eta_p^2 = 0.46$ (large effect size); Self-monitoring $p=.009$, $\eta_p^2 = 0.34$ (large effect size); Maintenance of Attention $p=.03$, $\eta_p^2 = 0.26$ (large effect size); Sequencing/Switching of Attention $p=.006$, $\eta_p^2 = 0.37$ (large effect size); and Execution $p=.02$, $\eta_p^2 = 0.29$ (large effect size)			

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
						(5) The GOALS group showed significant improvements post-treatment compared to the BHE group in Goal Processing Questionnaire scores of Self-Monitoring p=.02, η_p^2 = 0.22 (large effect size); Working Memory p=.03, η_p^2 = 0.19 (large effect size); Sequencing p=.02, η_p^2 = 0.23 (large effect size) and Execution p=.20, η_p^2 = 0.20 (large effect size). **Conclusion:** Provides support for the GOALS intervention compared to the BHE workshop for improving executive function outcomes on neuropsychological measures, with large effects; functional executive outcomes, with medium-large			

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
						effects; and on daily executive function measures, with large effects.			
9 Novakovic-Agopian et al., (2019)	**Design:** RCT follow-up from 2018 study **Aim(s):** To investigate the long-term effects of GOALS training in Veterans with a history of TBI.	Veteran's Affairs (VA) medical centres. **Country:** USA.	24 brain-injured Veterans with executive function impairments, who previously completed GOALS training in the Novakovic-Agopian et al., (2018) study. **Brain Injury:** 100% brain injury, 13 (54%) mild TBI, 5 (21%) moderate TBI, 6 (25%) severe TBI. No mechanism information reported. **Other Details:** Age range 25-66 years, mean age 41.13 (*SD*= 11.39), 23 (96%) male, 1 (4%) female, 16 (68%) White. No other ethnicity	**Intervention:** GOALS training, 10, 2-hour group sessions, three 1-hour individual sessions, 20 hours of home practice. **Comparison:** BHE 10, 2-hour group sessions, three 1-hour individual sessions, 20 hours of home practice. Interventions delivered by two therapists per group.	**Standardised Construct-Driven Measures** ***Working Memory:*** Auditory Consonant Trigrams, Letter Number Sequencing of the WAIS-III; ***Sustained Attention:*** Digit Vigilance test; ***Inhibition:*** DKEFS Stroop Inhibition; ***Mental Flexibility:*** Trail Making Test Parts A and B, DKEFS Design Fluency-Switching, DKEFS Verbal Fluency-Switching, DKEFS Stroop	**Standardised Construct-Driven Measures** (1) Significant improvement post-GOALS training relative to baseline on measures of Overall Attention and Executive function p=.002; Sustained Attention p=.002; and Mental Flexibility p=.004. No effect sizes provided. (2) Significant improvements for GOALS training group at 1 year follow up compared to baseline on measures of Overall Attention and Executive Function p<.000; Working Memory p=.006; Sustained Attention p=.001; and Mental Flexibility p=.009. No effect sizes provided.	**Strengths:** Explores long-term effect of intervention (6 months post), clinical sample, to reduce practice effects alternative forms of the DKEFS, HVLT-R, BVMT-R and Digit Vigilance test were used, and norms for repeated testing were used for the Auditory Consonant Trigrams. **Limitations:** Relatively small sample size, no power calculations included, high drop-out from original study, per-protocol analysis, no comparison condition at follow-up, follow-up time varied for participants, randomisation methods not described, assessors not blinded, Only per-protocol analysis used with n=6 withdrawing and an 80% adherence rate, results on some of the assessments likely to be influenced by practice effects e.g., Letter Number Sequencing and the Trail Making Test,	(A) Moderate (B) Strong (C) Strong (D) Weak (E) Strong (F) Moderate **QATQS Overall Rating: Moderate**	-

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
			information reported.		Inhibition-Switching; Composite Overall Attention and Executive Function Domain Score (constructed from the Z scores of all subdomains). **Functional Outcome Measures** Goal Processing Scale.	(3) No statistically significant changes between post-GOALS and 1 year follow-up scores on any neuropsychological outcomes. **Functional Outcome Measures** (4) Significant improvement post-GOALS training relative to baseline on GPS Total Score *p*=.001, and the subdomains of Planning *p*=.002; Self-Monitoring *p*=.000; Sequencing/Switching *p*=.01; and Task Execution *p*=.005). No effect sizes provided. (5) Significant improvements for GOALS-training group at 1 year follow up relative to baseline on GPS Total Score *p*=.01; Planning *p*=.008; Self-Monitoring *p*=.02; Sequencing/Switchi			

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
						ng *p*=.02; and Task Execution *p*=.005. (6) GPS Self-Monitoring scores were significantly lower at 1 year follow up compared to post-GOALS *p*<.05. **Conclusion**: Provides support for the GOALS intervention in improving executive function outcomes at 1-year follow up in both neuropsychological measures and measures of functional performance, except for self-monitoring. No effect sizes reported.			
10 Ramanathan et al., (2019)	**Design:** Case Study **Aim(s):** To investigate whether comprehens	Outpatient Clinic. **Country:** USA.	54 year old male participant, 7.5 years post severe brain injury following motor vehicle collision,	**Intervention:** Three 50-minute daily sessions of step-by-step Metacognitive Strategy Instruction. **Comparison:** N/A	**Standardised Construct-Driven Measures** DKEFS Verbal Fluency, Design Fluency,	**Standardised Construct-Driven Measures** (1) Clinically significant improvement (more than 1 standard	**Strengths:** Clinical case, includes a variety of outcome measures (neuroimaging included, but not reported in this table), detailed description of participant	(A) Weak (B) Weak (C) Weak (D) Weak (E) Moderate (F) Strong	-

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
	ive cognitive rehabilitation therapy for executive function, attention, and prospective memory can produce behavioural and structural/functional improvements.		reporting executive function impairments. Ethnicity= 'native English speaker'.	Sessions conducted by a graduate student clinician.	Sorting, Tower, Colour-Word Inference, Trail Making Test	deviation) on DKEFS Trail Making number sequencing and number-letter switching; Verbal Fluency and Category Fluency total correct scores; Tower Test total achievement and mean first move time; Colour-Word Inference Test inhibition completion time; and the Sorting Test sort recognition description score. No effect sizes reported. (2) Clinically significant decrease (more than 1 standard deviation) post-treatment compared to pre-treatment on DKEFS Colour-Word Interference test total inhibition/switching errors. No effect sizes reported. **Conclusion:** Provides evidence for the	characteristics provided, to reduce practice effects alternative forms of the DKEFS tests were used. **Limitations:** Intense intervention meaning feasibility and acceptability might be challenging, one participant so unlikely to be representative of target population, assessors not blinded to treatment, no report of reliability of measures, participant did not attend weekly sessions in post-treatment A phase, does not appropriately describe the setting, trail making test may be prone to practice effects.	**QATQS Overall Rating: Weak**	

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
						Metacognitive Strategy Instruction in improving executive function outcomes for individual in the case study.			
11 Storzbach et al., (2016)	**Design:** RCT **Aim(s):** To investigate the efficacy of a CCT intervention for Veterans with a history of mild TBI.	Veteran's Affairs (VA) medical centres. **Country:** USA.	119 Veterans with a history of mild TBI, reporting executive function impairments. **Brain Injury:** 100% mild TBI. No mechanism information recorded. **Other Details:** CCT group mean age 35.4 (*SD*=8.4), Control group 34.8 (*SD*= 7.8). CCT group 94% male, 6% female, control group 96% male, 4% female. CCT group 68% Caucasian, control group 64% Caucasian. No other	**Intervention:** CCT, 120-minute group sessions provided weekly for 10 weeks. *N*=50. **Comparison:** Treatment as usual *N*=69. Sessions conducted by masters or doctoral level therapists, usually in pairs.	**Functional Outcome Measures** PRMQ (self-report); MSNQ (self-report); PCSS; The Neurobehavioral Symptom Inventory (self-report); **Standardised Construct-Driven Measures** WAIS-IV Digit Span; WAIS-IV Digit Symbol; DKEFS Trails; DKEFS Verbal Fluency.	**Functional Outcome Measures** (1) The CCT group reported significantly fewer prospective memory challenges on the PRMQ relative to controls at week 10 $p<.001$, $\eta_p^2= 0.142$ (large effect size); and week 15 $p=.001$, $\eta_p^2= 0.122$ (medium effect size). (2) The CCT group reported significant improvements in MSNQ scores relative to controls at week 10 $p=.021$, $\eta_p^2= 0.067$ (medium effect size); and week 15 $p=.009$, $\eta_p^2= 0.091$	**Strengths:** Clinical sample, blinding of assessors (but at baseline only), treatment fidelity was monitored, control group. **Limitations:** Methods of randomisation are not described, only per-protocol analysis included with *n*=34 participants withdrawing and a 71.5% adherence rate, a lack of information is provided about withdrawals, no information about reliability/validity of outcome measures provided, significant difference across study sites for ethnicity, mostly male participants (94% in CCT group, 96% in control group), no power calculations included, assessors blinded at baseline only, results potentially influenced by practice effects.	(A) Moderate (B) Strong (C) Strong (D) Moderate (E) Moderate (F) Weak **QATQS Overall Rating: Moderate**	-

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
			ethnicity data recorded.			(medium effect size). **Standardised Construct-Driven Measures** (3) The CCT group reported significant improvements in performance on the WAIS-IV Digit Span *p*=.041, η_p^2= 0.048 (small effect size); and DKEFS Letter Fluency *p*=.009, η_p^2= 0.076 (medium effect size). **Conclusion:** Provides support for the CCT intervention in improving prospective memory and executive function outcomes with small-medium effects.			
12 Tornås et al., (2016)	**Design:** RCT **Aim(s):** To investigate the efficacy of GMT on	Outpatient clinic. **Country:** Norway.	70 brain-injured participants reporting executive function impairments.	**Intervention:** GMT, 8 2-hour group sessions over 4 days. Daily STOP SMS messages. *N*=33	**Functional Outcome Measures** BRIEF-A (self-report; Cognitive Failures Questionnaire	**Functional Outcome Measures** (1) Significant reductions in self-reported executive problems on the	**Strengths:** Clinical sample, participants refrained from participating in other cognitive interventions whilst participating, randomisation completed	(A) Moderate (B) Strong (C) Strong (D) Strong (E) Weak (F) Strong	(1) Low (2a) Some Concerns (2b) Low (3) Low (4) Low (5) Some Concerns

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
	executive function impairments in individuals with chronic brain injury.		**Brain Injury:** 45 (64.3%) TBI, 15 (21.5%) Stroke, 6 (8.6%) Tumour, 2 (2.9%) anoxic, 2 (2.9%) other. Mechanism and severity of injury not reported. **Other Details:** Age range 19-66 years old, Mean age 42.9 (*SD*=13); 37 (52.9%) male, 33 (47.1%) female. No ethnicity information recorded.	**Comparison:** BHW Workshop, 8 group sessions. *N*=37 Sessions conducted by a psychologist.	(self-report); DEX (self-report) **Standardised Construct-Driven Measures** CPT-II; DKEFS Color-Word Inference, DKEFS Verbal Fluency, DKEFS Tower Test, DKEFS Trails Test, The Hotel Task.	BRIEF-A Behavioural Regulation Index $p<.001$, Cohens $d=0.64$ (medium effect size); Metacognitive Index $p<.01$, Cohens $d= 0.55$ (medium effect size); and Global Executive Composite $p<.001$, Cohens $d= 0.66$ (medium effect size) from baseline to 6-months follow-up for the GMT group. (2) Significant reductions in self-reported executive problems on the BRIEF-A Metacognitive Index $p<.01$, Cohens $d= 0.30$ (small effect size) from baseline to post-intervention in the BHE group. (3) Significant reduction in self-reported dysexecutive symptoms on the DEX from baseline to 6-month follow-up for the GMT	by external source, participants and assessors were blinded, included 6 month follow-up, extensive neuropsychological measurement of executive function, relatively large sample size. **Limitations:** Only per-protocol analysis of results with *n*=3 participants withdrawing, and a 96% adherence rate, reliability and validity of outcome measures not reported, external cueing was not equivalent in both groups, heterogenous sample, measures may have been influenced by demand characteristics, social desirability bias and cognitive ability of participants, no power calculations included, results potentially influenced by practice effects.	**QATQS Overall Rating: Moderate**	**RoB-2 Overall Rating: Some Concerns**

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
						group, *p*=<.001, Cohens *d*= 0.56 (medium effect size). **Standardised Construct-Driven Measures** (4) Significant reduction in Commission Errors on the CPT-II in between baseline and post-treatment for the GMT g *p*<.01, Cohens *d*= 0.45 (small effect size), and BHE group *p*<.01, Cohens *d*= 0.50 (medium effect size); and between baseline and 6-month follow-up for the GMT *p*<.05, Cohens *d*= 0.30 (small effect size) and BHE group *p*<.001, Cohens *d*=0.63 (medium effect size). (5) Significant improvements of Tower Test total time from baseline to post-treatment in GMT *p*<.001,			

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
						Cohens *d*= 0.73 (large effect size); and BHE group *p*<.05, Cohens *d*=*0.37* (small effect size). And from baseline to 6-month follow-up in the GMT *p*<.001, Cohens *d*= 1.01 (large effect size); and BHE group *p*<.01, *Cohen's d*= 0.77 (large effect size). (6) Significant improvement in Tower Test Total Achievement score from baseline to post-intervention for GMT group *p*<.01, Cohens *d*= 0.43 (small effect size); and from baseline to 6-month follow-up for the GMT *p*<.05, Cohens *d*= 0.39 (small effect size) and BHE group *p*<.01, Cohens *d*= 0.31 (small effect size). (7) Significant improvement on the Hotel Task			

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
						number of tasks attempted from baseline to post-treatment for GMT $p<.05$, Cohens $d=$ 0.48 (small effect size) and BHE groups $p<.01$ Cohens $d=$ 0.58 (medium effect size); and from baseline to 6-month follow-up for GMT $p<.01$, Cohens $d=$ 0.53 (medium effect size) and BHE groups $p<.05$, Cohens $d=0.45$ (small effect size). **Conclusion:** Provides support for GMT interventions in improving self-reported everyday executive function outcomes with medium effects, lasting up to 6-months following intervention. Both GMT and BHE interventions appear to show varied improvements across			

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
						neuropsychological tests for executive function, ranging from small-large effects.			
13 Tornås et al., (2019)	**Design:** RCT follow-up from 2016 study **Aim(s):** To investigate the long-term effects of GMT intervention, 5 years post-training.	Outpatient clinic. **Country:** Norway.	50 brain-injured participants reporting executive function impairments, who had completed the GMT training in the al., (2016) study. **Brain Injury:** 29 (58%) TBI, 13 (26%) stroke, 6 (12%) tumour, 2 (4%) other. No mechanism or severity information recorded. **Other Details:** mean age 45.76 (*SD*= 10.87); 27 (54%) male, 23 (46%) female. No ethnicity information reported.	**Intervention:** GMT, 8 2-hour group sessions over 4 days. Daily STOP SMS messages. **Comparison:** BHW Workshop, 8 group sessions. Sessions conducted by a psychologist.	**Functional Outcome Measures** BRIEF-A (self-report)	**Functional Outcome Measures** ***BRIEF-A*** (1) Baseline to 6-month follow up data for the BRIEF-A reported in study 12. (2) BRIEF-A index scores returned to baseline for GMT group at 5 year follow-up. **Conclusion:** Long-term effects of GMT in the amelioration of self-reported daily executive function problems not supported.	**Strengths:** Clinical sample, control group. **Limitations:** Participants only completed BRIEF-A again, not the other measures that were previously completed in Study 12, participants not blind to treatment allocation, no report of influence of other life events in 5 years since original study, no power calculations included, Only per-protocol analysis used with *n*=17 withdrawing and a 75% adherence rate.	(A) Moderate (B) Strong (C) Moderate (D) Weak (E) Strong (F) Moderate **QATQS Overall Rating: Moderate**	-

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
14 Vas et al., (2011)	**Design:** RCT **Aim(s):** To investigate the ability of the SMART programme in improving gist-reasoning in TBI compared to BHW.	Outpatient Clinic. **Country:** USA	28 brain-injured participants reporting executive function impairments. **Brain Injury:** 100% TBI, severity data not available, mechanism of injury not reported. **Other Details:** age range 20-62, SMART group mean age= 39.0 (*SD*=14.44), BHW mean age= 47.0 (*SD*=8.24). No gender or ethnicity information reported.	**Intervention:** SMART, 12, 1.5-hour group sessions. The first 10 sessions were conducted over a 5-week period (two per week), the final two sessions were spaced out over the next three weeks. *N*=14. **Comparison:** BHW, 12, 1.5-hour group sessions. The first 10 sessions were conducted over a 5-week period (two per week), the final two sessions were spaced out over the next three weeks. *N*=14. Sessions were conducted by a speech pathologist and an occupational therapist with experience in TBI rehabilitation.	**Standardised Construct-Driven Measures** TOSL; Daneman and Carpenter working memory listening span task; Letter Number Sequencing from the WAIS-III; DKEFS Colour-Word Inference, Matrix Reasoning from WAIS-III; Trail Making Test-Part B; COWAT.	**Standardised Construct-Driven Measures** (1) Significant improvement in TOSL scores post-treatment *p*=.007, and at 6 months follow-up *p*=.004 for the SMART group compared to baseline performance. No significant changes for the BHW group. No effect sizes provided. (2) Significant improvement in scores on the Listening Span task post-training *p*=.005, and at 6 months follow-up *p*=.0001 for the SMART group compared to baseline. No significant changes for the BHW group. No effect sizes provided. (3) Significant improvements for the SMART group on DKEFS Colour-Word Inference Inhibition *p*=.01; Matrix Reasoning	**Strengths:** strong research design, clinical sample, control group, assessors blinded to treatment condition. **Limitations:** Randomisation procedure not described, only per-protocol analysis used with *n*=7 withdrawing post-treatment (80% adherence rate) and *n*=11 withdrawing from randomisation to six month follow up (69% adherence rate), no reliable documentation of severity of TBI, heterogenous sample, includes some participants whose TBI was during childhood (although study participation was as an adult), no power calculations included, speech pathologists and occupational therapists not qualified to administer all of the neuropsychological assessments within the study, results potentially influenced by practice effects.	(A) Moderate (B) Strong (C) Strong (D) Moderate (E) Strong (F) Moderate **QATQS Overall Rating: Strong**	(1) Some Concerns (2a) Some Concerns (2b) High (3) Low (4) Low (5) Some Concerns **RoB-2 Overall Rating: High**

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
						p=.001; and the Trail Making Test-Part B *p*=.01 at post-treatment and at 6 months follow-up. No effect sizes provided **Conclusion:** Provides support for the SMART intervention for improving gist-reasoning and executive function measures at post intervention, and at 6 months follow up. However, no effect sizes provided.			
15 Waid-Ebbs et al., (2014)	**Design:** Case Series **Aim(s):** To investigate the effect of GMT on Veteran's with executive function impairments following blast induced mild TBI.	Not stated. **Country:** USA.	6 brain-injured Veterans with mild TBI, reporting executive function impairments. **Brain Injury:** 100% mild traumatic brain injury due to blast-related injury. **Other Details:** 25-40 years old, mean age 31 years, 5 (83%)	**Intervention:** Modified GMT, 10 group sessions presented biweekly. **Comparison:** N/A No information on who delivered the training provided.	**Standardised Construct-Driven Measures** Computerised Tower of London Task (cTOL). **Functional Outcome Measures** BRIEF-A (self and proxy report)	**Standardised Construct-Driven Measures** (1) Significant improvement on cTOL Total Time *p*<.04, and Optimal Moves *p*<.03 post treatment relative to baseline. No effect sizes provided. (2) Regression analysis showed that for every point of impairment on measure of inhibition, there was an associated	**Strengths:** Uses reliable and valid measures, clinical sample, **Limitations:** Does not include research questions or hypotheses, no information about blinding of assessors/participants, could have included more information about participant characteristics, no operational definition of executive function included, no evaluation of procedural fidelity, results not reported for each individual but grouped	(A) Moderate (B) Weak (C) Weak (D) Weak (E) Strong (F) Moderate **QATQS Overall Rating: Weak**	-

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
			White, 1 (17%) African American, 4 (57%) male, 2 (33%) female.			1.3 points improvement on the cTOL; indicating participants with greater impairment had a greater response to treatment. (3) cTOL Total Time, Planning Time, and Optimal Moves did not significantly change between baseline and 1-month follow-up. **Functional Outcome Measures** (4) No significant change on BRIEF-A scores from baseline to post-treatment Behavioural Regulation Index patient Cohens *d*= 0.42 (small effect size), Behavioural Regulation Index caregiver Cohens *d*= 0.27 (small effect size), Metacognitive Index patient	together, no power calculations included.		

Study	Design and Aim(s)	Setting	Participants	Intervention and Comparisons	EF Outcome Measure(s)	Key Finding(s)	Evaluation	QATQS Ratings	RoB-2 Ratings
						Cohens *d*= 0.08 (negligible effect size), Metacognitive Index caregiver Cohens *d*= 0.49 (small effect size). No significant change in BRIEF-A scores between baseline and 1-month follow-up. **Conclusion:** Some limited evidence provided for GMT intervention in improving executive function outcomes, however these were not maintained, and no effect sizes were reported. No evidence for GMT intervention in improving self-reported everyday executive functions.			

Note: Aim(s) included refer exclusively to aims relating to executive function outcomes of the study. Only executive function outcomes of the studies are reported. Definitions of abbreviations include EF= Executive Function; QATQS= Quality Assessment Tool for Quantitative Synthesis; RoB-2= Risk-of-Bias Tool for Randomized Trails; RCT= Randomised Controlled Trial; GMT= Goal Management Training; N= number of participants; *SD*= Standard Deviation; GAS= Goal Attainment Scaling; CO-OP= Cognitive Orientation to daily Occupational Performance; DEX= Dysexecutive Questionnaire; WMT= Working Memory Training; EOS= Executive Observation Scale; WCST= Wisconsin Card Sort Test; BADS= Behavioural Assessment of Dysexecutive Syndrome; AIM= Assisted Intention Monitoring; STOP= Stop, Think, Organise, Plan; SMS= Short Message Service; DKEFS= Delis-Kaplan Executive Functioning System; WAIS-III=Wechsler Adult Intelligence Scale-III; GOALS= Goal-Orientated Attentional Self-Regulation); BHE= Brain Health Education; MET= Multiple Errands Test; TBI= Traumatic Brain Injury; CCT= Compensatory Cognitive Training; PRMQ= Prospective-Retrospective Memory Questionnaire; MSNQ= Multiple Sclerosis Neuropsychological Screening Questionnaire; PCSS= Portland Cognitive Strategies Scale; BRIEF-A= Behavioural Rating Inventory of Executive Function- Adult Version ; CPT-II=Conners' Continuous Performance Test-II; SMART= Strategic Memory and Reasoning Training; BHW= Brain Health Workshop.; TOSL= Test of Strategic Learning; COWAT= Controlled Oral Word Association Test. QATQS ratings: A= Selection Bias, B= Study Design, C= Confounders, D= Blinding, E= Data

Collection Methods, F= Withdrawal and Drop-outs; RoB-2 ratings: 1= Risk of bias arising from randomisation process, S= Risk of bias arising from period and carryover effects (Crossover Designs only), 2a= Effect of assignment to intervention, 2b= Effect of adhering to intervention, 3= Missing outcome data, 4= Risk of bias in measurement of the outcome, 5= Risk of bias in selection of the reported result.

Summary of Data

Narrative Summary

Study Characteristics

All 15 papers included participants with TBIs. 53% of studies (3,6,8-11,14,15) were TBI-only, 47% included brain disorders of other aetiologies (1,4,5,7,12,13). Of the TBI-only studies, seven reported severity (3,6,8-11,15). Two (11,15) included mild TBI only, two (6,10) severe TBI only, and three (3,8,9) mild, moderate, and severe TBIs. Of the studies with mixed aetiologies, only one reported TBI severity (5), including mild, moderate, and severe TBIs. All mixed aetiology studies combined TBI and other brain injury participant data. As no differences in study results and methodological quality were found between mixed aetiology and TBI-only studies, the data was combined for this review. Brain injury mechanisms were reported in 33% studies (6,7,8,10,15), these included motor vehicle collision, fall, assault, and blast-related injury. Four studies involved Veterans with TBI (8,9,11,15). All participants were middle-aged adults. 87% of studies (1-6,8-13,15) included a higher proportion of males than females. Only 33% studies (8-11,15) included ethnicity information.

Comparators consisted of GMT as a comparator to errorless learning GMT (1,2), treatment as usual (5,11), WMT (4), and a no intervention control (3). One study used a healthy control group (4), but only at pre-treatment. Three studies (6,10,15) had no control group. Six studies (7-9,12-14) used brain health psychoeducation workshops as a comparator. These workshops focused on brain functioning and were not EF interventions.

EF was assessed using standardised construct-driven, and functional outcome measures. Construct-driven measures assess specific areas of EF,

whilst functional measures assess the daily management of challenges associated with impairment (Parsons, 2015). Within the review, ten studies (2,4-9,11,12,15) utilised a mixture of construct-driven and functional measures, two (10,14) used construct-driven measures only and three (1,3,13) used purely functional measures. Of the construct-driven measures used, the most frequent were the Verbal Fluency test (2,4-12,14), the Trail Making Test (4,6-12,14), and the Stroop/Colour-Word Inference from the DKEFS (4,7-10,12,14). For functional measures, the DEX (2-4,6,12) and BRIEF-A (12,13,15) were most commonly used. Functional measures also included multi-step everyday task performance (1,4), the proportion of daily intentions achieved (5) or goals met (6) and other questionnaires such as the Goal Processing Questionnaire (7,8).

Interventions

67% of studies (1,2,4,5,7-9,12,13,15) used GMT, 13% problem-solving strategies (11,14) and 20% MST (3,6,10). All research was conducted in the USA, Canada, or Europe. Five interventions were run in both outpatient and community settings (1-5), five in outpatient clinics only (7,10,12-14). Three interventions were run in Veterans Affairs medical centres (8,9,11), one over videoconferencing software (6), and one did not report the setting (15).

GMT. All GMT studies (1,2,4,5,7-9,12,13,15) adapted the original protocol. Three (12,13,15) used group sessions, four (1,2,4,5) individual sessions and three (7-9) a mix of both. Three studies (5,12,13) supported GMT with external cueing, two errorless learning (1,2), one WMT (4) and one psychoeducation (15). Interventions ranged from 180 (5) to 2580 (7-9) minutes of sessions, with Study 5 including two 90-120 minute sessions, and Studies 7-9 including 10, 2-hour group sessions, three 1-hour individual sessions and 20 hours of home practice. Information on intervention facilitators varied; one study

provided no information (15) and three studies reported ‘two therapists’ (8,9) or an ‘examiner’ (4). Where facilitators were recorded, they consisted of psychologists/neuropsychologists (12,13), occupational therapists (OT) (5), or a both (1,2,7).

Other Problem-Solving Interventions. Problem-solving interventions consisted of Compensatory Cognitive Training (CCT; 11) and Strategic Memory and Reasoning Training (SMART; 14). All sessions were run as groups, and protocols ranged from 12, 1.5 hour (14) to 10, 2 hour sessions (11). Facilitators were either master’s or doctoral level therapists (11) or rehabilitation trained OTs and speech pathologists (14).

MST. MST protocols consisted of CO-OP (3,6) and Metacognitive Strategy Instruction (MSI) (10). All sessions were run individually, with protocols ranging from three, 50 minute (10) to 20, 1-hour sessions (3,6). Facilitators were graduate student clinicians (10), OTs (6), or a mix of OTs and ‘paraprofessionals supervised by an OT’ (3).

Design and Methodology

Ten studies (1,2,4,5,8,9,11-14) were RCTs, three (6,10,15) case studies, one (3) partially randomised pilot controlled trial, and one (7) pseudorandom crossover design. Only three studies (1,3,5) reported both power calculations and effect sizes, and just one (5) was sufficiently powered. The QATQS rated three studies ‘strong’ (4,5,14), eight ‘moderate’ (1,2,7-9,11-13) and four ‘weak’ (3,6,10,15). RCT’s (1,2,3,4,5,8,9,11-14) had the strongest overall methodology, and case studies (6,10,15) the weakest. No RCT had a low overall RoB-2 bias rating, with particular weaknesses in the ‘selection of the reported result’. This was largely due to facilitators being aware of which intervention condition they

were delivering, a particular challenge in intervention studies where appropriate training is required to accurately deliver the material. Additionally, the majority of RCTs utilised only per-protocol analysis, with just one (5) using intention-to-treat analysis as well.

Generally, studies using GMT (1,2,4,5,7-9,12,13), and problem solving interventions (11,14) had stronger methodological quality, whist all MST studies (3,6,10) were rated methodologically 'weak'. There was a low risk of bias from confounding variables, data collection methods, and withdrawals. Generalised weaknesses were found in selection bias, with 12 studies (1,2,4,5,7-9,11-15) receiving 'moderate' and three (3,6,10) receiving 'weak' ratings, and blinding, with six studies (3,7,9,10,13,15) receiving 'weak' ratings.

Results

Thirteen studies (1,4,5,6,7-15) provided statistically significant evidence for improving construct-driven and functional EF outcomes. Of these, eight (1,4,5,8,11-13,15) either reported effect sizes or included data sufficient to calculate effect sizes. The majority of these were RCTs with 'moderate'- 'strong' quality ratings (1,4,5,8,11-13), seven used GMT (1,4,5,8,12,13), and one a Problem-Solving strategy (11).

All interventions supported most EF outcomes, with the exception of sustained attention, goal achievement, everyday task performance, and the proportion of daily intentions achieved, which were only supported by GMT (1,4,5,7,8,9,12). GMT had the strongest evidence, with large effect sizes for improvements in construct-drive outcomes (8,11,12) and moderate-large effects for functional outcomes (1,5,8,12,13). When combined with errorless learning (1), WMT (4) and external cueing (5), GMT showed large effect sizes in all outcomes, indicating an increase in effect sizes for functional measures, and

movement within the large effect size for construct-driven measures. The problem-solving protocol (11) was generally weaker, showing medium effects for inhibition and functional outcomes, and small effects for working memory.

Of the six studies (7,9,12-15) looking at long-term outcomes, some improvement was found from between 5-weeks (7) to 1 year (9) post intervention. However, one study found that improvements in everyday EF returned to baseline at 5-year follow-up (13).

Interventions with a higher frequency of sessions (1,4,8,12,13), running between twice per week (1,8) to twice per day (12,13), had the largest effect sizes. No difference was found for the overall length of intervention, with both the lowest (1,4,5) and highest (8) number of session minutes included having large effects. Gender, TBI severity, injury mechanism and Veteran status had no impact on effect size. Studies with higher mean participant ages (42.9-49.7 years) had larger effects (1,5,8,12,13) with the exception of Study 4. Studies using psychoeducation (8,12,13) or an active intervention (1,4) as comparators showed higher effects than those using treatment as usual (5,11), or no comparators (15). This suggests that psychoeducation and active intervention have less of an impact on EF recovery than treatment as usual. This may be due to these interventions increasing awareness of EF challenges, without equipping individuals with strategies to cope.

Critical Summary

The review supports using cognitive rehabilitation interventions to improve EF outcomes following TBI, with improvements in outcome measures found across all intervention types. The largest effects were found in RCTs using GMT (1,4,5,8,12,13), particularly when run frequently (1,4,8,12,13), and supported by additional elements such as errorless learning (1), working

memory training (4) and external cueing (5). No difference in effect sizes was found for the number of intervention sessions. As individuals with TBI are prone to fatigue (Belmont et al., 2006), long running interventions may be challenging. Travelling to numerous sessions may be difficult, particularly as individuals with disabilities such as TBI experience disproportionate socioeconomic difficulties (Evans & Collard, 2022). Additionally, long running interventions may be more costly to healthcare services. Consequently, shorter-term interventions may be more optimal for clinical use.

Some evidence for the short-term maintenance of EF improvements over a 6-12 month period was found following GMT (7,8,12) and SMART (14). However, one study (13) found this returned to baseline 5-years post GMT, suggesting that whilst interventions may be beneficial in the shorter-term, the skills may be hard to continue independently.

Study Characteristics

Generally, studies included robust EF measures. However, not explicitly reporting reliability and validity information brought down the 'Data Collection' QATQS rating in some studies (1,2,5,6,8,10-12). The EF outcome measures used varied. As these measures hold low construct validity (Salthouse, 2005), and with no gold standard EF definition available, it cannot be sure that different measures evaluate the construct in the same way. Additionally, only four (7-10) of the 12 studies using construct-driven measures (2,4-12,14,15) utilised parallel forms. The remaining eight (2,4-6,11,12,14,15) may be influenced by practice effects (Lezak et al., 2004). Whilst functional outcome measures can help provide an understanding of real world implications (Chan et al., 2008), these rely on self-report which can be influenced by bias (Rosenman et al.,

2011) and EF impairments (Williams & Wood, 2010). 73% of studies (1-4,6-8,11-13,15) included self-report functional outcome measures.

There was a lack of diversity, with all studies published in Western countries, and a lack of participant ethnicity information provided. Where ethnicity information was reported (8-11,15) the majority of participants were White Western (64-83%). This is problematic, as clinical interventions adapted from the evidence base may be centred around White Western experiences, lacking perspectives from other cultures (Collins, 2017). Gender was unanimously reported as either 'male' or 'female', disregarding the experiences of non-binary individuals. 87% of the studies included more male than female participants, reflecting the lack of research available into the female experience of a TBI (Ackerman & Banks, 2003; Valera & Berenbaum, 2003).

Additionally, TBI severity was only reported in eight studies (3,5,6,8-11,15), and mechanism in just five (6-8,10,15). This may reflect the challenges of recruiting post-acute TBI participants, where access to medical records is limited, and self/other report is often relied upon. Whilst mechanism and severity of injury appeared to have no impact on effect sizes, if they had been reported as standard, differences in effects may have shown, for example from the impact of multiple TBI.

Methodology

Overall, study methodology was good, with 73% of studies (1,2,4,5,7-9,11-14) rated as 'moderate'- 'strong'. There were relatively small numbers of withdrawals, and studies typically controlled for confounding variables. Although all studies used clinical samples, selection bias was high. This is likely due to recruitment methods, as TBI participants are often recruited through clinics or

self-referral and may not be representative of the broader TBI population, limiting the generalisability of results.

There were some methodological challenges. Only three studies (1,3,5) reported both power calculations and effect sizes, and only one (5) was sufficiently powered. As underpowered results are likely influenced by random or systematic error, it is hard to draw accurate conclusions on the strength or substantive significance of the results. There was a lack of examiner blinding in RCT studies (1,2,4,5,8,9,11-14), potentially introducing detection or reporting bias and limiting the accuracy of the reported effect sizes. Additionally, all but one RCT (5) used per-protocol analysis only (1,2,4,8,9,11,12,14), potentially resulting in problems such as violating randomisation principles, analysed data not representing the original group due to attrition and the exaggeration of a treatment effect (Ranganathan et al., 2016).

Whilst RCTs using GMT provided the strongest evidence in terms of methodological quality (1,2,4,5,8,9,12,13) and effect sizes (1,4,5,8,12,13), a higher proportion of these studies were included in the review. Conversely, only three MST studies (3,6,10) met the inclusion criteria, all of which were rated ‘weak’. Whilst studies looking at problem-solving strategies were methodologically stronger, only two were included in the review (11,12), and both were published over six years ago. This highlights the lack of new, quality studies looking at MST and problem solving strategies available.

Discussion

This review provided support for compensatory cognitive rehabilitation interventions in improving EF outcomes following TBI. Particular support was found for GMT (1,4,5,7-9,12,13,15), with implications across the widest number of EF outcome measures, and some, albeit limited, evidence for long-term

effectiveness (7.9). This mirrors recently published clinical guidelines by the International Cognitive (INCOG) group, recommending the use of strategies such as GMT for EF cognitive rehabilitation in moderate-severe TBI (Jeffay et al., 2023).

All GMT studies in this review adapted the original protocol. The current study supported Krasny-Pacini et al., (2014) findings, that providing frequent sessions, and combining protocols with additional elements such as errorless learning (1,2), WMT (4), and external cueing (5) resulted in the strongest effects. GMT may be challenging for individuals with EF impairments, as tasks such as keeping track of steps and goals increases demands in already vulnerable executive systems (Bertens et al., 2015; Emmanouel et al., 2020). Supporting GMT with additional strategies may reinforce vulnerable EF areas. For example, in the Unity-Diversity model (Friedman et al., 2006; Miyake & Friedman, 2012; Miyake et al., 2000) errorless learning may support 'Updating' through freeing up monitoring resources to focus on the goal rather than error monitoring, external cueing may support 'Shifting' processes by drawing attention to goals and intentions, and WMT may support 'Updating' through increasing working memory ability (Emmanouel et al., 2020). As the Unity-Diversity model is both distinct and interconnected (Miyake & Friedman, 2012), support at one area of the system may support the system as a whole.

There are cautions in interpreting these findings. The widespread lack of reporting effect sizes and power calculations limits the interpretability of results. Although no difference between mechanism of TBI was reported, there was a lack of reporting this information. Injury context may contribute additional complexity, for example, Veterans experiencing blast-related injury may also experience post-traumatic stress disorder (Stevelink et al., 2018), which could

interact with impairments. Studies rarely reported ethnicity data, and where reported, the majority of participants were White Western. Consequently, there is a lack of understanding the applicability of EF interventions to other cultures.

In compensatory cognitive rehabilitation, strategies are taught to improve an individual's level of disability and changes in underlying cognitive ability are unlikely. Consequently, it would be expected that participants performance may increase on functional outcomes, but not on construct-driven measures (Parsons, 2015). Interestingly, the review reported positive effects in some construct-driven outcomes. This suggests that some remediation may be taking place, although this could also be explained by the participant's ability to adapt compensatory strategies to support their performance on construct-driven measures.

The INCOG guidelines (Jeffay et al., 2023), recommend that interventions such as GMT should be provided to support to EF impairments in moderate-severe TBI. The current review expands on this, containing 13 studies (1-11,14,15) investigating GMT (1,2,4,5,7-9,12,15), MST (3,6,10) and other problem-solving interventions (11,14) not included in the INCOG review. The results further indicate that GMT may also be useful for EF impairments in mild TBI and potentially PCS. However, there are differences in the breadth of interventions included; as INCOG also reviewed alternative emerging interventions such as music therapy and VR, which were excluded from the current review.

The current review is not consistent with Cicerone et al's (2019) previous review, where they recommended incorporating GMT and problem-solving approaches into MST. Whilst some evidence for MST is provided, the weak

methodology limits the interpretation of this, and no studies appear to explicitly combine both MST and GMT/problem-solving elements. Of the 22 studies with TBI participants published after 2010 included in the Cicerone et al., (2019) review, only five reached the current studies inclusion criteria (3,6,7,14,15). This was due to reasons such as using VR and emotion focused interventions, not accurately controlling for neurodegenerative conditions, and not having explicit EF outcomes. However, the stringent and focused inclusion and exclusion criteria of the current study may have limited the number of MST studies included, presenting a skew towards GMT.

Limitations

The review has a number of limitations. The search terms identified a high proportion of irrelevant records, with only 0.2% of these included in the review. This suggests weaknesses in the search strategy that could have been refined to ensure only relevant records were found. The stringent inclusion and exclusion criteria, applied in an effort to ensure all papers were highly relevant, may have inadvertently limited the scope of the literature included, resulting in a limited view of available EF interventions.

A high proportion of GMT studies were included, potentially biasing the results. Nine of the studies reporting positive outcomes focused on GMT (1,4,5,7-9,12,13,15), in contrast, only two included problem solving interventions (11,14), and two MST (6,10). Additionally, whilst seven GMT studies had reportable effect sizes (1,4,5,8,12,13,15), only one problem solving intervention (11) and no MST interventions had reportable effect sizes. Subsequently, the magnitude and clinical significance of the effect in these interventions is difficult to ascertain. GMT and problem-solving studies also had higher overall rated methodological quality than MST studies. Consequently, the increased support

for GMT over the other EF intervention protocols may be biased by the quality and number of the studies available in the evidence base.

The study has a number of strengths. The inclusion of quality ratings improved upon previous reviews, allowing interpretation of the findings in the context of the evidence quality. Using Rayyan reduced the likelihood of human error, and improved efficiency of working. A range of outcome data was included, giving insight into the effects of EF interventions on both construct driven and functional outcomes. Additionally, the study included information around gender and ethnicity, highlighting the need to develop the understanding of interventions across cultures, rather than specifically based on than White Western perspective.

Implications

Theoretical Implications

This review highlights the challenges associated with a lack of understanding of EF within the literature. With no gold standard definition, and a number of different theoretical models available, drawing parallels between interventions and outcome measures is challenging. Although the Unity-Diversity model (Friedman et al., 2006; Miyake & Friedman, 2012; Miyake et al., 2000) is widely cited, when mapped onto the Cattel-Horn-Carroll model of cognitive abilities (Carroll, 1993), Jewsbury et al., (2016) found both ‘Inhibition’ and ‘Shifting’ can be partly explained by a general processing speed factor, whilst ‘Updating’ reflects the same construct as short-term memory. Consequently, EF measures and interventions based on the available models may not accurately treat EF at a theoretical level.

Without a gold standard EF definition, the inclusion/exclusion criteria of the current study became hard to define. Through using standardised measures and self-report to conceptualise EF impairment it could be that other relevant areas were missed. In particular, emotional regulation, which could be labelled as ‘anger’ or ‘depression’ rather than EF impairment, and therefore would have been excluded from the current review. A lack of a gold standard model can lead to confusion. For example, EF interventions are categorised differently across the literature, with INCOG 2.0 (Jeffay et al., 2023) classifying GMT as a ‘metacognitive strategy intervention’. This contrasts with the current review, where GMT is classified independently, as it was felt that in defining GMT in terms of the Unity-Diversity model, metacognitive processes only partly explained the protocol.

Clinical Implications

This review provides evidence for the efficacy of cognitive rehabilitation interventions for EF impairments within TBI. In particular, support is provided for GMT with adaptations including WMT, errorless learning, and external cueing. This widens current clinical guidelines recommending the use of strategies such as GMT in moderate-severe TBI (Jeffay, 2023), to include mild TBI.

No difference in outcomes was found between the lowest and highest number of total intervention session minutes. As shorter intervention protocols are likely to be less burdensome, less costly, and more accessible to clinical clients, shorter interventions may be optimal. With shorter interventions clinicians able to treat a higher proportion of individuals.

In line with the low reporting of ethnicity information across studies, the cultural sensitivity of interventions must be considered for clients who are not White Western. Interventions were delivered across psychology, OT and

speech and language professions, reflecting integrated, multi-disciplinary working. Appropriate training and supervision around cultural competency and intervention delivery is important to ensure appropriateness and consistency.

Additionally, the larger effect sizes found in studies using psychoeducation as a rather than treatment as usual/no comparator. Clinicians should be aware that using psychoeducation to promote understanding of EF in TBI alone may exacerbate challenges, and individuals should be supported to develop strategies to cope.

The variety of improvements in EF outcomes found in this study highlights the need for comprehensive construct-driven and functional assessment of EF. At formulation the Unity-Diversity model (Miyake & Friedman, 2012) can be used to understand the complexity and heterogenous nature of EF.

Further research is needed to create accurate EF models. In doing this, not only can improvements be made in the appropriateness of EF interventions, but research methodology and consistency can be improved, leading to a clearer and more accessible understanding of the EF literature.

Future research must include more ethnically diverse and female participants, as well as accurate reporting of TBI mechanism and severity. Within psychology, cognitive impairment is not experienced in isolation of other psychological, and contextual factors (Anderson et al., 2019). Consequently, research addressing the intersection between areas of social oppression and privilege, including a wider understanding of the context of injury, is important.

Future studies must report effect sizes and power calculations. A need for quality research into MST and problem-solving strategies, and the longer-term effectiveness of interventions was also highlighted. This can promote

further understanding of how well interventions transfer into daily life, and if additional elements are needed to support individuals at post-intervention.

Conclusion

This review provides evidence for the efficacy of cognitive rehabilitation for EF impairments in TBI. In particular, the use of GMT with adaptations such as WMT, errorless learning, and external cueing. Shorter interventions were as beneficial as longer ones, and as they are likely to be less burdensome, less costly, and more accessible, they could be optimal for clinical use. Further high quality research is needed into MST interventions, TBI mechanisms and severity, and the efficacy of cognitive interventions across other genders, and in ethnically diverse populations. Whilst GMT can be mapped onto the Unity-Diversity model (Friedman et al., 2006; Miyake & Friedman, 2012; Miyake et al., 2000), further theoretical advancements in understanding EF as a construct are needed to inform future interventions.

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Appendices

Appendix A

PRISMA-P Checklist

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item
ADMINISTRATIVE INFORMATION		
Title:		
Identification	1a	Identify the report as a protocol of a systematic review
Update	1b	If the protocol is for an update of a previous systematic review, identify as such
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number
Authors:		
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments
Support:		
Sources	5a	Indicate sources of financial or other support for the review
Sponsor	5b	Provide name for the review funder and/or sponsor
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol
INTRODUCTION		
Rationale	6	Describe the rationale for the review in the context of what is already known
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)
METHODS		
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated
Study records:		
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review

Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2, Kendall's τ)
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.

Appendix B

Definitions of Traumatic Brain Injury (TBI) Severity

TBI Severity	Definition Level 1 (strictest)	Definition Level 2	Definition Level 3 (most lenient)
mTBI	GCS: 13-15 AND Loss of Consciousness: 30 minutes or less, or no loss of consciousness AND Post-Traumatic Amnesia: Less than 24 hours	Evidence of a traumatic brain injury AND Incomplete reporting of GCS, LoC, or PTA, but one or two noted. OR Medical professional report of mTBI.	Evidence of a traumatic brain injury AND Self-report mTBI
	With/ without Post-concussion syndrome (ICD-10 criteria) OR major or mild neurocognitive disorder due to TBI (DSM-V criteria)		
Moderate TBI	GCS: 9-12 AND Loss of Consciousness: 30 minutes – 24 hours AND Post-Traumatic Amnesia: 24 hours- 1 weeks.	Evidence of a traumatic brain injury AND Incomplete reporting of GCS, LoC, or PTA, but one or two noted. OR Medical professional report of moderate TBI	Evidence of a traumatic brain injury AND Self-report moderate TBI
Severe TBI	GCS: <8 AND Loss of Consciousness: >24 hours AND Post-Traumatic Amnesia: > 1 week	Evidence of a traumatic brain injury AND Incomplete reporting of GCS, LoC, or PTA, but one or two noted. OR Medical professional report of Severe TBI	Evidence of a traumatic brain injury AND Self-report Severe TBI

Appendix C

A copy of instructions for authors of the nominated journal:

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Contents

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Target Journal	Neuropsychological Rehabilitation
Word Count:	8254 words

This manuscript has been submitted in partial fulfilment of a Doctoral Degree in Clinical Psychology, University of Exeter.

Abstract

An estimated 31,500,000 females have experienced at least one intimate partner violence (IPV) related traumatic brain injury (TBI), or IPV-TBI in their lifetime in the United States of America (USA) alone. Survivors often experience executive function (EF) impairments, resulting in numerous functional and psychological challenges. Despite this, there are currently no studies into EF interventions for IPV-TBI survivors available. Compensatory cognitive rehabilitation and EF coaching have shown positive outcomes for EF in TBI. The current study aimed to investigate the effects of an intervention, combining cognitive rehabilitation and EF coaching for female survivors of IPV-TBI with EF impairments. A multiple baseline single case experimental design (MB-SCED) was used. Two female participants (age *M*=51.5, range=44-59) completed the study. The independent variable was a four-week cognitive intervention, the dependent variables were everyday executive function, goal attainment, and health-related quality of life (HRQoL). Analysis revealed that the intervention may have benefits for EF goal attainment, self-reported EF and HRQoL. However, these should be interpreted with caution due to the study limitations. The study highlights the need for further clinical interventions and research for IPV-TBI survivors.

Keywords: intimate partner violence, brain injury, cognitive rehabilitation, executive function, intervention.

Introduction

This research focuses on the female experience of intimate partner violence (IPV) related traumatic brain injury (TBI), or IPV-TBI. Within this report, the term 'female' describes individuals who were registered female sex at birth.

IPV describes the experience of physical, sexual, or psychological abuse by a current or ex-intimate partner in the context of power and control (Humphreys & Campbell, 2004). It is a pervasive concern to public health (Iverson et al., 2019), with estimates of one third of women worldwide experiencing IPV during their lifetime (World Health Organisation, 2017).

With the most common injuries occurring to the head, face, and neck (Sheridan & Nash, 2007), IPV survivors are vulnerable to sustaining a TBI, with Valera et al., (2019) estimating 31,500,000 females experiencing at least one IPV-TBI in their lifetime in the United States of America (USA) alone. These estimates are likely an underrepresentation, as IPV-TBI often goes unreported (Zieman et al., 2017), undiagnosed (Haag et al., 2019), and consequently untreated (Kwako et al., 2011).

Female experiences are underrepresented in TBI research, while IPV-TBI was not studied until the late 20th century (Casper & O'Donnell, 2020). Differing outcomes have been found for male versus female TBI. Females have a higher risk of developing mild neurocognitive disorder (Bock et al,. 2015), have worse functional and cognitive outcomes (Kwako et al., 2011), and longer recovery times following a concussion (Snedaker, 2020). Untreated TBI can result in increased burden to the individual, family, and community (Matney et al., 2022). Using sub-optimal interventions may create barriers to progress, limiting an individual's level of function (Stephens et al., 2015). Consequently, it is important to investigate whether similar interventions to those based on

predominantly male TBI participants, have the same outcomes for female IPV-TBI survivors.

IPV-TBI

IPV-TBI typically results in mild TBI (mTBI; Lifshitz et al., 2019). Multiple injuries are likely, occurring with increasing severity in the context of an abusive relationship (Valera & Kuyci, 2017). Following mTBI persistent physical, cognitive, and psychological symptoms can develop (McInnes et al., 2017) known as mild neurocognitive disorder (World Health Organisation, 2022). Vulnerability factors for developing mild neurocognitive disorder include female sex, previous TBI, trauma, social stressors, and a lack of opportunity to process having the injury (Conder & Conder, 2015; Ponsford et al., 2012). As all these factors are likely in IPV-TBI, the prevalence of mild neurocognitive disorder in this population may be heightened.

Multiple mTBI can result in widespread damage and degeneration (Valera & Berenbaum, 2003) impacting cognitive, emotional, physical, and behavioural functioning (Monahan, 2019; Iverson et al., 2019; St Ivany & Schminkey, 2019), and potentially resulting in long-term complications (Langlois et al., 2006). These challenges can be compounded by the experience of psychological trauma in IPV (Lifshitz et al., 2019). As psychological trauma and TBI share symptomology (Valera & Kuyci, 2017), they can be challenging to differentiate (Banks, 2007). Both can impact physiological changes. The hypothalamic-pituitary-adrenal and hypothalamic-pituitary-gonadal axes may be disrupted, reducing the body’s capacity to respond to stress, and new injuries (Baxter & Hellewell, 2019).

EF Impairment in IPV-TBI

Executive function (EF) is considered a collection of higher-order cognitive skills necessary for the regulation of thoughts, actions, and goal-directed behaviour (Friedman & Miyake, 2017). EF is commonly impaired in IPV-TBI (Daugherty et al., 2019), and can have a variety of consequences for survivors, including difficulty obtaining resources (Lee & DePrince, 2017), and challenges in leaving the abusive relationship and succeeding in judicial settings (Valera & Kuyci, 2017). Impairments can interfere with psychotherapy processes (Murrough et al., 2011), and have been linked to post-traumatic stress disorder (PTSD; Rosaura Polak et al., 2012) substance misuse (Brunelle & Flood, 2016), depression (Hebenstreit et al., 2014) and reduced quality of life (QoL; Pettemeridou et al., 2020). In domestic violence shelters, individuals with EF difficulties may be labelled as ‘non-compliant’, limiting their ability to succeed (Shifflet, 2017).

Unity-Diversity Model of EF

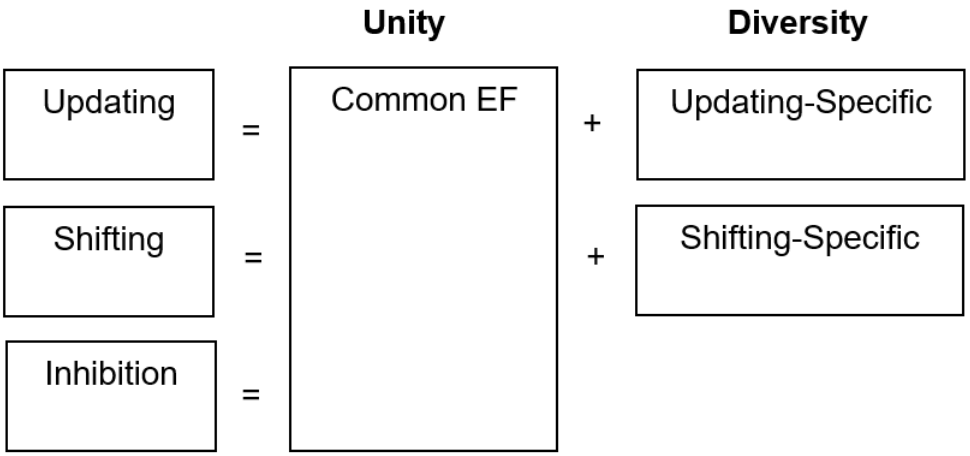
EF can be explained by the Unity-Diversity Model (Miyake & Friedman, 2012). The model (Figure 1) describes EF as three components that are both distinct, yet inter-related constructs (Miyake et al., 2000). These areas are ‘Updating’, the maintenance and manipulation of the contents of working memory in response to a current task; ‘Shifting’, moving between multiple tasks, disengaging from one task in favour of another; and ‘Inhibition’, the deliberate suppression of automatic or prepotent responses (Miyake et al., 2000).

Within the model, the ‘Unity; across all areas of EF is described as the ‘Common EF’. This controls the maintenance and management of goals, and in turn, using these goals to bias cognitive processes (Miyake & Friedman, 2012). The unique aspects of each area of EF, or ‘Diversity’, are described in the

'Updating-Specific', and 'Shifting-Specific' components (Miyake & Friedman, 2012). 'Updating-Specific' represents the precision of the 'Updating' construct, whilst 'Shifting-Specific' represents the speed of goal replacement (Friedman & Miyake, 2017). 'Inhibition' does not have a specific component and can be explained as part of the 'Common EF' (Friedman & Miyake, 2017).

Figure 1

The Unity-Diversity Model of EF (Miyake & Friedman, 2012)



EF impairments may be influenced by the combined impact of neurological and psychological trauma in IPV-TBI. In TBI, an EF impairment may arise due to a deficit in any part of the Unity-Diversity model. Impairments may be compounded by the experience of psychological trauma. Whilst the model does not specifically account for this, it may also impact working memory ('Updating'), 'Inhibition' (Aupperle et al., 2012; Kira et al., 2022), and reasoning ability ('Common EF'; Nyvold et al., 2021).

Interventions

There are currently no interventions for EF in IPV-TBI available in the literature. In contrast, multiple papers exist investigating interventions in mTBI from similar mechanisms e.g., sports-related, and military populations. In these groups, integrated treatment approaches compromising psychotherapy,

psychoeducation and cognitive rehabilitation are recommended (Conder & Condor, 2015; Conder et al., 2020; Cooper et al., 2015).

Due to the high prevalence of physical and psychological trauma in survivors of IPV-TBI (Ackerman & Banks, 2003), and the influence of trauma on EF impairment (Daugherty et al., 2019), it is essential to ensure interventions use trauma-informed approaches. This includes following the principles of trauma informed care (Sweeney et al., 2016): recognising the signs and impacts of post-traumatic stress, preventing re-traumatisation, acknowledging cultural, historical and gender contexts, trustworthiness and transparency, collaboration and mutuality, empowerment, choice and control, safety, understanding the importance of survivor partnerships, and providing access and signposting to appropriate trauma-specific care. Following these principles allows for a better understanding of the underlying features of IPV trauma and how it interacts with TBI symptomology and adjustment (Monahan, 2019).

Compensatory Cognitive Rehabilitation

Compensatory cognitive rehabilitation involves systematically delivering functional interventions based on brain-behaviour impairments (Cicerone et al., 2006) using internal and external strategies (Gopi et al., 2022). They have shown success in improving EF, wellbeing, and QoL in military (Cooper et al., 2015), sports (Conder et al., 2020) and other TBI populations (Cicerone et al., 2019; Jeffay et al., 2023) and may be promising for IPV-TBI survivors.

Metacognitive strategies promoting awareness and self-regulation are consistently recommended in EF rehabilitation guidelines (Cicerone et al., 2019; Jeffay et al., 2023). These strategies involve processes such as goal setting, self-monitoring, support planning, initiation, and error management (Cicerone et al., 2019). Goal setting and monitoring have been used across a variety of

interventions. Theoretically derived interventions such as Goal Management Training (GMT; Levine et al., 2000) and Problem Solving Training (PST; von Cramon et al., 1991) have been successful in EF rehabilitation (Miotto et al., 2009; Stamenova & Levine, 2019). These interventions combine a variety of constructs with the aim of promoting awareness of EF difficulties through psychoeducation and self-monitoring. Strategies are then developed to interrupt unhelpful automatic processes to intentionally attend to individualised goals. Goals are then broken down into subgoals, and attainment of these is continually monitored.

In terms of the theoretical base, successful EF interventions could map onto the Unity-Diversity model (Miyake & Friedman, 2012). They could target 'Updating' through developing working memory strategies (Åkerlund et al., 2013; Lundqvist et al., 2010; Vallat-Azouvi et al., 2009), 'Shifting' through promoting cognitive flexibility and 'Inhibition' through maintaining activation of certain stimuli whilst inhibiting responses of another. An over-arching focus on metacognitive strategies can be represented by the 'Common EF', which can support other areas of EF by focusing on goals in the context of self-awareness, goal-management, and maintenance.

Whilst interventions such as GMT have shown positive outcomes in trauma populations (Protopopescu et al., 2022) there are some limitations, such as limited space for flexibility, collaboration, and mutuality. They do not specifically outline individual strengths, which can support empowerment, choice, and control. Additionally, the length of, and required commitment to GMT can present as a burden (Boyd et al., 2022). This may be particularly challenging for IPV-TBI survivors who may have a variety of other unmet needs (Iverson et al., 2019).

EF Coaching

EF coaching may be beneficial in compensating for these limitations. It follows a client-centred approach, supporting individuals to understand their areas of strength and difficulty, and to develop strategies to overcome challenges (Ahmann et al., 2018; Hallowell & Ratey, 1994; Wright, 2014). Originating in the context of Attention Deficit Hyperactivity Disorder (ADHD), EF coaching is grounded in the understanding of ADHD as an EF disorder (Ahmann et al., 2018), and may support metacognitive strategies, reflecting the overarching 'Common EF' processes of goal-management and maintenance within the Unity-Diversity model (Miyake & Friedman, 2012). It has shown positive outcomes for self-esteem and QoL and has been successfully incorporated into existing mental health interventions (Ahman et al., 2018). Although primarily focused on children, adolescents and young adults, EF coaching may provide beneficial support to an IPV-TBI population, providing an opportunity to bring cognitive rehabilitation strategies more in line with principles of trauma-informed care.

Current Study

The prevalence of IPV-TBI in females is high (Valera et al., 2019). EF impairments are common in survivors (Daugherty et al., 2019), and may result in numerous social, legal, financial, and psychological challenges (Brunelle & Flood, 2016; Hebenstreit et al., 2014; Lee & DePrince, 2017; Rosaura Polak et al., 2012; Shifflet, 2017; Valera & Kuyci, 2017). Despite calls for research (Campbell et al., 2018; Haag et al., 2019), there are currently no studies into EF interventions for IPV-TBI survivors available in the literature.

Cognitive rehabilitation has been recommended for the treatment of EF impairments (Cicerone et al., 2019; Jeffay et al., 2023). As survivors present

with both physical and psychological trauma (Ackerman & Banks, 2004), interventions need to be trauma-informed, following the principles of trauma-informed care outlined by Sweeney et al., (2016). Combining evidence-based principles incorporated into interventions such as GMT (Levine et al., 2000) and PST (von Cramon et al., 1991) with EF Coaching (Hallowell & Ratey, 1994) may present a promising direction for IPV-TBI survivors.

Aims

The current study aims to investigate the effects and acceptability of an intervention, combining cognitive rehabilitation and EF coaching, for individuals with an EF impairment as a result of IPV-TBI.

Hypotheses

H_1: Delivery of the cognitive intervention will significantly increase the use of compensatory EF strategies in everyday life in survivors of IPV-TBI, as shown by an increase on the target measures.

H_2: Participants will make progress towards their individualised goals through the cognitive intervention, as shown by an increase on the target measure question ‘how close to achieving this goal are you?’.

H_3: Delivery of the cognitive intervention will significantly improve performance on standardised self-report measures of EF in survivors of IPV-TBI. This will be shown by a statistically significant reliable change index (RCI; Ferguson et al., 2022) and a clinically significant change.

H_4: Delivery of the cognitive intervention will significantly increase levels of health-related QoL (HRQoL) in survivors of IPV-TBI. This will be shown by a statistically significant RCI (Ferguson et al., 2002) and a clinically significant change.

Methodology

Ethical approval was obtained from the University of Exeter's Psychology Ethics Committee (Appendix A).

Design

The study followed a between-subjects, multiple baseline single case experimental design (MB-SCED) including two phases; baseline and treatment, consisting of 30 data points for each participant. The baseline phase included at least five data points, occurring daily across a 1-week period from Monday-Friday. The treatment phase spanned 6-weeks, including a minimum of 20 data points. This allowed for a 1-week randomisation period, and the completion of the 4-week intervention.

The phase change and subsequent start of the intervention for each participant was randomised through https://www.randomizer.org/#randomize. The maximum number of participants (12) were randomly allocated one number from 1-5, corresponding to the day of the week from Monday-Friday.

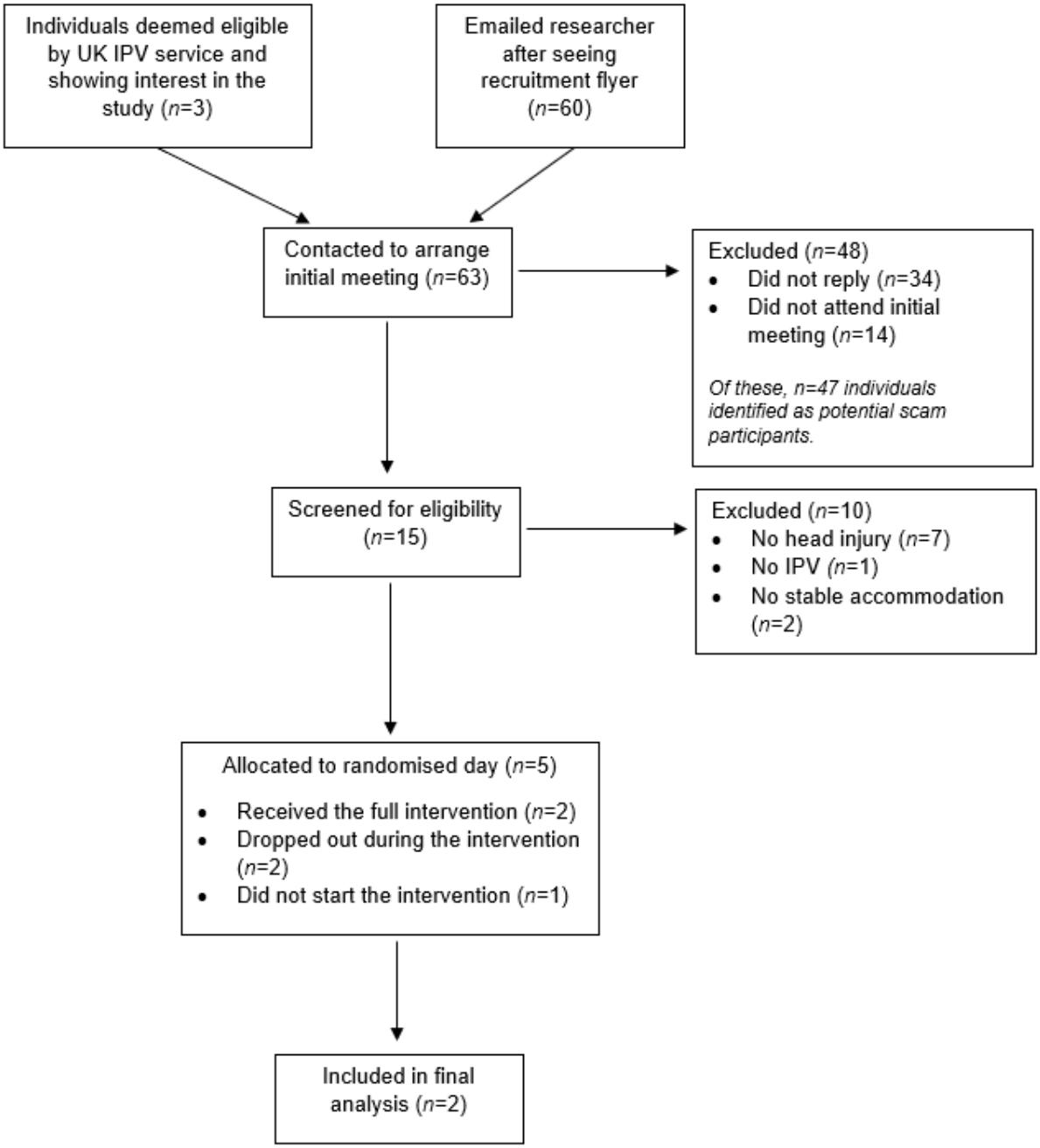
Recruitment and Consultation

Prior to recruitment, consultation around the intervention, recruitment and risk was discussed with staff teams at a United Kingdom (UK) IPV service. This was a specialist service, offering a range of support for IPV survivors.

Recruitment of IPV-TBI survivors occurred between September 2022-January 2023. Unfortunately, no appropriate participants were identified from the UK IPV service. Consequently, the study widened to include worldwide IPV charities. Of 107 additional charities contacted, seven supported with recruitment. Two shared the flyer with their staff, and five on their social media, reaching approximately 19,041 followers. The recruitment procedure is shown in Figure 2.

Figure 2

Recruitment Flow Chart



Participants

Five participants were recruited by responding to the online flyer. Three participants dropped out without giving a reason, one after the initial interview, one after an initial intervention session, and one after two intervention sessions. The final sample consisted of two participants, both female, aged 44 and 59

years, resulting in a 40% adherence rate. Participant demographic details are in Table 1.

Table 1

Participant Demographic Information

Participant	Age	Sex	Ethnicity	Country	Completed Study?
P01	44	Female	White American	USA	Yes
P03	59	Female	White American	USA	Yes

Individuals were included if they were 18 years or older, female, and had access to Zoom. Participants had a history of IPV, defined as 'a pattern of physical and/or sexual violence in the context of coercive control by an intimate or ex-intimate partner' (Humphreys & Campbell, 2004), were at least 1 year post this relationship, and living in stable accommodation. Participants had self-reported or confirmed TBI; defined as a physiological disruption in brain function resulting from an external force (McKee & Daneshvar, 2015), or mild neurocognitive disorder, defined as persistent symptoms lasting more than 3 months post mTBI (McInnes et al., 2017; World Health Organisation, 2022). Participants had difficulties in everyday EF tasks, operationally defined as at least one T Score at or above 65 on any Behaviour Rating Inventory of Executive Function- Adult Version (BRIEF-A; Roth et al., 2005) subscale, or self-report of difficulties with any area of the BRIEF-A, lasting at least 3 months as established at the screening stage.

Due to male-female differences in TBI (Shifflet, 2017; Snedaker, 2020), and the lack of female representation within TBI studies (Casper & O'Donnell, 2020), participants were excluded if they were registered male at birth. To ensure participants could engage in the intervention, they were excluded if they

were medically unstable, or had a severe TBI diagnosis. Due to the ethical implications of adding burden to individuals in extreme stress situations, individuals were excluded if they were currently in an IPV relationship or not in stable accommodation. As the intervention was conducted in English, exclusion of non-English speaking individuals was necessary.

Power Analysis

To reach the recommended statistical power for empirical research of .80 or above (Cohen, 1988), the study must have at least four participants (Heyvaert et al., 2017). As only two participants completed the study, it was not appropriately powered.

Measures and Materials

Target Measure (Appendix B)

The target measure assessed H_1 and H_2. It was an idiographic measure based on Goal Attainment Scaling (GAS; Kiresuk & Sherman, 1968), with three questions around individual goals rated on a Likert Scale between 1-10. It takes approximately 5 minutes to complete. The target measure was sent at the same time daily from Monday-Friday, at each data point through the baseline and treatment phases, either via Short Messaging Service (SMS) or email as per participant preference.

As an idiographic measure, there is no information about the reliability and validity of the target measure available. However, GAS has shown excellent inter-rater reliability and satisfactory concurrent validity in TBI, and shows good sensitivity to change (Malec, 1999). GAS been recommended for use in the TBI population (Grant & Ponsford, 2014), and has previously been used in studies on GMT in TBI participants (Bertens et al., 2015).

Standardised Measures

The standardised measures assessed H_3 and H_4. They were completed independently by participants pre and post the study period.

BRIEF-A (Roth et al., 2005; Appendix C). The BRIEF-A is a self-report measure of EF. It takes roughly 15 minutes and consists of 75 items across nine clinical scales: inhibit, self-monitor, plan/organise, shift, initiate, task monitor, emotional control, working memory, and organisation of materials. These clinical scales are divided into two indexes: The Behavioural Regulation Index (BRI) and Metacognition Index (MI) and, an overall summary score; the Global Executive Composite (GEC). A T-Score at or above 65 on any subscale of the BRIEF-A indicates an EF impairment. It has acceptable item and person reliability, and good internal consistency in a TBI population (Waid-Ebbs et al., 2012). The BRIEF-A was purchased via PARiConnect: https://app.pariconnect.com/. Scores informed a participant profile of strengths and weaknesses for the intervention.

Subscales can be mapped onto the Unity-Diversity model of EF, with 'self-monitor', 'task-monitor', and 'working memory' representing, 'Updating', 'shift' representing 'Shifting', 'inhibit' and 'emotional control' representing 'Inhibition' and 'plan/organise' 'organisation of materials', and 'initiate' representing the 'Common EF'. It is recommended for use in IPV-TBI (Smirl et al., 2019) and has previously been utilised in studies of GMT in TBI (Tornas et al., 2016; 2019).

Quality of Life After Brain Injury (QOLIBRI; Bullinger et al., 2002; Truelle et al., 2008; von Steinbüchel et al., 2005a, 2010a, 2010b; Appendix D). The QOLIBRI is a self-report measure of HRQoL designed for individuals with TBI. It takes approximately 15 minutes and consists of 36 items across six

subscales: cognition, self, daily life and autonomy, social relationships, emotions, and physical problems. Scores are reported on a scale of 0-100, where 0=worst possible and 100=best possible HRQoL. The QOLIBRI is free to use and accessed via: https://qolibrinet.com/.

The QOLIBRI has high internal consistency and excellent test-retest reliability (*r*= .78-.91) in an international TBI population. The QOLIBRI is in line with the participation component of the ICF framework and is recommended for use in TBI (McCulloch et al, 2013; Polinder et al., 2015).

Qualitative Measures

Qualitative measures were completed to assess intervention acceptability.

Session Reflective Questions. To understand the acceptability of individual intervention sessions, participants were emailed the following questions: 'Does the information that we covered today make sense?' and 'Do you think the information we covered is relevant to you in your everyday life?'.

Qualitative Feedback Questions (Appendix E). On study completion, participants completed the qualitative feedback questionnaire via interview, comprising of questions about their experience. This was completed to understand the feasibility and acceptability of the intervention and is an important step in intervention development (Skivington et al., 2021).

Esendex (Commify UK Ltd, 2023)

Target measures (Appendix F) and STOP! prompts (Appendix G) were sent to participants via SMS at scheduled times. These were managed using the Esendex platform: https://www.esendex.co.uk/. Target measure SMS messages were sent from an '07' number participants could reply to. STOP!

prompts were sent from the name ‘TBI Study’ which participants could not reply to.

Zoom (Yuan, 2019)

Zoom is a videoconferencing platform. All Zoom meetings were arranged through the researcher’s University of Exeter account.

Intervention (Appendix H)

The intervention consisted of four, one-hour weekly sessions delivered individually via Zoom. EF goal setting occurred in the initial meeting. These were short-term goals collaboratively made using the Specific, Measurable, Achievable, Relevant, and Time Bound (SMART) criteria. All sessions were delivered by the researcher, a doctorate student in clinical psychology. The intervention was informed by principles of compensatory cognitive rehabilitation, GMT (Levine et al., 2000), and EF coaching. All sessions were conducted in line with trauma-informed approaches (Sweeney et al., 2016; Appendix I). To promote information retention, participants received an information pack after each session (Appendix J).

> **Session 1, Understanding EF:** Including psychoeducation about the brain and EF, introducing each participant’s unique EF profile based on BRIEF-A scores, and guiding participants to consider any strengths and resources they have for achieving their goal. This session was developed to promote self-awareness, an important step in both cognitive rehabilitation (Von Cramon et al., 1991; Levine et al., 2000) and EF Coaching (Quinn et al., 2000), and may support the ‘Common EF’ area of the Unity-Diversity model (Miyake & Friedman, 2012).

Session 2, Autopilot, The Mental Whiteboard, and STOP!: Autopilot is widely described in the literature and relates to Norman and Shallice's (1986) concept of 'Contention Scheduling'; a lower-level mechanism involved in familiar, automatic actions, requiring no active involvement of higher-level EFs. This may negatively impact goal attainment (Duncan, 1986; von Cramon et al., 1991; Levine et al., 2000). The 'mental whiteboard' reflects working memory, described as a 'mental workspace', where information is temporarily available for manipulation (Baddeley & Hitch, 1974). Although many analogies have been used, the GMT (Levine et al., 20000) analogy of the 'mental whiteboard' was felt the most accessible. Participants were reminded of the challenges of autopilot and the mental whiteboard, (Smith & Kosslyn, 2008), and encouraged to mitigate this challenge using STOP!.

STOP!, an acronym for 'Stop, Think, Organise, Plan' prompts participants to periodically pause, consider their goal, and plan the steps required to achieve this (Fish et al., 2007). Prompting has been widely used in cognitive rehabilitation, and consistently supports cognitive task performance in TBI populations (Elbogen et al., 2019; Gracey et al., 2017; Manly et al., 2002; Sohlberg et al., 1988). As in Fish et al's., (2007) study, eight STOP! cues were sent to participants at random times throughout the intervention. Times were randomised using: https://www.random.org/clock-times/ and were sent via either SMS or email, as per participant preference.

This session promotes metacognitive processes, goal setting, planning, and self-monitoring. These processes together may provide insight into the 'Updating', 'Shifting' and 'Inhibition' areas of the Unity-Diversity model

(Miyake & Friedman, 2012). Through the need to suppress a dominant response in autopilot, 'Inhibition' may be activated, attention is then moved to another, goal-related task through 'Shifting', and this goal is broken down and worked on through the 'Updating' system. STOP! may load onto the 'Common EF' through representing processes involved in goal management and maintenance.

Session 3, Bridges and Barriers, Re-Evaluating Goals: Participants are taught to anticipate 'Barriers' to goals, and develop strategies, or 'Bridges' to overcome these. This session enhances self-awareness and strengths-based problem solving. It includes metacognitive strategies such as self-monitoring and may support processes in the 'Common EF' area of the Unity-Diversity model (Miyake & Friedman, 2012).

Session 4, Reviewing the Intervention: A review of the intervention and skills learnt. This session draws on EF coaching principles of supporting the individual to become their own coach (Ahman et al., 2018), and was developed to promote self-efficacy and self-confidence in continuing to practice concepts.

Procedure

Participants responded to an online flyer by emailing the researcher. They were sent the information sheet (Appendix K) and an initial Zoom videocall was scheduled. Here informed consent was taken (Appendix L), and a screening and demographic questionnaire was completed (Appendix M). If not eligible, individuals were thanked and informed they could not participate. If eligible, participants were supported to set short-term EF goals using the SMART criteria and were introduced to the target measure. The first

intervention session was arranged. Participants were then sent the BRIEF-A and QOLIBRI questionnaires to complete.

Target measures started on a Wednesday. This marked the beginning of the baseline phase. The first intervention session was at least one week after the target measures began and marked the beginning of the treatment phase. Due to recruitment challenges, participants completed the study sequentially.

All intervention sessions were administered virtually from the researcher's home; a secure location, which only the researcher occupied during sessions. Participants completed sessions in their own homes. It was ensured that this was safe, secure, and private. Intervention sessions were completed at 1 week intervals. Follow-up interviews were arranged after the study period finished. Here participants were read the debrief transcript (Appendix N) and were asked the qualitative feedback questions (Appendix E). These were recorded and transcribed using Zoom, then checked for accuracy. All sessions and assessments were completed by the researcher. Participants were compensated with a £20 voucher for completion of the study.

Risk Management

The project supervisors were available for clinical support if any risk issues were raised during intervention sessions. Risk and escalation protocols were designed (Appendix O). Participants were required to give the information of their Doctor and advised of the limits of confidentiality.

Analysis

Data analysis was completed by hand or through R Studio, an integrated development environment for the programming language 'R' (RStudio Team, 2020). The R Script is in Appendix P.

To assess H_1 and H_2, target measure data was analysed using visual analysis and randomisation tests, using the Single-Case Visual Analysis (SCVA) and Single-Case Randomization Test (SCRT) packages. Non-Overlap of Pairs (NAP) effect sizes were calculated by hand (Carter et al., 2011). To assess H_3 and H_4, BRIEF-A and QOLIBRI data was analysed using the RCI (Ferguson et al., 2002) and clinical change thresholds.

To assess acceptability, reflexive thematic analysis (RTA; Braun & Clark, 2021) was originally planned. As only two participants completed the study, this was not possible and instead qualitative feedback analysis informed by RTA was conducted. This took a critical realism ontology and a constructionism epistemology.

Self-Reflexivity

As an individual who has no personal experience of IPV, I was aware of the limitations of my knowledge and understanding. I was cautious to approach topics around IPV sensitively and appropriately with participants, and made extra care to work to the trauma-informed principles outlined in Appendix I. This level of caution may have inadvertently resulted in hesitation, potentially limiting the exploration of issues around IPV and involvement in research.

As an individual who identifies as female, I was aware of this parallel between the study participants and myself. I have strong beliefs in feminism and promoting gender equality and was aware of my own emotional involvement in this topic, and motivation to increase the evidence base around female experiences. With low participant numbers, I experienced a strong feeling of responsibility to create a meaningful study. This drive for the success of this research may have influenced my interpretation of the qualitative data.

Results

Participants

Two participants completed the study, referred to as P01 and P03. P01 had five baseline data points and 25 intervention data points, P03 had seven baseline data points and 23 intervention data points. P01 received target measures via SMS and P03 via email. Participants completed all intervention sessions, there were no adverse events or missing data.

H_1 and H_2: Goal Progress and Strategy Use

The target measure was analysed to assess H_1 and H_2.

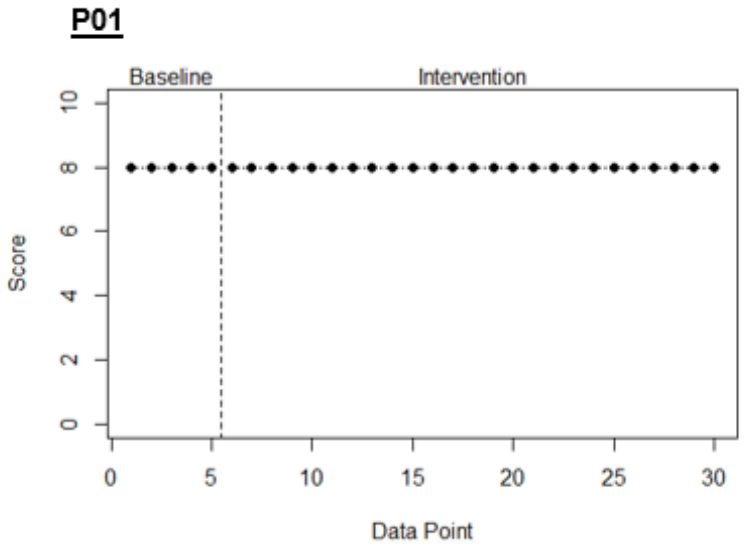
Visual Analysis

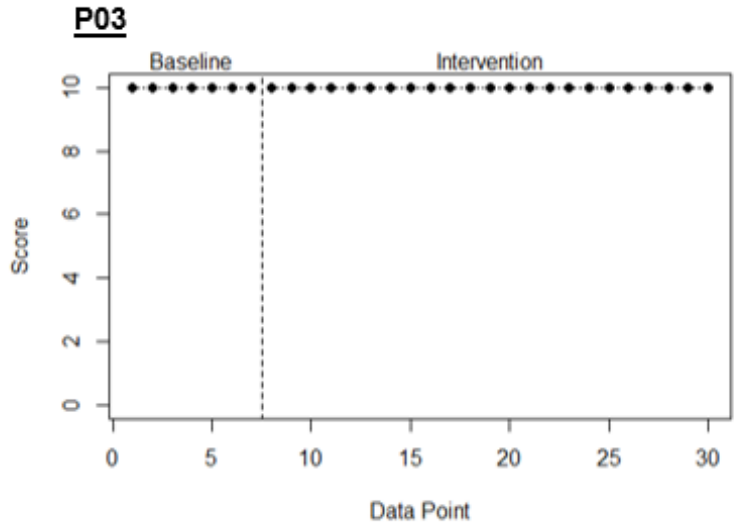
Visual analysis of trend is presented in Figures 3-5. The split middle method was used (Morley, 2018). Visual analysis of central tendency is represented in Appendix Q.

T1. How important is this goal to you? (Figure 3). No trend was found in goal importance for either participant.

Figure 3

Visual Analysis of T1.

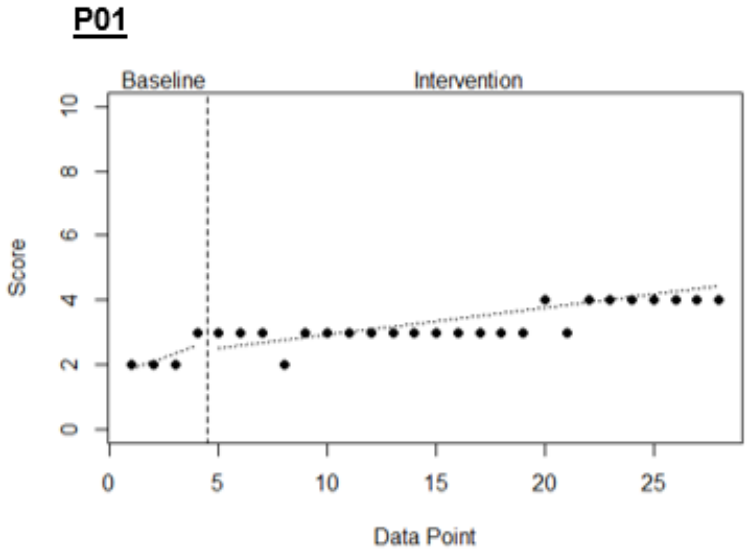


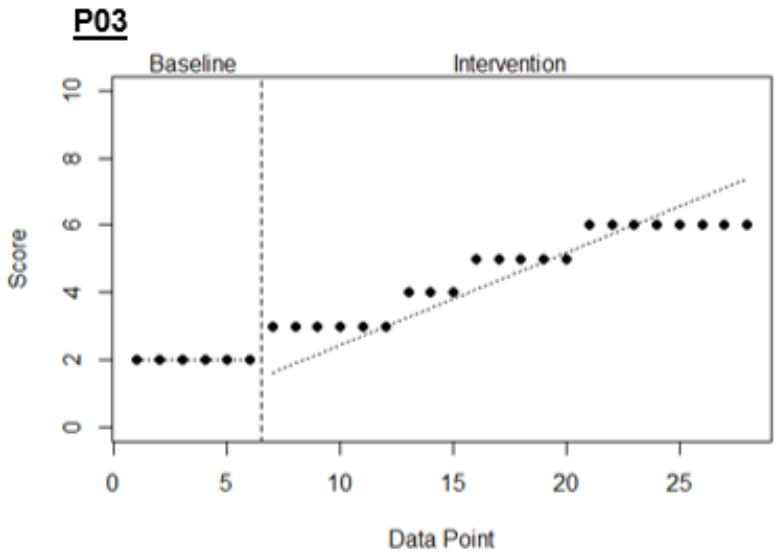


T2. How close are you to achieving this goal? (Figure 4). A positive trend was found for the rating of closeness to achieving the goal for both participants. For P03, where there was no trend across the baseline phase, and a positive trend across the intervention phase. For P01, a positive trend was found across both phases.

Figure 4

Visual Analysis of T2.

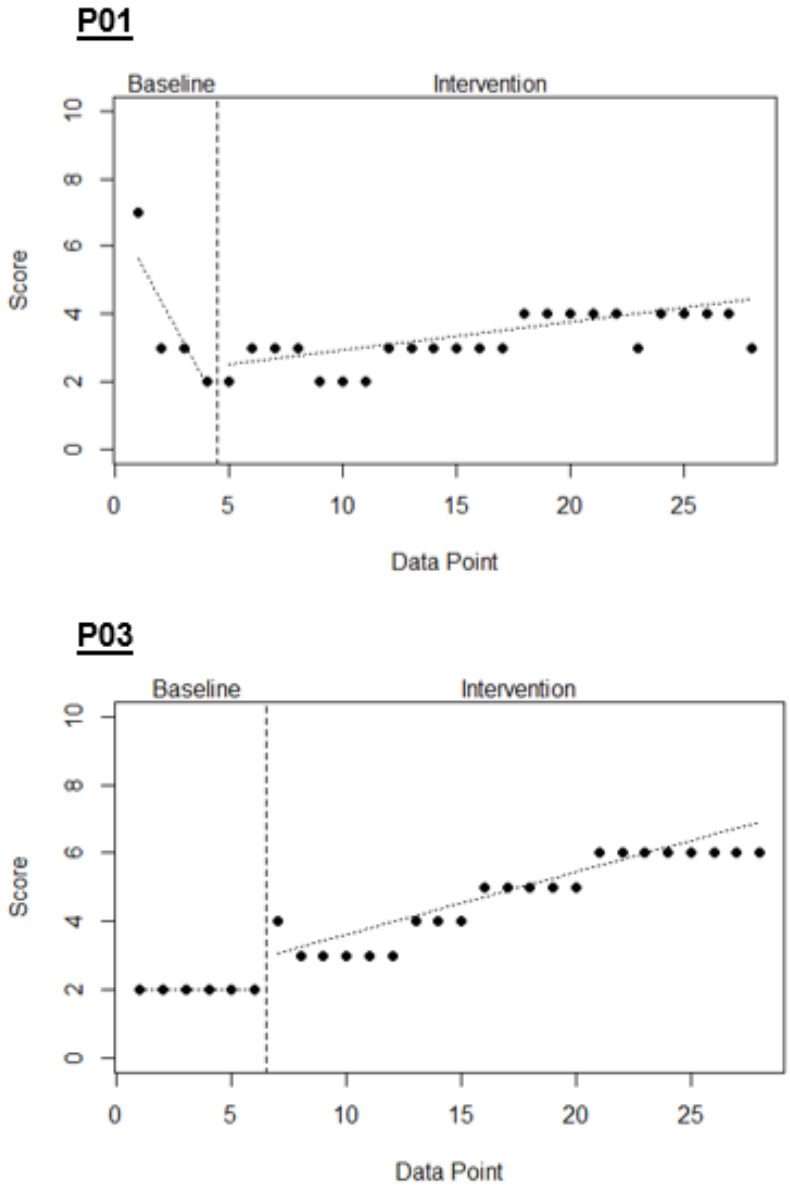




T3. How difficult is achieving this goal? (Figure 5). Q3 is reverse scored. A positive trend was found for both participants, indicating a reduction in perceived goal difficulty. For P01, perceived goal difficulty appeared to increase at baseline, and decrease across the intervention. The rating of ‘7’ at data point 1 is an outlier and may represent confusion with the scale. Consequently, further statistical analysis has been conducted with and without this data point for comparison. For P03, no trend was observed across the baseline phase, and a positive trend was found across the intervention phase.

Figure 5

Visual Analysis of T3.



Randomisation Tests and NAP

Randomisation and NAP analysis were conducted for individual and combined data (Table 2). Alpha level of significance was set to 0.2 using the following equation: 1/number of days in the transition phase (Bulté, & Onghena, 2008). 50 possible data tracks were recorded. For NAP analysis, the adjustment: 1-NAP/0.5 was used to correct for chance level agreement (Parker

& Vannest, 2009). As data is only available for two participants, randomisation and NAP analysis are not valid, and were undertaken to explore the data.

Table 2

Randomisation and NAP Analysis

Participant	Phase duration (days)		Mean score (SD)		Adjusted NAP	*p-value*
	Baseline	Intervention	Baseline	Intervention		
How important is this goal to you?						
P01	5	25	8 (0)	8 (0)	0	1.0
P03	7	23	10 (0)	10 (0)	0	1.0
Combined	12	48	9.17 (1.03)	9 (1.01)	0	1.0
How close are you to achieving this goal?						
P01	5	25	2.4 (.55)	3.28 (.54)	.69	.43
P03	7	23	2 (0)	4.70 (1.22)	1	.33
Combined	12	48	2.17 (.39)	3.96 (1.17)	.86	.04*
How difficult is achieving this goal?						
P01	5	25	3.4 (2.07)	3.2 (.71)	-.22	1.0
P01**	4	25	2.5 (.58)	3.2 (.71)	-.52	.95
P03	7	23	2 (0)	4.74 (1.18)	1	.14*
Combined	12	48	2.58 (1.44)	3.92 (1.22)	.63	.84
Combined**	11	48	2.18 (.40)	3.92 (1.11)	.80	.2*

**indicates a statistically significant score.*
***indicates outlier removed.*

T1. How important is this goal to you? No statistically significant difference was found between baseline and intervention phases on Q1 (p= 1.0). The effect size was small Adjusted NAP = 0.

T2. How close are you to achieving this goal? A statistically significant effect was found between baseline and intervention on Q2 for the combined data (p=.04). The effect size was medium (Adjusted NAP = .86). No statistically significant effects were found on Q2 for P01 (p=.43) or P03 (p=.33). Although the effect sizes were medium-large; Adjusted NAP= .69 and 1 respectively.

T3. How difficult is achieving this goal? A statistically significant effect was found between baseline and intervention on Q3 for P03 (p=.14) and the combined data minus the outlier (p=.2). For P03 the effect size was strong;

Adjusted NAP = 1. For the combined data minus the outlier, the effect size was medium; Adjusted NAP =.80. No significant effects were found for any other data, with weak effect sizes.

H_3 and H_4: EF and HRQoL

The RCI was calculated by hand. It was statistically significant if +/-1.96. Data is presented in Table 3.

Table 3

RCI and Clinical Change for the BRIEF-A and QOLIBRI

Participant	Subscale	Pre-Treatment Score	Post-Treatment Score	RCI	Clinical Change
BRIEF-A (T Scores)					
P01					
	Inhibit	83	76	1.65	
	Shift	84	79	1.07	
	Emotional Control	64	61	0.67	
	Self-Monitor	87	78	1.54	
	Initiate	73	69	0.73	
	Working Memory	97	97	0.00	
	Plan/Organise	82	71	1.83	
	Task Monitor	90	85	0.88	
	Organisation of Materials	55	52	0.80	
	BRI	83	77	1.60	
	MI	83	77	1.60	
	GEC	86	79	2.02*	
P03					
	Inhibit	56	46	2.36*	
	Shift	71	76	-1.07	
	Emotional Control	47	47	0.00	
	Self-Monitor	42	38	0.69	
	Initiate	82	75	1.28	
	Working Memory	74	66	2.00*	
	Plan/Organise	72	63	1.5	**
	Task Monitor	67	62	0.88	**
	Organisation of Materials	47	41	1.60	
	BRI	54	51	0.80	
	MI	71	63	2.14*	**
	GEC	65	58	2.02*	**
QOLIBRI (Scale Scores)					
P01					
	Cognitive	14.25	28.5	-1.64	
	Self	14.25	39.25	-2.55*	
	Daily Life and Autonomy	25	21.5	0.40	
	Social Relationships	29.25	41.75	-1.13	
	Emotions	30	75	-3.72*	**
	Physical Problems	25	20	0.34	
	Total	22.5	32.5	-2.24*	

P03					
	Cognitive	10.75	67.75	-6.54*	**
	Self	3.5	28.5	-2.55*	
	Daily Life and Autonomy	25	42.75	-2.12*	
	Social Relationships	50	66.75	-1.51	**
	Emotions	80	85	-0.41	
	Physical Problems	30	45	-1.01	
	Total	30.5	54.75	-5.43*	

** statistically significant change.*
*** clinically significant change.*

BRIEF-A

The SE_{Diff} was provided by Roth et al., (2005). A positive RCI indicates an improvement in scores. There was a significant improvement in scores at post-treatment for both participants GEC (RCI =2.02), and for P03 MI (RCI= 2.14), and Inhibit (RCI= 2.36) and Working Memory (RCI= 2) subscales.

Clinically significant change was characterised by a change from above to below the threshold (T Score ≥65) at post-treatment. A clinically significant change was found for P03 ‘MI’, ‘GEC’, and the subscales ‘Plan/Organise’ and ‘Task Monitor’. No clinically significant changes were reported for P01.

QOLIBRI

The SE_{Diff} was calculated for each QOLIBRI subtest using statistics provided by von Steinbüchel et al., (2010b; Appendix R). Score improvement is indicated by a negative RCI. A significant improvement at post-treatment was found for ‘QOLIBRI Total Score’ (P01 RCI= -2.24; P03 RCI= -5.43) and ‘Self’ (P01 RCI= -2.55; P03 RCI= -2.55) for both participants, ‘Emotions’ for P01 (RCI= -3.72) and ‘Cognitive’ (RCI= -6.54) and ‘Daily Life and Autonomy’ (RCI= -2.12) for P03.

Clinically significant change was characterised by a change from below to above the threshold (<60) at post-treatment (Truelle et al., 2010; Wilson et

al., 2017). A clinically significant change was found for P01 ‘Emotions’, and P03 ‘Cognitive’, and ‘Social Relationships scales.

Qualitative Feedback Analysis

The qualitative data were analysed using an approach informed by RTA (Braun & Clark, 2021). Both participants rated the study “very easy” to participate in, and the intervention “very useful”. They responded “yes” to all session reflective questions, indicating that they were relevant to their everyday life. Seven themes were generated from interview analysis: ‘A Trusted Source’, ‘Applicability’, ‘An Individualised Approach’, ‘Trauma-Informed’, ‘Helpful Tools’, ‘Continuing the Work’ and ‘Potential Improvements’.

A Trusted Source

The importance of the study being advertised through a trusted source was highlighted:

> I probably wouldn’t have given it much of a look through if it hadn’t been for who I found it through…I trust the work that…X... does enough to trust when she said this is an opportunity…I was like, okay, I’ll look into that. (P01).

Study credibility was also important, with P01 reporting “…I looked into Exeter…I went on the website.”

Applicability

Both participants found the intervention useful, with one stating “If your goal is to like help people…have had brain injuries and intimate partner violence…I think these are all useful tools” (P01). P01 reflected on experiencing small changes “…small incremental change… is just undervalued. But it adds up”.

Participants felt that the intervention was relevant, stating “it’s relevant. I use it. I refer to it.” (P03). It was also considered pitched at the right level: “…it seemed to be just the right amount…you know anything less might leave some areas for questions or a lack of understanding, and too much would be overwhelming” (P03).

An Individualised Approach

Participants found the intervention individualised, stating “…you were working to tailor it to me… you have to start out kind of cookie cutter… then you put like my favourite frosting on it or something” (P01). The benefits of using an individualised, strengths-based approach were outlined by P03:

> I really liked going through the categories…breaking each one down…coming up with those self-tailored…that was really neat to be able to do...helping me go over and refocus on what I can do…instead of sitting there just going…I can’t do anything right now.

Trauma Informed

A strong therapeutic rapport centred around collaboration, guided discovery and safety was important: “…the partnership is really important …it makes a difference it really does…you have to build trust and safety first. Or you know people aren’t gonna,…respond” (P03).

Approaching trauma within the context of the intervention was reflected on, with P01 stating “…if you were going to ask a lot of trauma-based questions …you know depending on them what somebody could have left…No, it was analytical. So, it was doable”. With regard to their experience of trauma, P01 reflected:

> …it probably would have been more difficult to talk about them. It was nice to feel kind of up to about it, you know. Because I feel like…you're not necessarily looking for what happened in the relationship, or what exactly happened in the brain injury.

Helpful Tools

This theme covered the specific parts of the intervention that participants found beneficial. These included "…those stop texts…those were like probably one of my biggest positive takeaways" (P01) and learning terminology to describe their EF challenges: "The words were a big deal for me…to have that specifically laid out was just helpful" (P01).

Having support to apply knowledge was helpful, with P03 stating "you know things like smart goals and breaking things down… it's the applying it. Yeah, that's the hard step". P03 found the information pack beneficial, saying "…it's great…It's like my reference guide".

Continuing the Work

The challenge of continuing the work independently was highlighted: "…I still have a reminder on my phone every day, it just says bridge barrier …I would see it, and I would be like, what does that mean again?...you use it, or you lose it" (P01). They reported finding initiating the strategies challenging, saying "I thought about writing down things on like index cards, and just kind of putting them in random spots around. I just didn't do it" (P01).

Potential Improvements

Potential additional material included "a brief overview of brain injury and its effects… introducing…IPV and brain injury" (P03) and consolidation sessions "…I would change the length and hope that, like a little bit more time would have…help like ingrain it a little more" (P01).

The importance of intervention timing was emphasised:

> I would have tried to have done this like 10 years ago…there's no time for it…If you recently got a head injury or you recently left the violent relationship like your stress levels…I don't know if someone like that would be able to carry it out… being a human being in crisis like you've got to get those needs taking care of first, and like until those are…the stuff we're talking about… it's secondary to survival. (P01).

Discussion

This study explored the effects and acceptability of a cognitive rehabilitation and EF coaching intervention on EF and HRQoL in two female survivors of IPV-TBI. Findings suggest that the intervention was easy to participate in and applicable to participants' everyday EF challenges. Although, the high drop-out rate suggests that these findings should be interpreted with caution. Statistically significant improvements were found in strategy use, progress towards goals, and self-report measures of EF and HRQoL. Of these, P01's emotional HRQoL and P03's overall EF, metacognition and cognitive HRQoL also showed clinically significant changes. Due to insufficient statistical power, the study findings are not sufficiently robust to accept or reject study hypotheses.

Goal Progress and Strategy Use

Significant improvements were found for combined ratings of closeness to achieving the goal and perceived goal difficulty, and P03's perceived goal difficulty, with moderate-large effect sizes. This suggests the intervention had a meaningful effect on goal attainment and strategy use for these two

participants, supporting evidence from TBI literature (Bertens et al., 2015; Gracey et al., 2017).

Although not significant, visual analysis revealed an increase in ratings of closeness to achieving the goal with moderate-large effect sizes for both participants, and reduced goal difficulty with a small effect size for P01, potentially suggesting some improvement. For P01, goal difficulty appeared to increase at baseline, and decrease across the intervention, while closeness to achieving the goal was less steep at intervention than baseline. This may have been due to an initial increased awareness of EF difficulties, whilst knowing they will soon receive an intervention.

Interestingly, P03's patterns of responding represent almost ideal data. Whilst this may reflect the effectiveness of the intervention, it is important to note that other influences, such as a potential interest in increasing the prevalence of IPV-TBI interventions in research, may have unintentionally affected responding.

No significant difference was found for ratings of goal importance. This may be due to using volunteer sampling methods, where participants likely take part because the topic is important to them and may not accurately represent the wider IPV-TBI population (Gabor, 2007).

EF and HRQoL

Significant improvements were found for overall EF in both participants and metacognition, inhibition and working memory for P03, suggesting the intervention had a positive effect on self-rated EF. This reflects previous TBI research in military and civilian populations (Novakovic-Agopian et al., 2011, 2018, 2019; Tornas et al., 2016). Of these changes, only P03's overall EF and metacognition were clinically significant. Overall, P03's pre-treatment scores

were lower than P01's. Consequently, the intervention may specifically benefit participants with moderate levels of EF impairment.

Significant improvements were found for self-reported ratings of overall and self-related HRQoL, P01's emotional and P03's cognitive and daily life and autonomy HRQoL, suggesting that the intervention has positive effects on HRQoL. However, only P01's emotional and P03's cognitive changes were clinically significant, and participants continued to report widespread impairments in HRQoL post-intervention. This may have been influenced by low pre-intervention scores, meaning large changes would be needed to reach clinical significance.

Previous research has shown mixed evidence of cognitive interventions on QoL (Gracey et al., 2017; Storzbach et al., 2015). The positive findings in the current study may be influenced by the addition of the EF coaching element. Although not all clinically significant, improvements in HRQoL may reflect an increased acceptance of areas of challenge. Changes in the self and daily life and autonomy subscales indicate potential improvements in self-esteem, self-perception, and independence; areas targeted by trauma-informed approaches to empower survivors (Sweeney et al., 2016). Whilst these findings may be attributed to the intervention, they could also be influenced by simply being offered a space to reflect and process their TBI-related challenges.

Acceptability

Subjective feedback was positive, with participants finding the study easy to participate in and the intervention useful and relevant. Particularly helpful aspects included STOP!, EF terminology, and support applying skills.
Using an individualised, trauma-informed approach was valued. This included advertising the study through a trusted source, building therapeutic rapport,

collaborative working, and emphasising safety. Challenges included continuing to use the learnt skills, and participants felt that additional consolidation sessions and more psychoeducation on IPV-TBI may be beneficial. The long-term benefits of EF interventions have shown mixed reviews (Novakovic-Agopian et al., 2019; Tornas et al., 2019) and the intervention could be further developed with this in mind.

Intervention timing was important. Following IPV, safety becomes the main focus (St Ivany et al., 2018). In Maslow's (1943) hierarchy of needs, this relates to lower levels, whilst the intervention represents the upper 'self-actualization' level. According to Maslow, needs at lower levels must be met in order to engage with self-actualisation. Consequently, the intervention may only be beneficial when basic needs are met. This may be particularly difficult for IPV-TBI survivors, where challenges in meeting these needs can be exacerbated by the experience of a TBI (Crabtree-Nelson et al., 2016).

Strengths and Limitations

Study strengths include the MB-SCED design. Consultation with IPV support services optimised the intervention, ensuring it was trauma informed. Additionally, there were no adverse events or missing data, suggesting high engagement in the participants who completed the study.

The small sample size limited the validity of the results. Unfortunately, initial recruitment revealed no appropriate participants. This may have been due to the inclusion criteria of survivors being at least 1 year post IPV relationship, combined with the acute nature of UK IPV services. Additionally, services may lack awareness and screening of IPV-TBI (St Ivany et al., 2018), resulting in potential participants being missed.

As recruitment expanded, only seven of 107 charities could support the study and despite reaching approximately 19,041 individuals, only 60 registered their interest. Building trust is important for trauma survivors (Sweeney et al., 2016), which may have been limited through using an online flyer. Following IPV, shame and avoidance are likely (Doyle et al., 2022) and survivors may refrain from engaging in treatment (St Ivany et al., 2018). St Ivany found IPV-TBI survivors may have 'conscious avoidance' of TBI-related challenges. According to Gracey et al's (2009) Y-Shaped model the threat associated discrepancies in sense of self pre and post-TBI can lead to avoidance, unintentionally resulting in poorer outcomes. Interestingly, this process is reflected in Ehlers and Clark (2000) cognitive model of PTSD. Consequently, the experience of both physical and psychological trauma in IPV-TBI may compound the experience of threat and adjustment.

Study adherence was low, with only two out of 63 interested individuals completing the study. This is a common challenge in IPV research (Lifshitz et al., 2019). Of the participants not completing the study, 48 either did not reply or did not attend the initial meeting, ten were not eligible, and three withdrew. Engagement challenges may have included intervention timing post-IPV relationship, potential 'scam' participants, EF impairments (Murrough et al., 2011), and the burden of engaging in weekly one-hour sessions.

Due to a lack of resources, the assessor was not blinded, and procedural fidelity was not formally analysed, influencing study validity. The study lacked diversity, and consequently the intervention's cultural appropriateness and accessibility is unknown. This reflects a wider problem within research, where ethnically diverse and disabled individuals are often underrepresented (Moriarty, 2021; Rios et al., 2016).

All study measures relied on self-report, which can be influenced by bias (Miskowiak et al., 2016) and cognitive impairments (Hart et al., 2004). The target measures could have been improved by removing goal importance questions and including a more direct measure of EF strategy use to answer $H_{1.}$ Additionally, using daily target measures may have inadvertently imitated EF coaching principles of self-monitoring and accountability (Ahmann et al., 2018), potentially influencing participant outcomes.

Although recommended for use in IPV-TBI (Smirl et al., 2019), the BRIEF-A emotional control subscale may not be appropriate in this population. Here, a lack of emotional responding is rated as positive emotional control, when it may actually represent emotional numbing common in trauma survivors with post-traumatic stress symptoms (PTSS; American Psychiatric Association, 2013). Due to the high prevalence of EF and PTSS in TBI (Van Praag et al., 2019), trauma informed measures are needed.

Implications

Theoretical Implications

Significant EF outcome improvements can be reflected in the Unity-Diversity model (Miyake & Friedman, 2012). Overall EF and metacognition improvements may represent the ‘Common EF’, whilst working memory and inhibit may implication ‘Updating’ and ‘Inhibit’ components. Participants found the STOP! prompts particularly helpful, potentially reflecting support in the ‘Common EF’. Outcomes differed between participants, with P03 reporting more widespread improvement than P01. As P01 had more EF difficulties, the intervention may be more beneficial for individuals with moderate levels of difficulty.

Interestingly, these areas are also implicated in survivors of psychological trauma (Aupperle et al., 2012; Kira et al., 2022). Whilst trauma clearly impacts EF, the Unity-Diversity model (Miyake & Friedman, 2012) does not account for this. Consequently, mechanisms of change remain unknown. As psychological trauma is likely experienced by a variety of TBI survivors, EF models should be developed to incorporate this by including psychological influences on cognition.

Clinical Implications

The study expands EF intervention recommendations (Ahman et al., 2018; Jeffay et al., 2023) to include female IPV-TBI survivors. Whilst previous recommendations have proposed the use of interventions such as GMT, these can be lengthy, with GMT containing approximately 20 hours of training material (Levine & Stamenova, 2018). Longer interventions may be more burdensome, more costly to services, and less accessible to clients, particularly individuals with complex additional needs such as the IPV-TBI population (Monahan, 2019; St Ivany et al., 2018). As impairments following a TBI are heterogenous (Covington & Duff, 2021), providing shorter, flexible treatment programmes may be beneficial. These could present evidence-based protocols as a ‘menu’ of options for clinicians to choose the most appropriate aspects of interventions for individual clients.

The current intervention could be developed for use in IPV support settings, run by service staff with training and supervision from a neuropsychology professional. As IPV-TBI impacts a variety of needs (Monahan, 2019), integrating the intervention into flexible treatment programmes may be beneficial. A wider ‘TBI package’ could be created for support services. Delivered by neuropsychology professionals, this could

include building awareness of IPV-TBI, screening, healthcare referrals, and the teaching of evidence-based cognitive interventions. In 2016/2017, The Home Office estimated that IPV cost the UK government approximately £5.5 billion per year (Oliver et al., 2019). Funding these services may be an important step in reducing these costs, whilst increasing survivors' wellbeing and social opportunities.

Future Research

The intervention shows potential for supporting EF and HRQoL outcomes for female survivors of IPV-TBI. However, further research with larger sample sizes is needed. SCEDs are a promising methodology, allowing personalisation of interventions and reflecting clinical practice (Morley, 2018). The intervention should be further developed with consultation from IPV-TBI survivors from diverse backgrounds, with a focus on recruitment, retention, and longer-term outcomes.

Conclusion

To the author's knowledge, this is the first study examining EF interventions in female survivors of IPV-TBI. The study expands upon previous research supporting EF interventions in TBI (Ahmann et al., 2018; Conder et al., 2020; Cooper et al., 2015; Jeffay et al., 2023), suggesting cognitive rehabilitation and EF coaching interventions may benefit goal attainment, EF and HRQoL in IPV-TBI survivors. However, results should be interpreted with caution as their validity is influenced by the small sample size. Future research should expand on the current study, focusing on recruitment and retention and including assessor blinding, diversity, more refined goal and EF measures and trauma-informed theories.

Declaration of Interest Statement

The author declared no potential conflicts of interest with respect to the research.

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Appendices

Appendix A

University of Exeter

Ethical Approval Letter

Research Ethics Committee Review Outcome

Dear RUTH SALMON

Ethics Application ID: 492912
Title: A Cognitive Intervention for Everyday Executive Function in Female Survivors of Traumatic Brain Injury, and Intimate Partner Violence Related Traumatic Brain Injury
(Version: 4.0)
Proposed Project Duration: 11 Nov 2021 - 24 Mar 2023

Your research study ethics application submitted above on 15 Dec 2022, 17:26 has been reviewed by the FHLS Psychology Ethics Committee.

Outcome decision by Research Ethics committee: Approved

This minor amendment to an already approved application is now approved!

Thanks

Ciro

Decision Date: 5 Jan 2023, 19:20*

You can only start your research once you have received an **Approved outcome. The start date of your research will be no sooner than the Ethics Committee Approval decision date above.*

Research Ethics Committee Approval End Date: 31 Mar 2023, 21:40

Regards,

FHLS Psychology Ethics Committee

Note: This approval letter represents the final version of the ethics, where amendments had been made to broaden the participant pool to include female survivors of TBI generally. As the minimum number of IPV-TBI participants were recruited, this was not needed. The study focusing on IPV-TBI participants was approved on: 6th September 2022.

Appendix B

The Target Measure

Goal Setting

How important is this goal to you?

1	2	3	4	5	6	7	8	9	10

Not important — Extremely important

How close to achieving this goal are you?

1	2	3	4	5	6	7	8	9	10

Not close at all — I have achieved my goal

How difficult is achieving this goal?

1	2	3	4	5	6	7	8	9	10

Extremely difficult — Not at all difficult

Appendix C

The Behaviour Rating Inventory of Executive Function- Adult Version

(BRIEF-A; Roth et al., 2005) Questions

Inhibit

5	I tap my fingers or bounce my legs	
16	I have trouble sitting still	
29	I have problems waiting my turn	
36	I make inappropriate sexual comments	
43	I make decisions that get me into trouble (legally, financially, socially)	
55	People say I am easily distracted	
58	I rush through things	
73	I am impulsive	

Shift

8	I have trouble changing from one activity or task to another	
22	I have trouble accepting different ways to solve problems with work, friends, or tasks	
32	I have trouble thinking of a different way to solve a problem when stuck	
44	I am bothered by having to deal with small changes	
61	I get disturbed by unexpected changes in my daily routine	
67	After having a problem, I don't get over it easily	

Emotional Control

1	I have angry outburst	
12	I overreact emotionally	
19	I have emotional outbursts for little reason	
28	I react more emotionally to situations than my friends	
33	I overreact to small problems	
42	I get emotionally upset easily	
51	My anger is intense but ends quickly	
57	People say I am too emotional	
69	My mood changes frequently	
72	I get upset quickly or easily over little things	

Self-Monitor

13	I don't notice when I cause others to feel bad or get mad until it is too late	
23	I talk at the wrong time	
37	When people seem upset with me, I don't understand why	
50	I say things without thinking	
64	People say I don't think before acting	
70	I don't think about consequence before doing something	

Initiate

6	I need to be reminded to begin a task even when I am willing	
14	I have trouble getting ready for the day	
20	I lie around the house a lot	
25	I have problems getting started on my own	
45	I have difficulty getting excited about things	
49	I have trouble getting started on tasks	
53	I start things at the last minute (assignments, chores, tasks)	
62	I have trouble coming with ideas for what to do with my free time	

Working Memory

4	I have trouble concentrating on tasks (such as chored, reading or work)	
11	I have trouble with jobs or task that have more than one step	
17	I forget what I am doing in the middle of things	
26	I have trouble staying on the same topic when talking	
35	I have a short attention span	
46	I forget instructions easily	
56	I have trouble remembering things, even for a few minutes (such as direction, phone numbers)	
68	I have trouble doing more than one thing at a time	

Plan/Organise

9	I get overwhelmed by large tasks	
15	I have trouble prioritising activities	
21	I start tasks (such as cooking, project) without the right materials	
34	I don't plan ahead for future activities	
39	I have unrealistic goals	
47	I have good ideas but I can't get them on paper	
54	I have difficulty finishing a task on my own	
63	I don't plan ahead for tasks	
66	I have problems organising activities	
71	I have trouble organising work	

Task Monitor

2	I make careless errors when completing tasks	
18	I don't check my work for mistakes	
24	I misjudge how difficult or easy tasks will be	
41	I make careless mistakes	
52	I have trouble finishing tasks (such as chores, work)	
75	I have problems completing my work	

Organisation of Materials

3	I am disorganised	
7	I have a messy closet	
30	People say I am disorganised	
31	I lose things (such as keys, money, wallet, homework)	
40	I leave the bathroom a mess	
60	I leave my room or home a mess	
65	I have trouble findings things in my room, closet or desk	
74	I don't pick up after myself	

Note: The BRIEF-A is under copyright and not available in the public domain.

Appendix D

The Quality of Life After Brain Injury (QOLIBRI; Bullinger et al., 2002; Truelle et al., 2008; von Steinbüchel et al., 2005a, 2010a, 2010)

QOLIBRI - QUALITY OF LIFE AFTER BRAIN INJURY

In the first part of this questionnaire we would like to know **how satisfied** you are with different aspects of your life since your brain injury. For each question please choose the answer which is closest to how you feel now (including the past week) and mark the box with an "X". If you have problems filling out the questionnaire, please ask for help.

PART 1

A. These questions are about your thinking abilities now (including the past week).

	Not at all	Slightly	Moderately	Quite	Very
1. How satisfied are you with your ability to concentrate, for example when reading or keeping track of a conversation?					
2. How satisfied are you with your ability to express yourself and understand others in a conversation?					
3. How satisfied are you with your ability to remember everyday things, for example where you have put things?					
4. How satisfied are you with your ability to plan and work out solutions to everyday practical problems, for example what to do when you lose your keys?					
5. How satisfied are you with your ability to make decisions?					
6. How satisfied are you with your ability to find your way around?					
7. How satisfied are you with your speed of thinking?					

B. These questions are about your emotions and view of yourself now (including the past week).

	Not at all	Slightly	Moderately	Quite	Very
1. How satisfied are you with your level of energy?					
2. How satisfied are you with your level of motivation to do things?					
3. How satisfied are you with your self-esteem, how valuable you feel?					
4. How satisfied are you with the way you look?					
5. How satisfied are you with what you have achieved since your brain injury?					
6. How satisfied are you with the way you perceive yourself?					
7. How satisfied are you with the way you see your future?					

C. These questions are about your independence and how you function in daily life now (including the past week).

	Not at all	Slightly	Moderately	Quite	Very
1. How satisfied are you with the extent of your independence from others?					
2. How satisfied are you with your ability to get out and about?					
3. How satisfied are you with your ability to carry out domestic activities, for example cooking or repairing things?					
4. How satisfied are you with your ability to run your personal finances?					
5. How satisfied are you with your participation in work or education?					
6. How satisfied are you with your participation in social and leisure activities, for example sports, hobbies, parties?					
7. How satisfied are you with the extent to which you are in charge of your own life?					

D. These questions are about your social relationships now (including the past week)

	Not at all	Slightly	Moderately	Quite	Very
1. How satisfied are you with your ability to feel affection towards others, for example your partner, family, friends?					
2. How satisfied are you with your relationships with members of your family?					
3. How satisfied are you with your relationships with your friends?					
4. How satisfied are you with your relationship with a partner or with not having a partner?					
5. How satisfied are you with your sex life?					
6. How satisfied are you with the attitudes of other people towards you?					

PART 2

In the second part we would like to know **how bothered** you feel by different problems. For each question please choose the answer which is closest to how you feel now (including the past week) and mark the box with an "X". If you have problems filling out the questionnaire, please ask for help.

E. These questions are about how bothered you are by your feelings now (including the past week).

	Not at all	Slightly	Moderately	Quite	Very
1. How bothered are you by feeling lonely, even when you are with other people?					
2. How bothered are you by feeling bored?					
3. How bothered are you by feeling anxious?					
4. How bothered are you by feeling sad or depressed?					
5. How bothered are you by feeling angry or aggressive?					

F. These questions are about how bothered you are by physical problems now (including the past week).

	Not at all	Slightly	Moderately	Quite	Very
1. How bothered are you by slowness and/or clumsiness of movement?					
2. How bothered are you by effects of any other injuries you sustained at the same time as your brain injury?					
3. How bothered are you by pain, including headaches?					
4. How bothered are you by problems with seeing or hearing?					
5. Overall, how bothered are you by the effects of your brain injury?					

Appendix E

The Qualitative Feedback Questionnaire

A Cognitive Intervention for Female Survivors of Intimate Partner Violence Related Brain Injury

Post-Study Feedback Questionnaire

Thank you for taking the time to complete this study. We would like to hear a bit more about your experience. Please feel free to be as honest as you can. Your feedback is important in letting us know what went well, and what could be done to improve.

All of the information from this form will be kept confidential.

How did you find participating in this study?

How easy was it to take part in this study?

Very Difficult	Difficult	Average	Easy	Very Easy
				

How useful did you find the intervention?

Not at all Useful	Not Useful	Average	Useful	Very Useful
				

Was there anything that you liked about the intervention?

Was the information covered in the intervention relevant to you and your everyday life?

Was there anything that you did not like/would change about the intervention? **Is there anything that you would add to the intervention? (e.g., more about the cause of injury, more IPV component)** **Is there anything you would take away from the intervention?**

Would you recommend the intervention to somebody else?

Was there anything that you already knew?

A Cognitive Intervention for Female Survivors of Intimate Partner Violence Related Brain Injury

Do you have any other comments?

Thank you for taking the time to complete this form.

Appendix F

Esendex Daily Measures SMS Template

IPV Head Injury Study

Thank you for taking part in the head injury study. Please complete the following questions as soon as possible after receiving them.

To complete the questions, please reply to this text.

Q1: On a scale of 1-10, where 1 is "not important at all" and 10 is "extremely important", how important is your goal to you?

Q2: On a scale of 1-10, where 1 is "not close at all" and 10 is "completely achieved", how close are you to achieving your goal?

Q3: On a scale of 1-10, where 1 is "extremely difficult" and 10 is "not difficult at all", how difficult is achieving your goal?

Appendix G

Esendex STOP! prompts SMS template

This is your reminder to STOP!

STOP what you are doing

THINK about what you have got to do to reach your goal

ORGANISE what you need to do to complete the task

PLAN how you are going to do this

Appendix H

The Intervention PowerPoint

Executive Function in IPV Related Head Injury Intervention

Ruth Salmon
Trainee Clinical Psychologist
University of Exeter

With thanks to Dr Jenny Limond (Clinical Neuropsychologist) and Sarah Hester (Trainee Clinical Psychologist)

University of Exeter

CEDAR
Clinical Education Development and Research

Intervention Overview

- **Pre-Intervention Meeting: Goal Setting, Questionnaires**
- Week 1: Understanding Executive Functions
- Week 2: Autopilot, The Mental Whiteboard & STOP!
- Week 3: Barriers and Bridges, Re-Evaluating Goals
- Week 4: Reviewing the Intervention, Questionnaires

Pre-Intervention

Goal Setting

Completing Questionnaires

Goal Setting

Goal Setting

Long Term Goal:

Shorter-Term Goals to Work Towards:

SMART Goals

Specific:

Measurable: Using our daily measure

Attainable:

Relevant:

Time-bound: By the end of the intervention.

Goal Setting

How important is this goal to you?

1	2	3	4	5	6	7	8	9	10

Not important — Extremely important

How close to achieving this goal are you?

1	2	3	4	5	6	7	8	9	10

Not close at all — I have achieved my goal

How difficult is achieving this goal?

1	2	3	4	5	6	7	8	9	10

Extremely difficult — Not at all difficult

Questionnaires

Questionnaires

To do (twice) between now and our next session, and at the end of our sessions:

- BRIEF-A
- QOLIBRI

To do every day:

- Daily Measures

Intervention Overview

Pre-Intervention Meeting: Goal Setting, Questionnaires

→ **Week 1: Understanding Executive Functions**

Week 2: Autopilot, The Mental Whiteboard & STOP!

Week 3: Barriers and Bridges, Re-Evaluating Goals

Week 4: Reviewing the Intervention, Questionnaires

Week 1

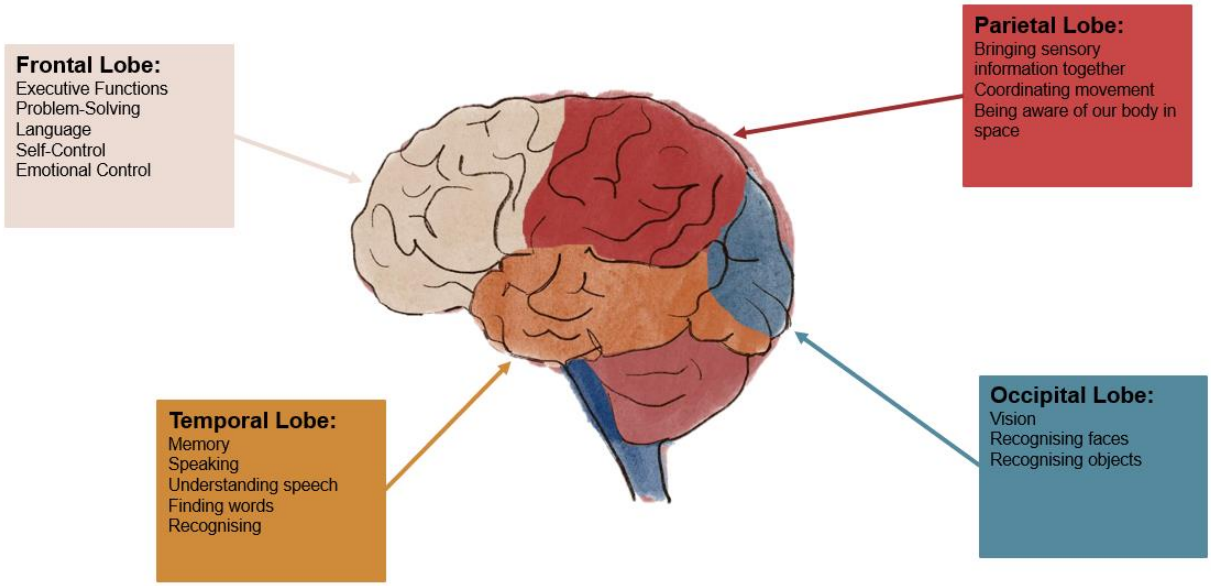
What is Executive Function?

Your Unique Executive Function Profile

Thinking About Our Goals

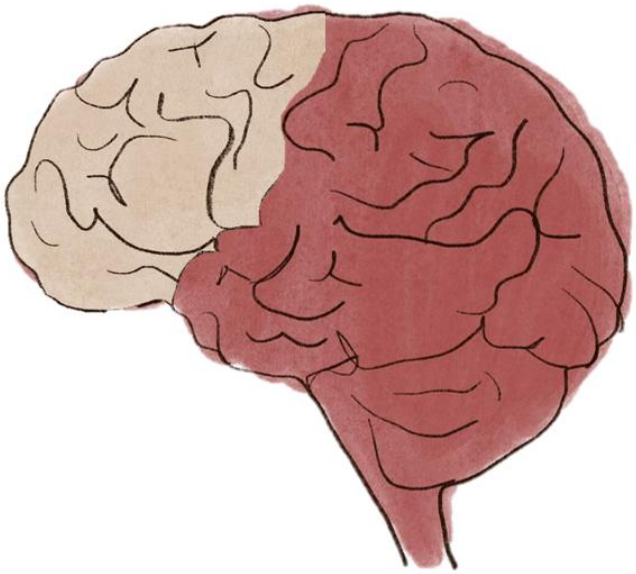
What is Executive Function?

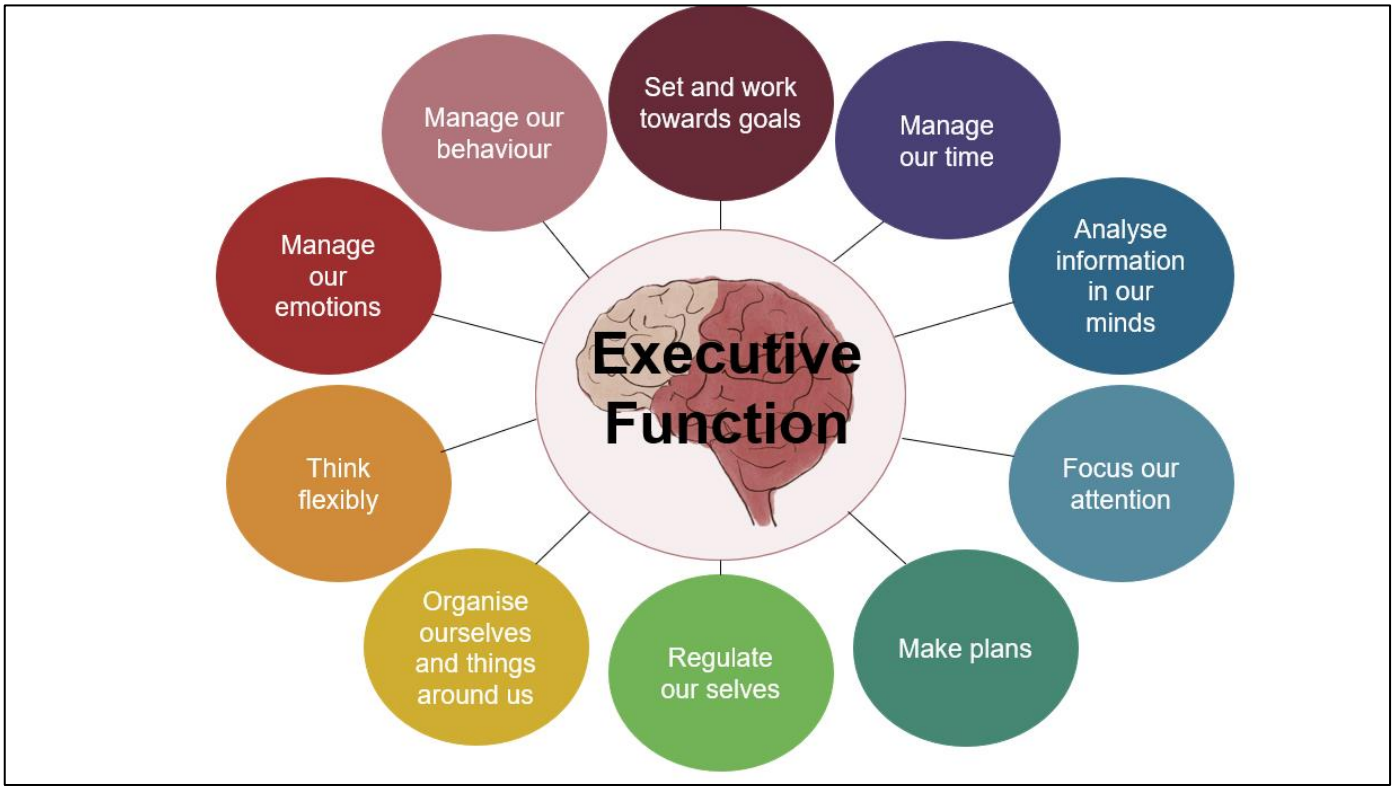
The Brain



What is Executive Function?

- "The Command Centre"
- Skills needed to coordinate and control our thinking, attention, behaviour, and emotions.
- Hot and Cold executive functions

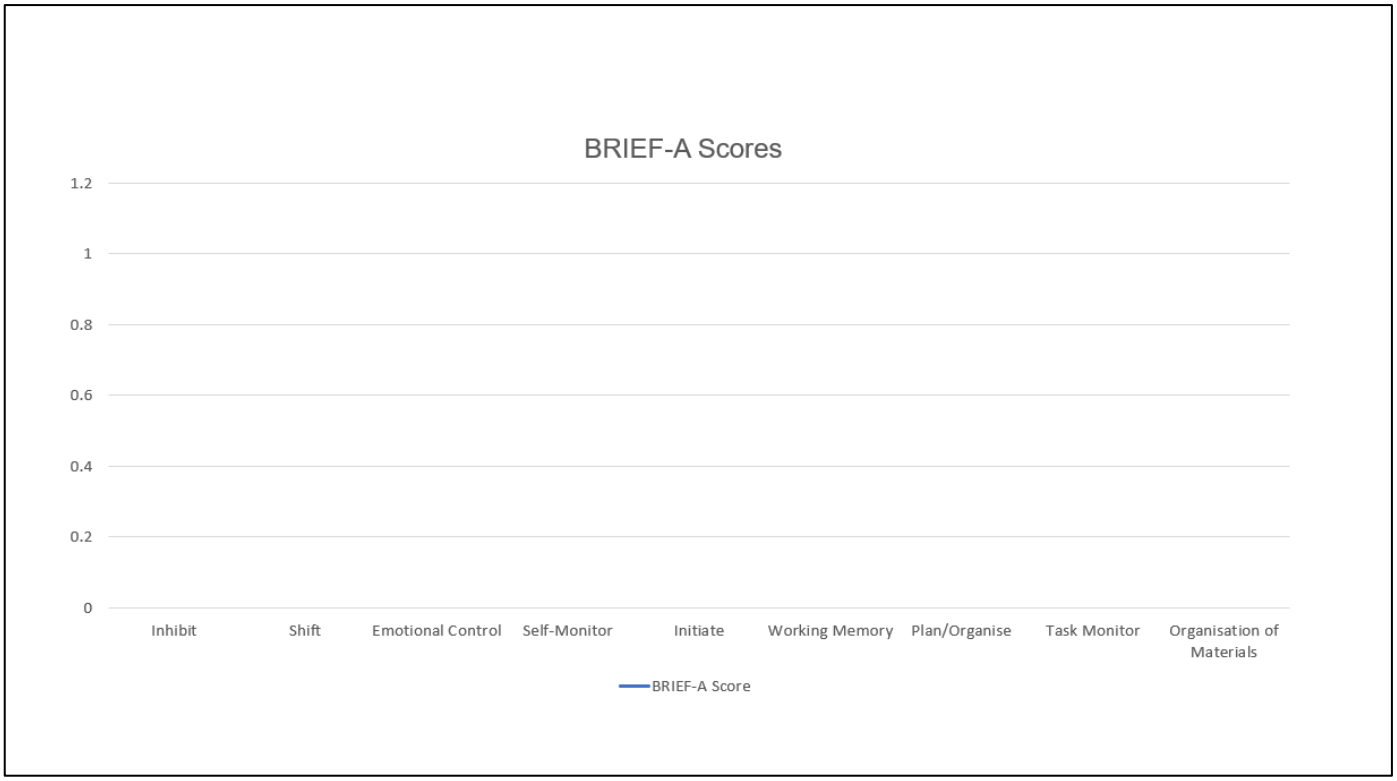




Head Injury and Executive Function

- When our heads are injured, we may also injure our brains.
- When our brains are injured, we can have difficulty with our thinking skills.
- One of these skills is executive function.

Your Unique Executive Function Profile



Areas of strength:

Things you might find more difficult:

Executive Functions

Your areas of strength

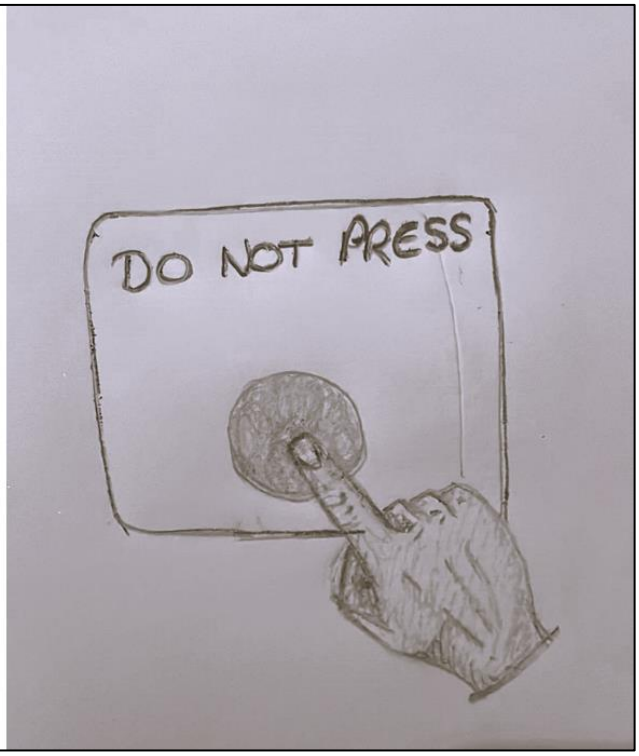
Executive Functions

Things you might find more difficult

Note: The below definitions of executive functions are moved under the appropriate heading i.e., 'Your areas of strength' or 'Things you might find more difficult'.

Response Inhibition

- Resisting our impulses/urges
- Thinking of the consequences before we do things
- Being "in control" of ourselves.

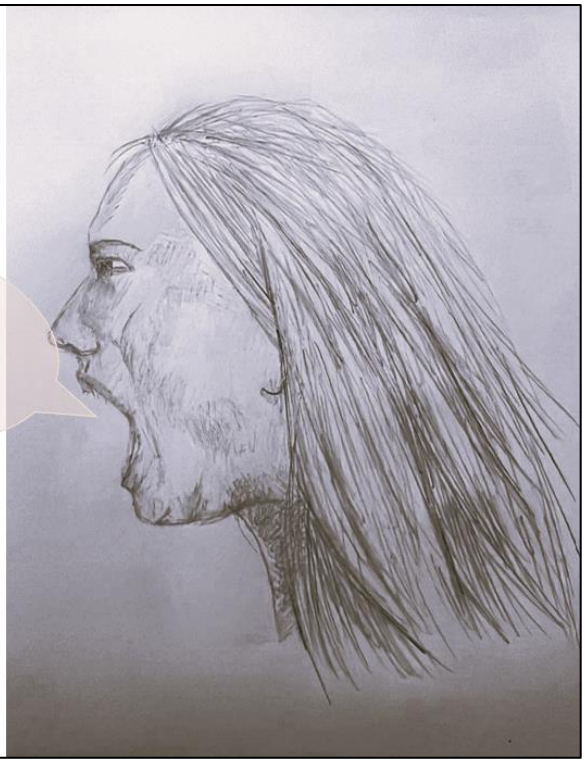


Shift or Flexible Thinking

- Our ability to move from one activity to another as needed
- Tolerating change
- Switching our attention.

Emotional Control

- Our ability to regulate our emotions.

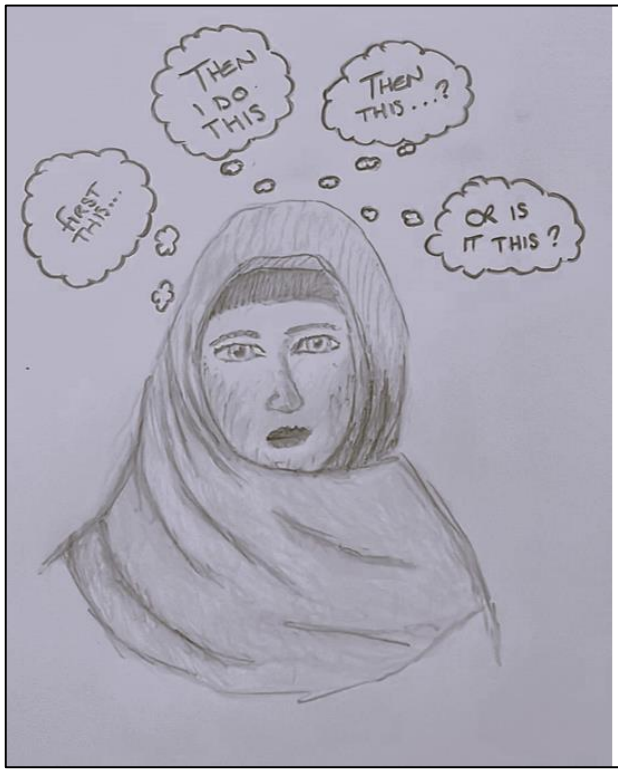


Self-Monitoring

- Our ability to be aware of ourselves, and the effect of our behaviour on others.

Task Initiation or Getting Started

- Our ability to start a task or activity
- "Getting going"
- Our ability to independently think of ideas and responses.



Working Memory

- Our ability to hold the information we need to complete a task in our mind
- "Active memory"

Planning and Organising

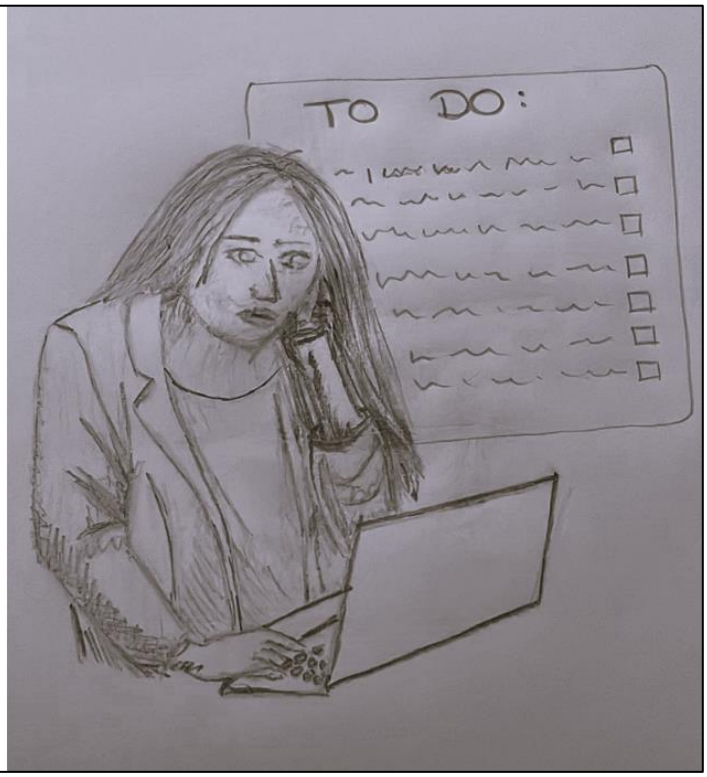
- Our ability to manage current and future task demands.

Planning:

- Anticipating future events, setting goals, and thinking of steps ahead of time.

Organisation:

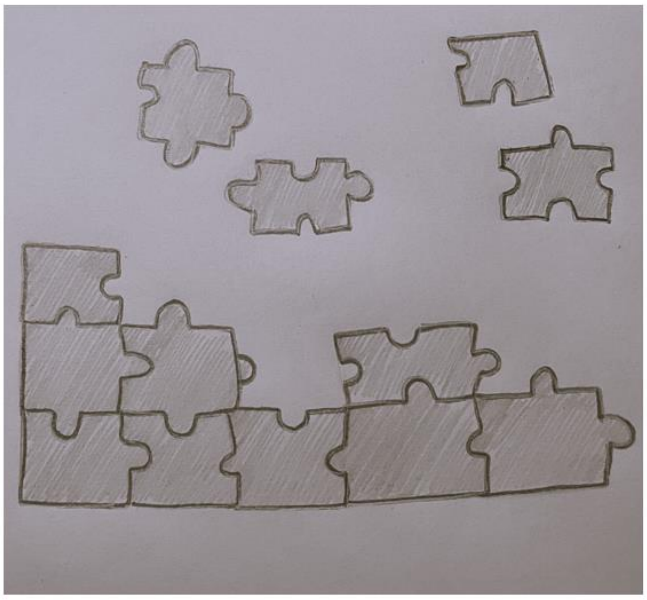
- Our ability to bring order to information.

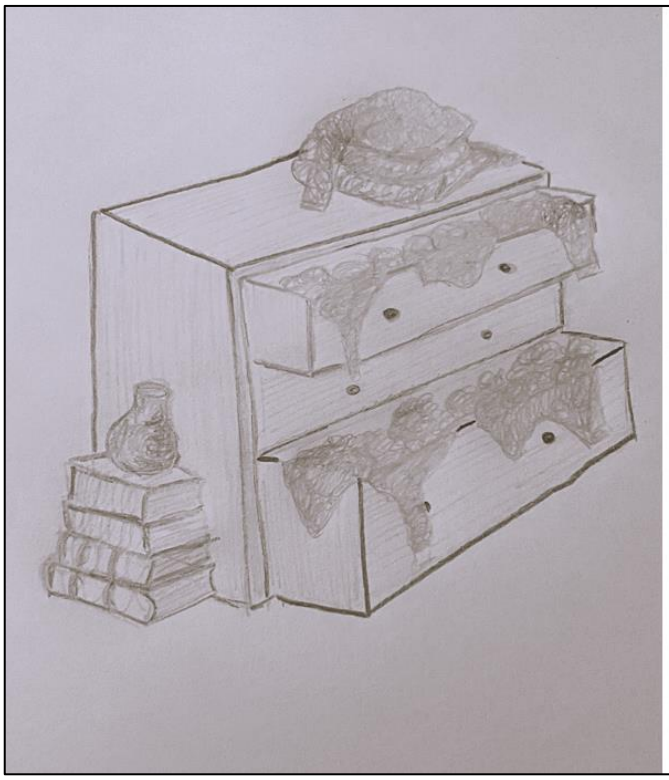


Task Monitoring

- Our ability to keep track of our problem-solving

- Our ability to find and correct mistakes.





Organisation of Materials

- Our ability to keep our spaces organised.

How can we help?

- Help develop strategies to reach our goals
- Help develop strategies to support the executive functions we find more difficult
- Based on your unique profile.

Thinking About Our Goals

Your Goals

Your Goal: *

Strengths and Resources:

End of Session 1 Reflections

Does the information that we covered today make sense?

Do you think the information we covered is it relevant to you in your everyday life?

Thank you for taking part!

We covered a lot of information today.
A lot of this is likely to be new and you may have found it hard.

If you are feeling distressed and need any further support, here are some helplines to support you:

SAMARITANS

Telephone: 116 123
www.Samaritans.org

mind

Telephone: 0300 123 3393
Text: 86463
www.mind.org.uk

PAPYRUS

Telephone: 0800 068 4141
Text: 07860039967
www.papyrus-uk.org

Intervention Overview

Pre-Intervention Meeting: Goal Setting, Questionnaires

Week 1: Understanding Executive Functions

→ **Week 2: Autopilot, The Mental Whiteboard & STOP!**

Week 3: Barriers and Bridges, Re-Evaluating Goals

Week 4: Reviewing the Intervention, Questionnaires

Week 2

Understanding the "Autopilot"

The Mental Whiteboard

STOP!

Understanding the "Autopilot"

The Autopilot

Our ability to complete tasks without conscious effort.

Helpful for:

- Doing familiar tasks quickly and accurately without conscious effort
- Developing habits
- Saving energy.

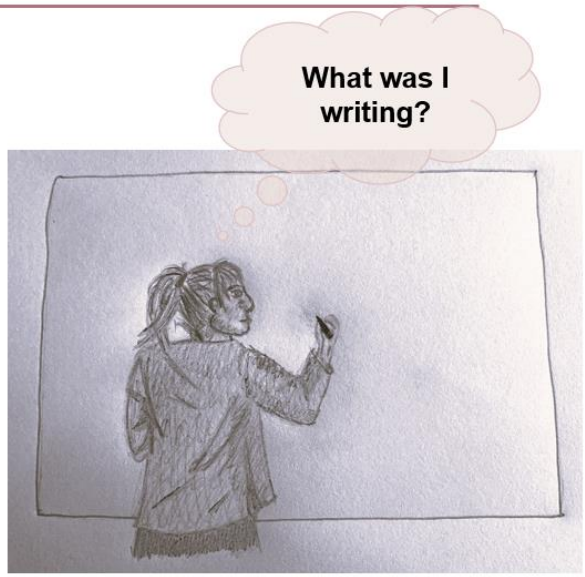
Less Helpful for:

- Forgetting to do things
- Restricts our awareness of what is happening around us
- Making mistakes.

The Mental Whiteboard

The Mental Whiteboard

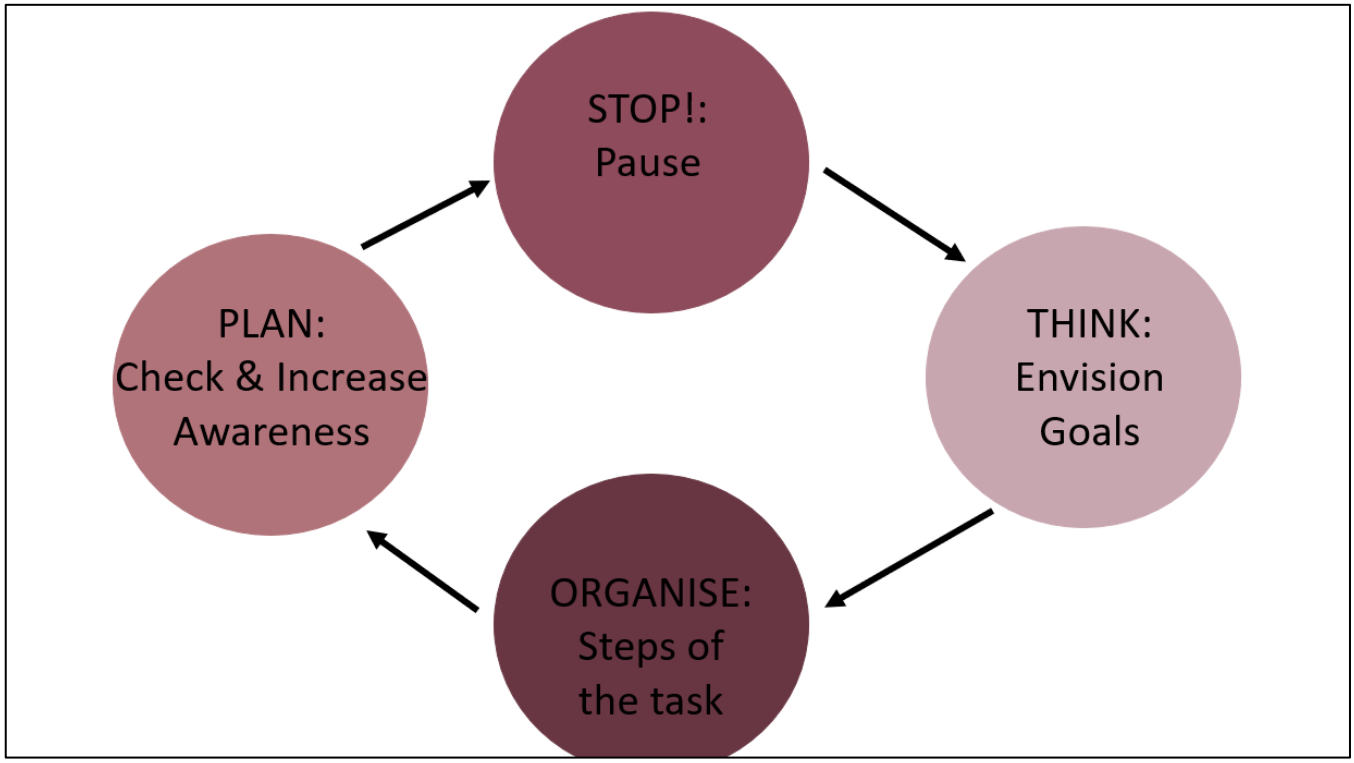
- Short-term memory as a “mental whiteboard”
- Wiped clean by distraction/autopilot
- Can mean we forget things that we need to do.

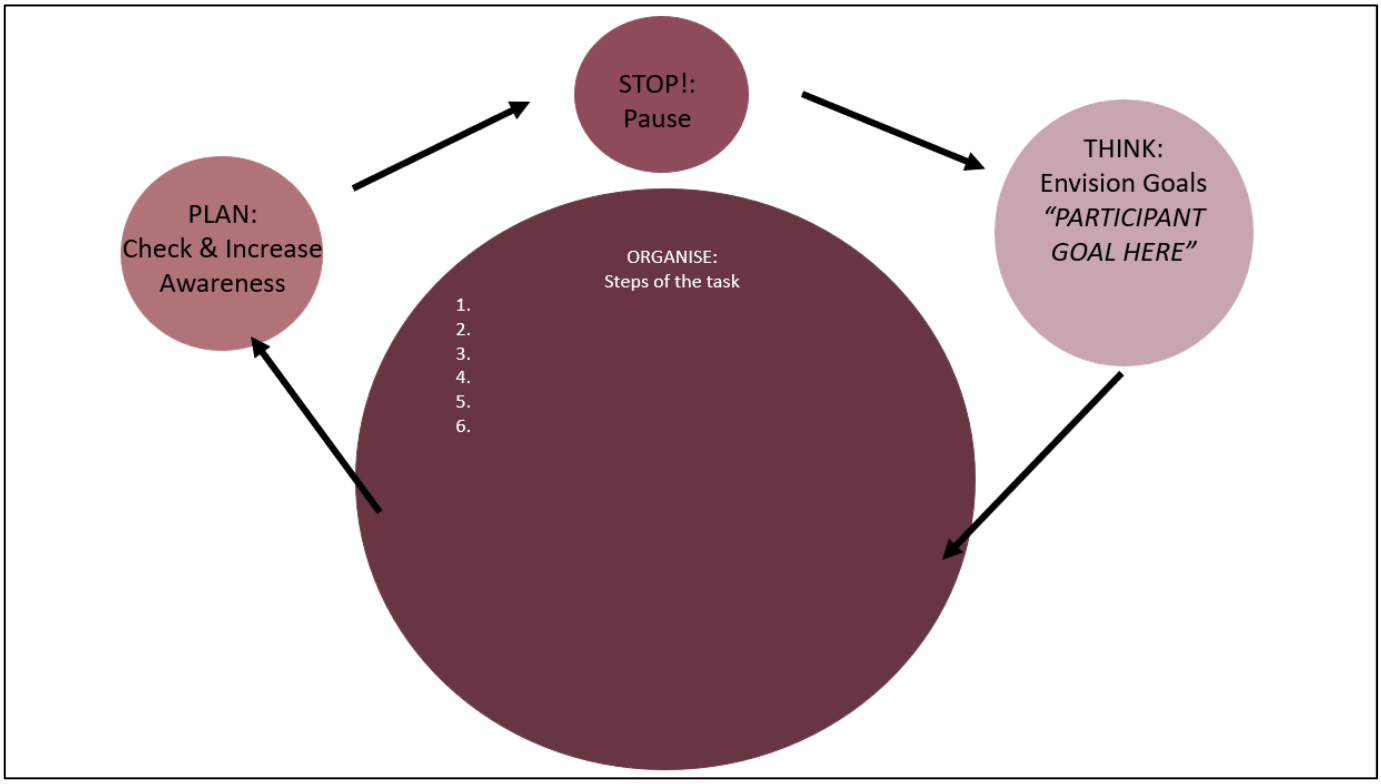


STOP!

STOP!

Stop
Think
Organise
Plan


STOP!:
Pause
THINK:
Envision
Goals
ORGANISE:
Steps of
the task
PLAN:
Check & Increase
Awareness


STOP!:
Pause
THINK:
Envision Goals
"PARTICIPANT
GOAL HERE"
PLAN:
Check & Increase
Awareness
ORGANISE:
Steps of the task
1.
2.
3.
4.
5.
6.

End of Session 2 Reflections

Does the information that we covered today make sense?

Do you think the information we covered is it relevant to you in your everyday life?

Thank you for taking part!

A reminder…
If you are feeling distressed and need any further support, here are some helplines to support you:

SAMARITANS
Telephone: 116 123
www.Samaritans.org

mind
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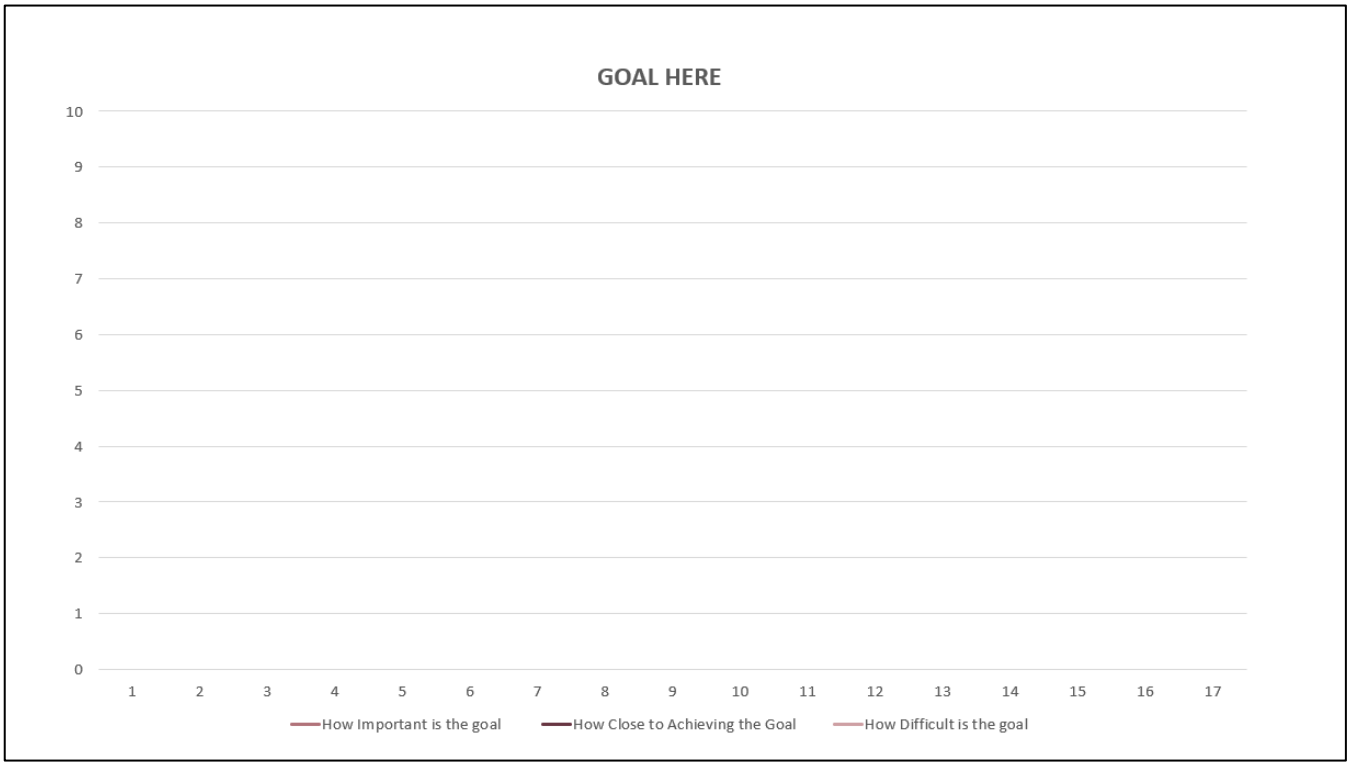
→ **Week 3: Barriers and Bridges, Re-Evaluating Goals**

Week 4: Reviewing the Intervention, Questionnaires

Week 3

Barriers and Bridges

Re-Evaluating Goals



Barriers and Bridges

Barriers and Bridges

Barriers

Things that make it harder to reach our goals

Examples:

- Tiredness
- Challenges with areas of executive function (e.g., working memory)
- Stress/anxiety.

Bridges

Things we can do to support us to reach our goals

Examples:

- Setting reminders on our phones,
- Using calendars/diaries,
- Making notes/to-do lists.

Re-Evaluating Goals

Your Goal: XXX

Barriers	Bridges

End of Session 3 Reflections

Does the information that we covered today make sense?

Do you think the information we covered is it relevant to you in your everyday life?

Thank you for taking part!

A reminder…
If you are feeling distressed and need any further support, here are some helplines to support you:

SAMARITANS
Telephone: 116 123
www.Samaritans.org

mind
Telephone: 0300 123 3393
Text: 86463
www.mind.org.uk

PAPYRUS
Telephone: 0800 068 4141
Text: 07860039967
www.papyrus-uk.org

Intervention Overview

Pre-Intervention Meeting: Goal Setting, Questionnaires

Week 1: Understanding Executive Functions

Week 2: Autopilot, The Mental Whiteboard & STOP!

Week 3: Barriers and Bridges, Re-Evaluating Goals

→ **Week 4: Reviewing the Intervention, Questionnaires**

Week 4

Reviewing What We Have Learnt

Ending

Reviewing What We Have Learnt

Reviewing the Intervention

- Executive Function
- Your Unique Executive Function Profile
- The Autopilot
- STOP!
- The Mental Whiteboard
- Barriers and Bridges

Ending

Continuing The Work..

To continue to work towards my goal(s) I can:	
Potential barriers to my goal(s):	
How can I overcome these barriers:	
Bridges/things that can help reach my goal(s):	

What Happens Now?

- Keep completing daily measures for **X** days
- Complete BRIEF-A and QOLIBRI questionnaires again
- Arranging Follow-up call

End of Session 4 Reflections

Does the information that we covered today make sense?

Do you think the information we covered is it relevant to you in your everyday life?

Thank you for taking part!

A reminder…
If you are feeling distressed and need any further support, here are some helplines to support you:

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Appendix I

Trauma Informed Care Principles

This table outlines how the EF intervention fit with trauma informed principles of care, outlined by Sweeney et al., (2016).

Key Principles of Trauma Informed Care	How the Project Aims to Meet The Key Principle
Recognition of the prevalence, signs, and impacts of trauma.	• The researcher will familiarise themselves with evidence base surrounding trauma following IPV. • The researcher will aim to understand the impact of the trauma on the participants ability to survive in the present moment. • Where appropriate, the IPV-TBI survivor's experience of trauma and brain injury will be approached in a respectful way. Their experience of trauma will be recognised, as recognising the trauma with the individual can create feelings of validation, safety, and hope. • The researcher will take the approach of "what has happened to you" instead of "what is wrong with you". • The researcher will have regular supervision and support from the research supervisors
Resisting re-traumatisation.	• The researcher will take time to reflect upon the power differentials between themselves and the participants and take steps to eliminate this. • The IPV-TBI survivors experience of trauma will be approached in a respectful way. Participants will be forewarned of any questions relating to trauma and will be reminded that they can choose not to answer.
Acknowledging cultural, historical, and gender contexts.	• It will be ensured that interventions are culturally and gender appropriate. • The participants intersectionality's and how these might impact them will be recognised and considered.
Trustworthiness and transparency.	• The research, its aims, what it will involve and why it is being conducted will be openly communicated with each participant.

	• The researcher will aim to be open and transparent at all times.
Collaboration and mutuality.	• The researcher will reflect on the power differentials between themselves and the participants and take steps to eliminate these. • Intervention goals will be collaboratively set and worked towards.
Empowerment, choice, and control.	• The researcher will take a strengths-based approach, supporting IPV-TBI survivors gain independence in their application of the executive function skills. • The choice to continue participating will be made apparent throughout the research study.
Safety.	• The researcher will do what they can to ensure the intervention feels emotionally and physically safe. • It will be made sure that each survivor is in a physically and emotionally safe environment before participating in the study.
Survivor partnerships, the understanding that peer support and the co-production of services is integral to trauma-informed care.	• The researcher understands the importance of peer-support. • Feedback will be requested from each participant to enable to development and co-production of the intervention.
Supporting survivors to access appropriate trauma-specific care.	• Participants involved in the study will also be involved in IPV services/charities. These services are able to offer trauma-specific care. Where appropriate, they will be notified of the individual's involvement in the study and contacted if further support is needed.

Appendix J

Client Information Pack

The relevant client information pack for each week was sent via email to each participant after the completion of each session. For participants in the USA, the second final page was sent.

Executive Function in Intimate Partner Violence Related Head Injury

Client Intervention Pack

Ruth Salmon

Trainee Clinical Psychologist

University of Exeter

(With thanks to Dr Jenny Limond, Clinical Neuropsychologist and Sarah Hester, Trainee Clinical Psychologist)

CEDAR
Clinical Education Development and Research

UNIVERSITY OF EXETER

Overview of the Intervention

The intervention is designed to help you think of and use strategies to support challenges with executive functions. These will be tailored to your unique executive function profile and based on your individual goals.

The intervention is supported by this client pack, to help you to remember what we have covered in each session.

The overview of the intervention, and what each week will include is found below:

Week	Content
Before the Intervention	• Goal Setting • Questionnaires
1	• Understanding Executive Functions • Your Unique Executive Function Profile
2	• The Autopilot • The Mental Whiteboard • STOP!
3	• Barriers and Bridges • Re-evaluating goals
4	• Review of intervention • Ending

Goal Setting

An important part of the intervention is setting individual goals. This helps to make sure that the information is tailored to you.

Your Long-Term Goal:	
Your Shorter Term Goal:	

SMART Goals

Specific:

Measurable:

Attainable:

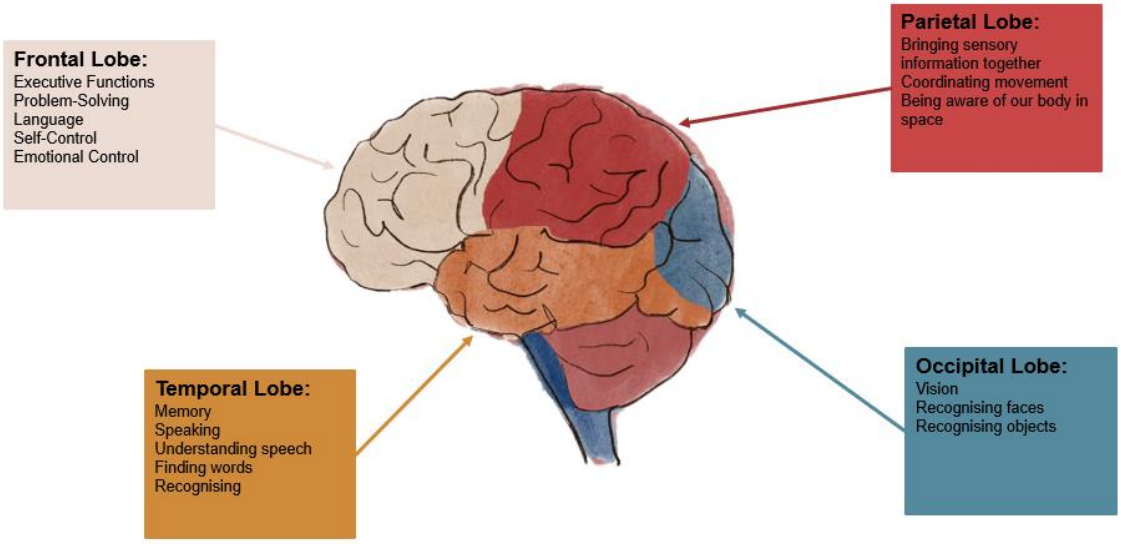
Relevant:

Time-Bound:

Week 1: Understanding Executive Functions

The Brain

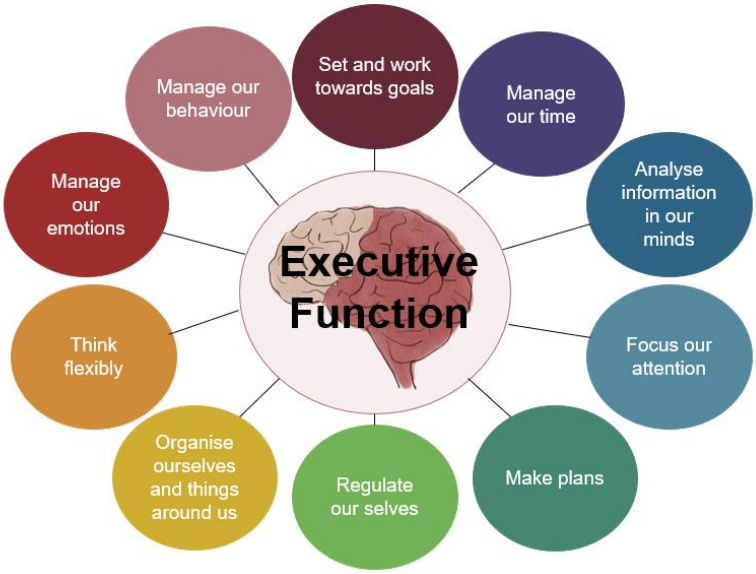
The brain is responsible for everything that we do. It is separated into different parts, known as “lobes”. These lobes are responsible for different things. They connect together through nerves, making the brain a large network that works together to complete tasks



Executive Function

Executive function describes lots of different skills. It can be thought of as the “command centre” of the brain. Executive function skills are important to help us control and coordinate our thinking, behaviour, and our attention. They are helpful for thinking about and acting on our goals.

Executive functions are important for many things:



Head Injury and Executive Function

When we have a head injury, we may also injure our brains. When our brains are injured, we can have difficulty with some of our thinking skills. Our executive functions are skills that are often more difficult after a head injury.

Your Unique Executive Function Profile

Everybody naturally has differences in their abilities, some things we find easier, and some things we find more difficult. This is normal.

Use this table below to write down your strengths and skills you might find more difficult:

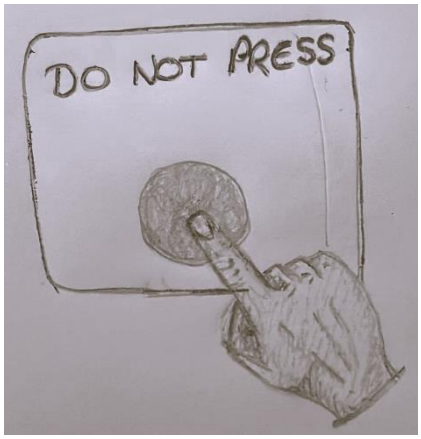
Areas of Strength	Areas you Might Find More Difficult

Different Executive Functions

Response Inhibition

Response inhibition is the ability to resist our impulses and urges.

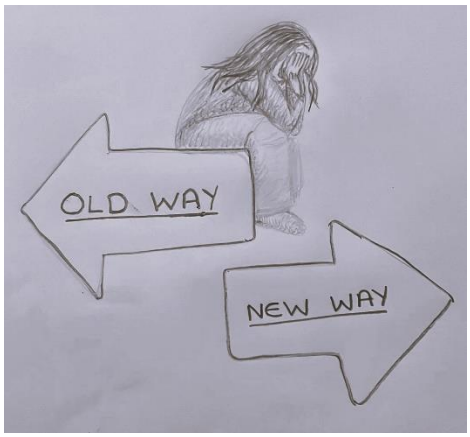
These might be urges to do or say something inappropriate or do things before we think about the consequences. It can be thought of as being "in control" of ourselves.



Shift or Flexible Thinking

Shift, or flexible thinking is out ability to move from one situation or activity to another as needed.

It includes our ability to make transitions, tolerate change, problem solve flexibly, alternate our attention, and change focus from one topic to another.



Emotional Control

Emotional control is our ability to regulate our emotions.

If we find this harder, we might be more likely to have outbursts, frequent mood changes, or long periods of feeling upset.

Self-Monitoring

Self-monitoring is out ability to be aware of ourselves, and the effect of our behaviour on other people.

Task Initiation or Getting Started

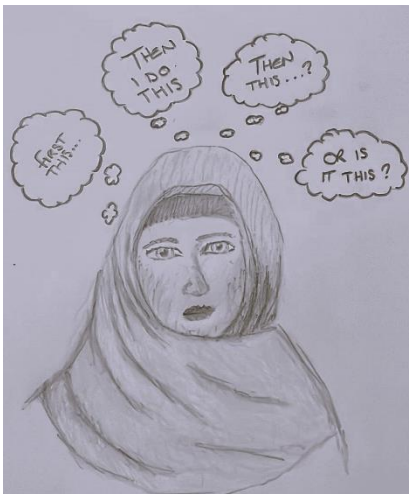
Task initiation is our ability to start a task or an activity. It can be thought of as our ability to “get going”.

It involves our ability to independently think of ideas, responses, or to problem-solve.

Working Memory

Working memory is our ability to hold the information that we need to complete a task in mind. It is important for doing activities that have lots of steps, for example mental maths, or following complicated instructions.

Working memory can be thought of as our “active memory”.

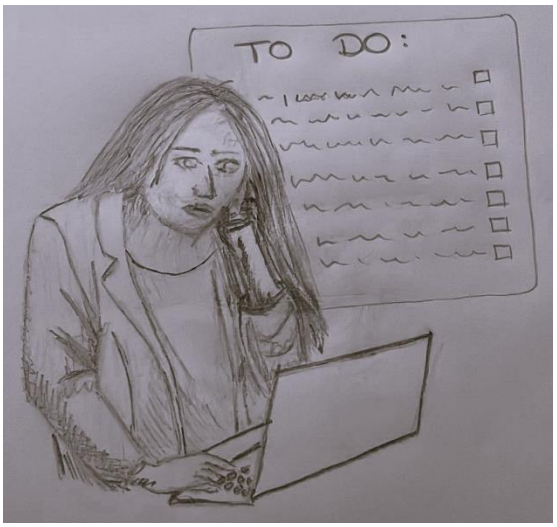


Planning and Organising

Planning and organising are our abilities to manage current and future task demands.

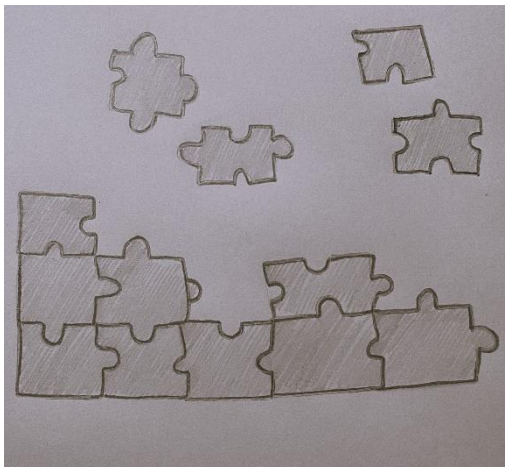
Planning: Our ability to anticipate future events, set goals, and develop appropriate steps ahead of time in order to do an activity.

Organising: Our ability to bring order to information.



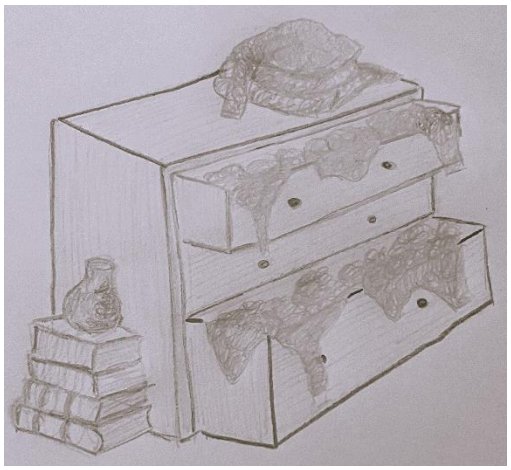
Task Monitoring

Task monitoring is our ability to keep track of our problem solving successes and failures. It includes our ability to find and correct mistakes we have made.



Organisation of Materials

Organisation of materials is our ability to keep our work, living, and storage spaces organised so that we can find things when we need them.



Week 2: Autopilot, The Mental Whiteboard, STOP!

Even when we are determined to meet our goals, they can be hard to achieve. We can get distracted, they can slip our minds and get forgotten, we can run out of time, they can feel too big, and sometimes we do not feel like doing them.

To reach our goals, we need to remember what we want to do, and when we need to do it. This can be challenging, especially after a head injury.

Mistakes can often occur. This is not because you cannot do it, but because your mind was not focusing on what you were doing at the time.

The Autopilot

The “autopilot” is what happens when we do things without paying conscious attention to them. This is a normal thing, and generally happens around 50% of the time.

The autopilot can be helpful, and usually happens when tasks are routine, or repetitive (such as brushing our teeth and getting ready in the morning). It allows us to do these tasks quickly and accurately, without conscious thought, so that we can focus on other things. It is helpful in helping us to develop habits and saving energy.

Sometimes, the autopilot is not helpful. Being in autopilot can cause us to forget to do important things, restrict our awareness of what is going on around us, and make mistakes.

Some examples of autopilot include:

- Walking into a room and forgetting what you went in there for
- Daydreaming instead of listening to somebody talking
- Having to re-read something because you were not paying attention

Helpful for:

- Doing familiar tasks quickly and accurately without conscious effort
- Developing habits
- Saving energy.

Less Helpful for:

- Forgetting to do things
- Restricts our awareness of what is happening around us
- Making mistakes.

The Mental Whiteboard

As we are doing a task, we have an instruction of how to do it in our head. We can think of our short-term memory as a whiteboard.

There is not enough space to store lots of information. So, once we have finished a task, the mental whiteboard gets wiped clean. When we get distracted by something, and go into autopilot, the instructions can get wiped from our whiteboard before we have had a chance to complete the task.

This can mean we forget to do things that we need to do to reach our goals.

STOP!

To stop things from getting wiped from our mental whiteboards before we are ready, we can stop ourselves from going into autopilot by regularly telling ourselves to stop and think. This can take effort but using “STOP!” Can help.

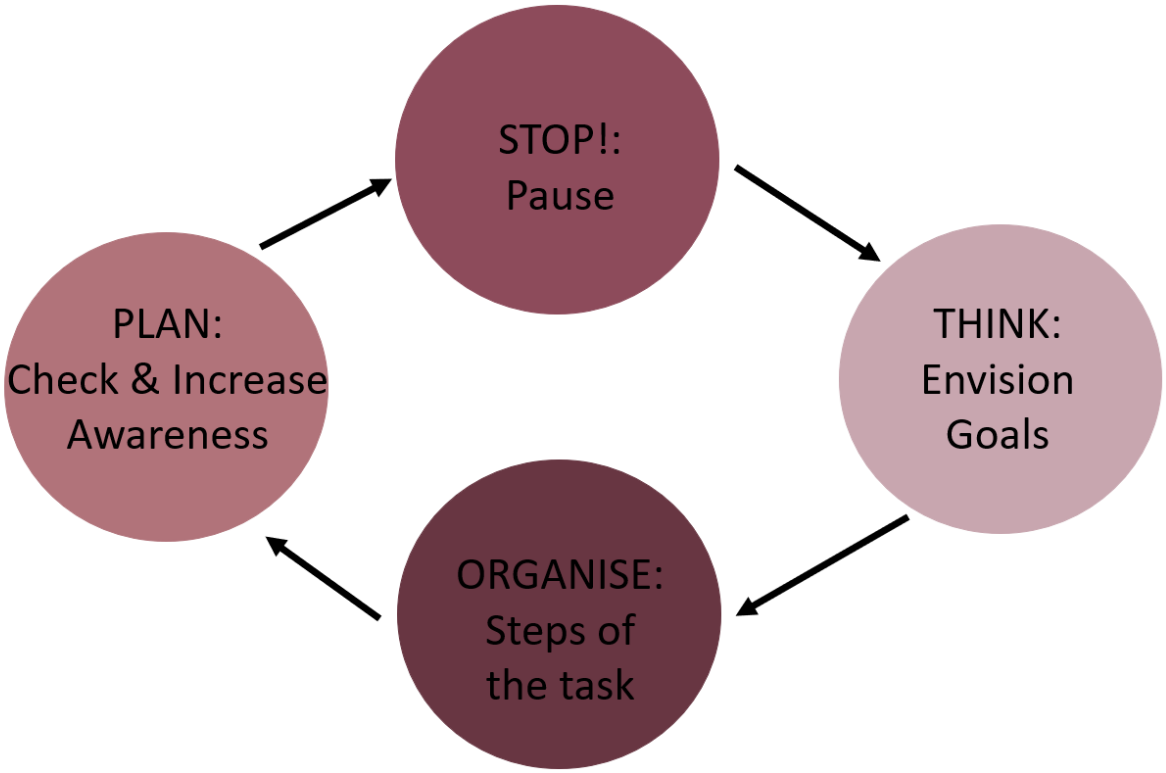
STOP what you are doing

THINK about what you have got to do to reach your goals/task.

ORGANISE what you need to do to complete the task

PLAN how you are going to do this.

The Process of STOP!



STOP! Follows the cycle above

1. STOP! Here you pause, and think about what is happening around you, and what you are doing. You can use mindfulness or grounding strategies to help with this, such as paying attention to your five senses. This might involve thinking about what you can see hear, smell, touch, or taste.

2. THINK: Here you envision your goals. You can ask yourself questions such as “am I ok to continue with what I am doing, or do I need to be concentrating on something else?” or “is there anything I need to be doing differently right now?”

3. ORGANISE: Here you think about the tasks that you need to do to reach your goals, and break these tasks down into smaller, more structured steps. It might help to write these down and keep these to hand. Writing these down can help them from being wiped from the mental whiteboard.

4. PLAN: Here you think about what you need in order to complete the tasks. At this stage you can keep checking what you are doing. This helps to increase our awareness and stop us from slipping into autopilot.

Our STOP! Example

PLAN: What might help me to complete the tasks?

STOP! Text Messages

Over the duration of the intervention, you will receive messages that say "STOP!" at random times from Monday-Friday. When you get these, if it is safe to do so, take a moment to go through the STOP process.

Week 3: Barriers and Bridges, Re-Evaluating Goals

Barriers and Bridges

To help think about how to reach our goals, we can use the idea of bridges and barriers.

Barriers

Things that make it harder to reach our goals

Examples:

- Tiredness
- Challenges with areas of executive function (e.g., working memory)
- Stress/anxiety.

Bridges

Things we can do to support us to reach our goals

Examples:

- Setting reminders on our phones,
- Using calendars/diaries,
- Making notes/to-do lists.

Re-Evaluating Goals

Use the space below to write down the barriers you might face, and the bridges you can use to support yourself:

Bridges	Barriers

Bridges	Barriers

Week 4: Review and Consolidation

Reviewing What We Have Learnt

Together we have covered a lot of information! Below are the topics that we have learnt about:

Continuing The Work

In our last session, we thought of ways that you can continue the work you have been doing over the last 4 weeks.

Use the table below to help you remember:

To continue to work towards my goal(s) I can:	
Potential barriers to my goal(s):	
How can I overcome these barriers:	
Bridges/things that can help reach my goal(s):	

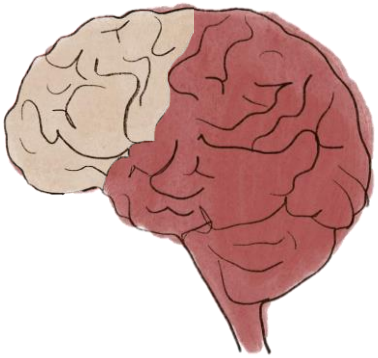
What Happens Now

Please continue to complete the daily measures, these will be sent to you for approximately another week.

You will also receive a second copy of the BRIEF-A and QOLIBRI questionnaires to complete again. Please fill these in as soon as possible and send them back to me at: rs850@exeter.ac.uk

As this is a new intervention, your feedback is really important to help us to develop it! I will arrange a follow-up call with you to talk about the study and ask for your feedback.

Thank You For Taking Part!



Thank you for taking the time to complete this intervention. Some of the information covered may result in some distress. If this is the case, please contact one of the following helplines to support you.

If you need immediate, emergency support please call 999 or go to your local A&E department.

Helplines:

SAMARITANS

Telephone: 116 123

www.Samaritans.org

mind

Telephone: 0300 123 3393

Text: 86463

www.mind.org.uk

PAPYRUS

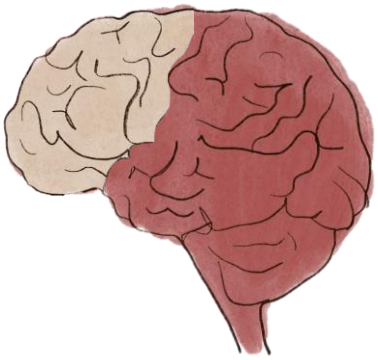
Telephone: 0800 068 4141

Text: 07860039967

www.papyrus-uk.org

Final page for participants in the USA:

Thank You For Taking Part!



Thank you for taking the time to complete this intervention. Some of the information covered may result in some distress. If this is the case, please contact one of the following helplines to support you.

If you need immediate, emergency support please call 911 or go to your nearest ER department.

Helplines:

988 SUICIDE & CRISIS LIFELINE

Telephone: 988

https://988lifeline.org

CRISIS TEXT LINE

Text: 'HOME' to 741741

https://www.crisistextline.org

NATIONAL DOMESTIC VIOLENCE HOTLINE

Call: 1-800-799-7233

Text: 'START' to 88788

https://www.thehotline.org/

Appendix K

Participant Information Sheet

Participant Information Sheet

A Cognitive Intervention for Female Survivors of Intimate Partner Violence Related Head Injury

Researcher name: Ruth Salmon

My name is Ruth Salmon, I am a Trainee Clinical Psychologist studying at the University of Exeter. I would like to invite you to take part in my study. I am hoping to look into an intervention for difficulties in executive function following a head injury from intimate partner violence.

Before you decide whether you wish to take part in this study, it is important to know why the research is being done and what it would involve. Please take the time to read the following information carefully. If you have any questions or would like to know more about the study, please feel free to contact me. My contact details are: rs850@exeter.ac.uk.

What is the purpose of this study?

Head and neck injuries are common in survivors of intimate partner violence. In some cases, this can cause an injury to the brain. When the brain is injured, difficulties with thinking skills known as our executive functions can happen.

Executive functions are the skills that we need for to complete goals. Having challenges with executive functions can make it more difficult to do things such as planning, and keeping things organised.

A list of common executive functions is shown in the table below.

Area of Executive Function	What this Means
Emotional Control	The ability to control our emotions and behaviour to achieve our goals and complete tasks.
Inhibition	The ability to think before we act, and to resist urges.
Initiation	The ability to begin a task or activity, and to create our own ideas or responses.
Organisation	The ability to create ways to keep track of information or things.
Planning	The ability to think about ways to achieve future tasks.
Self-Monitoring	Being aware of how the way we behave might impact others.
Shifting	The ability to move freely from one task to another.

Task Monitoring	The ability to keep track of our problem-solving, and to correct our mistakes.
Working Memory	The ability to hold information in mind whilst doing tasks.

This study aims to run a 4-week intervention for executive function. The intervention will run for 1 hour per week. It will look at building strategies and supporting individuals to use them in everyday life. This will be for survivors of people who have had a brain injury after intimate partner violence.

Why have I been approached?

You have been approached about this study as you are a survivor of intimate partner violence attending support services.

You are able to take part in this study if:

- You are over 18 years old.
- You are female.
- You have a history of intimate partner violence and are at least 1 year post this relationship.
- You are in stable accommodation.
- You have experienced a concussion, or a knock to the head.
- You have difficulties in common everyday executive function tasks.
- You are English speaking.
- You are able to access video-conferencing software.

What would taking part involve?

If you want to take part in this study, you can either let your support service know or contact me here: rs850@exeter.ac.uk. Taking part in this study is completely voluntary.

I will then contact you to arrange an appointment. This will be either over the telephone, or video call using Zoom video conferencing software. In this appointment, I will ask you some questions about yourself, and your experience of executive function difficulties. You will also be asked to complete the pre-study questionnaires and set some goals. I will also ask for the contact details of your GP. We will also talk about the date that the study is going to start and when you can be available for the intervention. This appointment will take around 1 hour.

The study will last 6 weeks. During this time, you will be asked to complete a short questionnaire each day from Monday to Friday. This will be sent to you either by email or text and will take roughly 5 minutes to complete. In week 1 you just need to complete the daily questionnaire. In weeks 2-5, you will also take part in the intervention.

The intervention will include weekly 1-hour appointments with me, for 4 weeks. In these appointments, we will talk about head injury. We will also think about different strategies that can help you reach your goals. Together we can think about potential problems, and what you can do to solve them. All that you need to do is to engage with the intervention appointments, and keep completing the 5-minute daily questionnaire, Monday-Friday.

The study lasts 6 weeks. This is to make sure that there is enough time for each participant to complete the 4-week intervention. You will get the dates and times of your intervention appointments before the study begins. There will be some flexibility on these appointments, to allow for a time that suits you.

At the end of the study, we will organise a follow up call to talk about your experience. Here, I can answer any questions you may have. You will be asked to complete the same questionnaires again and answer a few questions on your experience of the intervention.

Future Studies

We are hoping to run a future study thinking about the long-term effects of the intervention at 6 months or 1 year. If you would like us to contact you about this, please let us know. If you decide that you do not want to take part in any future studies, this will not affect your ability to take part in the current study in any way.

What are the benefits of taking part?

We expect that the main benefits may be a reduction in difficulties with executive function. It is important to note that we do not know what the study outcomes may be. Because of this, we cannot promise that there will be any specific benefits. We hope that the study will contribute towards the evidence base for improving outcomes in survivors who have a head injury after intimate partner violence.

What are the disadvantages of taking part?

If you want to take part in this study, you will need to fill out two questionnaires before and after you take part. You will also need to fill out 5-miute questionnaires, every day from Monday-Friday for 6 weeks. You will also need to attend weekly 1 hour intervention appointments for 4 weeks of the 6 week period.

Talking about head injury after intimate partner violence can be difficult. It you find this upsetting; you can let me know. You can either talk about this with me, or I can direct you to other forms of psychological support.

Please know that if you tell me that there is a significant risk to yourself or others around you, I will need to pass this on to your GP, and support services staff.

What will happen if I do not want to carry on with the study?

Taking part in the study is completely optional. You can stop taking part at any time, without having to give a reason why. If you stop taking part in the study, you will not receive payment for taking part. Deciding that you do not want to continue with the study, will have no impact on your access to any other service, or future studies.

If you wish to withdraw from the current study or any future study, please contact me using this email address: rs850@exeter.ac.uk

Please note that I cannot destroy the data you have provided once the report has been written up. The deadline to withdraw from the study is: 1st February 2023.

How will my information be kept confidential?

The University of Exeter processes personal data for the purposes of carrying out research in the public interest. The University will aim to be clear about its processing of your personal data. This information sheet should provide a clear explanation of this. If you have any questions about the University's processing of your personal data that cannot be resolved by the research team, further information may be obtained from the University's Data Protection Officer by emailing dataprotection@exeter.ac.uk or at www.exeter.ac.uk/dataprotection

All of your personal information, and the information spoken about in your intervention appointments will be kept confidential. This information will be kept in a secure place. Only the research team will be able to access it. All of the data that you give us during the study will be made anonymous by using a code. Your name and your code will be stored in a different place to your study data. The anonymous data you give us may be looked at by members of the research team or individuals from the University of Exeter. Your computer IP address will not be stored. When the results of the study are written up it will not include any of your personal information. Your data will be stored 3 years after the study has finished before it will be destroyed.

If any risk to yourself or others is disclosed during the study, information about this risk will be passed on to your GP and support services staff. If this happens, I will let you know that I am going to do this.

Will I receive any payment for taking part?

Yes- you will receive a £20 gift voucher for taking part in the study.

What will happen to the results of this study?

Your data will be put together with the data from the other individuals who have taken part. I will study this information and write up the results. These results will be presented to the other individuals who are studying for their doctorate in clinical psychology.

The study results will be published as part of a doctorate dissertation. They may also be published in an academic journal. A summary of what has been found can be sent out to you after the study has finished if you wish. Your information will be kept anonymous and confidential.

Who has reviewed this study?

This study has been reviewed by the Research Ethics Committee at the University of Exeter

Contact details

If you would like to know more about the study, or would like to take part, please email me at: rs850@exeter.ac.uk.

If you are not happy with any part of the study and want to complain, please contact:

Dr Jenny Limond, Senior Research lead for DClinPsy, Consultant Clinical Neuropsychologist, Department of Psychology, Washington Singer Laboratories, University of Exeter. J.Limond@exeter.ac.uk

OR

Dr Jana Funke, Chair of the College of Humanities Ethics Committee, University of Exeter, Department of English & Film, Queen's Building, The Queen's Drive, EXETER EX4 4QH j.funke@exeter.ac.uk 01392 725612

Professor Ian McLaren i.p.l.mclaren@exeter.ac.uk, or Ciro Civile c.civile@exeter.ac.uk, Charis of Psychology Ethics Committee, University of Exeter.

Thank you for your interest in this study.

Appendix L

Participant Consent Form

Participant Identification Number:

CONSENT FORM

Title of Study: A Cognitive Intervention for Female Survivors of Intimate Partner Violence Related Head Injury

Name of Researcher: Ruth Salmon Please initial box

1. I confirm that I have read the information sheet dated 26.10.22 (version no 1.5) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reasons why. I understand that withdrawal from this study will not affect my relationship with any intimate partner violence service in any way. ☐
3. I understand that my personal details will be kept secure and no identifiable information will be used as part of the research results. ☐
4. I understand that relevant sections of the data collected during the study may be looked at by members of the research team (Dr Jennifer Limond and Dr Anke Karl) and individuals from the University of Exeter. I understand that they must preserve the confidentiality of this data, at all times. ☐
5. I understand that taking part involves questionnaire responses around head injury, executive function and wellbeing, and that these responses may be used for the purposes of reports published in an academic journal. ☐
6. I am willing and able to give the research team the name and contact details of my GP. ☐
7. I understand that if any significant risk to myself or others is disclosed during the study, this information will be passed on to my GP, and the member of staff who informed me about the study at the intimate partner violence service I was referred from. ☐
8. I agree to take part in the above study. ☐
9. I give permission for the research team to contact me regarding future, follow-up research. I understand that this is optional, and if I do not give permission to be contacted, I am still able to take part in the current study. ☐

GP Details:

Name:

Address:

Contact Telephone Number:

_____	_____	_____
Name of Participant	Date	Signature
_____	_____	_____
Name of researcher taking consent	Date	Signature

Appendix M

Screening and Demographic Questionnaire

Screening Questionnaire

NOTE: This screening questionnaire will be used as an outline for the initial zoom meeting with potential participants, to check that they meet the inclusion criteria.

Demographic/Background Information

Age:

Sex: (male/ female)

Gender:

- ☐ Female
- ☐ Gender Fluid
- ☐ Gender Neutral
- ☐ Male
- ☐ Non-Binary
- ☐ Omnigender
- ☐ Polygender/ Pangender
- ☐ Transgender
- ☐ Prefer not to say
- ☐ Other

Preferred pronouns:

Ethnicity:

Asian/ Asian British
- ☐ Bangladeshi
- ☐ Chinese
- ☐ Indian
- ☐ Pakistani
- ☐ Other [FREE TEXT]

Black/ African/ Caribbean/ Black British
- ☐ African
- ☐ Caribbean
- ☐ Other [FREE TEXT]

Mixed/ Multiple Ethnic Groups
- ☐ White and Black Caribbean
- ☐ White and Black African
- ☐ White and Asian
- ☐ Other [FREE TEXT]

White
- ☐ English/ Welsh/ Scottish/ Northern Irish/ British
- ☐ Irish
- ☐ Irish Traveller
- ☐ Other [FREE TEXT]

Other Ethnic Group

- ☐ Arab
- ☐ Chinese
- ☐ Other [FREE TEXT]

Years of Education:

- ☐ GCSE or equivalent
- ☐ A Level or equivalent
- ☐ Certificate of higher education
- ☐ Bachelor's degree (BSc/ BA)
- ☐ Master's degree (MSc/ MA)
- ☐ PhD/ Doctorate
- ☐ Other [FREE TEXT]

Employment:

Do you have/ have you had any other neurological conditions (such as epilepsy, multiple sclerosis, a brain tumour, dementia)?

IPV Screening Questions

Some of these questions may be quite difficult to answer, if it is too difficult, please let me know and we can slow down/ stop at any point.

Do you have a history of intimate partner violence?

Are you currently in a relationship involving intimate partner violence?
IF YES- Risk assessment, referral to appropriate support, stop questionnaire.

What is your current living situation? (i.e., do you have access to your own private space? Is it stable?)

TBI Screening Questions

Some of these questions may be quite difficult to answer, if it is too difficult, please let me know and we can slow down/ stop at any point.

Have you ever experienced a blow to the head/ been strangled?
IF NO- Stop questionnaire.

Did you ever lose consciousness?

Were you ever dazed and confused?

Has anyone else told you that you have had a brain injury?

IF YES: can you tell me more?

Practical Screening Questions

Are you available (INSERT STUDY TIME HERE)?

Can you commit to weekly 1 hour intervention sessions?

Do you have access to video-conferencing software? (Zoom or Teams as appropriate)

Can you speak fluent English?

Executive Function Impairment Screening Questions

I am going to read a list of statements and ask you how regularly you experience them from:

0- Never
1- Rarely
2- Occasionally
3- Often
4- All the time

• I have difficulty following my goals through to completion.	0	1	2	3	4
• I get distracted by competing tasks/ interests.	0	1	2	3	4
• I have difficulty monitoring my own performance on everyday tasks.	0	1	2	3	4
• I have difficulty monitoring my thoughts.	0	1	2	3	4
• It is hard to revise my plans when there are obstacles/ set backs.	0	1	2	3	4
• I have difficulty adapting to changes in everyday life.	0	1	2	3	4
• I have difficulty keeping things organised at home.	0	1	2	3	4
• I have difficulty planning a route to a new place.	0	1	2	3	4
• I have difficulty deciding how to approach completing a task.	0	1	2	3	4
• I find it difficult to resist my urges.	0	1	2	3	4
• I speak before I think.	0	1	2	3	4
• I find it difficult to pay attention to a task.	0	1	2	3	4
• I have difficult starting tasks at home.	0	1	2	3	4
• I have difficulty with time management.	0	1	2	3	4
• I have difficulty holding information in mind when performing tasks.	0	1	2	3	4

Appendix N

Debrief Transcript

A Cognitive Intervention for Everyday Executive Functioning in Female Survivors of Intimate Partner Violence Related Traumatic Brain Injury.

Debrief Transcript

Thank you for taking the time to participate in the study.

Our study aimed to explore the effects of an intervention for everyday executive function challenges for female survivors of intimate partner violence related head injury.

Intimate partner violence related head injury can result in a variety of challenges. One of the most commonly reported challenges is difficulty with executive functioning: the skills we need for self-regulation and goal-directed behaviour. Cognitive rehabilitation interventions have proven to be beneficial for individuals with a head injury. However, at present, there are no evidence-based intervention available to support individuals with executive function difficulties following head injuries resulting from intimate partner violence. Our study hopes to be an important step in providing an evidence base for cognitive interventions in female survivors of intimate partner violence related head injury.

Thank you again for your time and interest in our study.

If you would like to receive an executive summary of the research, please let us know be contacting: rs850@exeter.ac.uk

Please note, providing an email address means you are consenting for this email address to be stored securely until the end of the project, solely for the purpose of disseminating the project findings.

Support Services

We understand that the topics covered are difficult and can be distressing. We wanted to provide a list of support services for those who may have been affected.

The Samaritans

Available 24 hours a day, providing confidential emotional support for individuals experiencing feelings of distress, despair, or suicidal thoughts.

Tel: 116 123
Website: www.samaritans.org

Mind

Available Monday to Friday, 9am-6pm (except bank holidays). Offering advice and support for individuals experiencing a mental health difficulty.

Tel: 0300 123 3393
Text: 86463
Website: www.mind.org.uk

Papyrus UK

Available 9am- midnight, every day. A charity supporting people under the age of 35 who are experiencing distress and thoughts of suicide.

Tel: 0800 068 4141
Text: 07860039967
Website: www.papyrus-uk.org

In addition to these, you can also access support through your intimate partner violence charity services.

If you are in need of immediate, emergency help please call 999 and go to your local A&E department.

If you have any further questions, please feel free to contact us:

Ruth Salmon, Trainee Clinical Psychologist: rs850@exeter.ac.uk.

Dr Jenny Limond, Research Supervisor: j.limond@exeter.ac.uk

Professor Ian McLaren or Ciro Civile, Chairs of Psychology Ethics, University of Exeter: i.p.l.mclaren@exeter.ac.uk, c.civile@exeter.ac.uk,

Gail Seymour, University of Exeter Ethics Manager: g.m.seymour@exeter.ac.uk, 01392 726621

Appendix O

Risk Protocol

A Cognitive Intervention for Everyday Executive Functioning in Female Survivors of Intimate Partner Violence Related Traumatic Brain Injury.

The risk protocol has been adapted from the Mood Disorders Center Protocol for Assessing and Reporting Risk at the University of Exeter, to suit the research study and client group.

General Principles

Individuals working on the research project will have received adequate trianing prior to participant contact in assesing and managing risk. The researcher (Trainee Clinical Psychologist) will receive ongoing supervision throughout the research project.

General Procedures

Whenever any significant risk is identified, a risk assesment should be completed and signed by both the researcher and research supervisor. If possible, this should be done at the time of assessment, or as soon afterwards as possible.

Any significant, but not imminent risk should be reported to the person's GP and, if appropriate, other health care professionals, as soon as is reasonably possible.

For research outside of the local area, PIs / supervisors should familiarise themselves with the local providers' risk procedures, and researchers should hold the relevant contact details needed in the case of immediate risk.

When clinical academic staff are out of office, they should ensure appropriate cover is arranged for any risk issues that might arise in their absence.

When conducting telephone interviews in which risk may be disclosed, the interviewer should establish the location of the participant at the start of the call and clarify the boundaries of confidentiality (as per trial / clinic protocol).

Emergency Contact Numbers

Emergency contact numbers will be given to participants at the start of the study.

The Samaritans

Available 24 hours a day, providing confidential emotional support for individuals experiencing feelings of distress, despair, or suicidal thoughts.

Tel: 116 123
Website: www.samaritans.org

Mind

Available Monday to Friday, 9am-6pm (except bank holidays). Offering advice and support for individuals experiencing a mental health difficulty.

Tel: 0300 123 3393
Text: 86463
Website: www.mind.org.uk

Papyrus UK

Available 9am- midnight, every day. A charity supporting people under the age of 35 who are experiencing distress and thoughts of suicide.

Tel: 0800 068 4141
Text: 07860039967
Website: www.papyrus-uk.org

If you are in need of immediate, emergency help please call 999 and go to your local A&E department.

Exploring Risk in Research Interviews

THOUGHTS

"I see that you've said / you mentioned that…….. These are thoughts / feelings that people suffering from depression often have, but it's important to make sure you are receiving the right kind of support. So if it's OK, I would now like to ask you some more questions that will explore these feelings in a little more depth."

PLANS

1 Do you know how you would kill yourself? Yes / No
If **yes –** details

2 Have you made any actual plans to end your life? Yes / No
If **yes –** details

ACTIONS

3 Have you made any actual preparations to kill yourself? Yes / No
If **yes –** details

4 Have you ever attempted suicide in the past? Yes / No
If **yes –** details

PREVENTION

5 Is there anything stopping you killing or harming yourself at the moment? Yes / No

If **yes –** details

6 Do you feel that there is any immediate danger that you will harm or kill yourself? Yes / No

Details:

FOLLOW-UP FROM PREVIOUS CONTACT

7 **If Action B was enacted at previous assessment and level B risk is identified at current assessment**: Last time we met I suggested that you spoke to your GP about these thoughts, and I also wrote to your GP about this. Have you been able to speak with your GP about these thoughts since we last met? Yes / No

See Research Risk Protocol for appropriate actions

Researcher Risk Protocol

To be used following any indication of risk from questionnaire items, responses to interview questions or any other sources. Look at answers from the sheet to determine the level of risk, A B or C:

Actions by Researcher	***Tell Participant***
All answers 'no' apart from Q5 'yes': ↓ **A**	*I can see that things have been very difficult for you, but it seems to me these thoughts about death are not ones you would act on – would this be how you see things? (if they say yes) I would advise you to make an appointment to see your GP to talk about these feelings* ***(as per trial protocol)****.*
'Yes' for any **one** of Qs 1-4; plus 'yes' for Q5 and 'no' for Q6 ↓ **B1**	*Things seem to be very hard for you right now and I think it would help if you were to speak to your GP about these feelings. I will be writing to your GP to tell them that you have been here today and have been having some troubling thoughts. I would also advise you to make an appointment to see your GP to talk about these feelings. (**as per trial protocol).***
'Yes' for any **one** of Qs 1-4; plus 'yes' for Q5 and 'no' for Q6 **and** 'no' to Q7 ↓ B2	*I think it's important that your GP knows how difficult things are for you right now. I will be telephoning your GP to speak with him/her and suggest that you meet with one another. I also advise that you make an appointment to see your GP to talk about these feelings.* ***(as per trial protocol****).N.B: telephone call to GP to be followed up by letter. The letter should include the statement "*the clinical management of this patient remains your responsibility, but it is part of our protocol to inform you of any risks disclosed to ourselves so that you can take account of them in your care plan.*"*

Scoring 'no' to Q5 or 'yes' to Q6

↓

C Actively Suicidal → *I am very concerned about your safety at this moment, I am not a clinician but I would like you to talk to one right now. I am going to make some telephone calls now to arrange for your GP Care Co-ordinator / Crisis Management team/the emergency services to let them know how you are feeling and to arrange for you to receive immediate help.*

Action to take in the case of immediate risk:

Participant needs immediate help – **do not leave them alone, or if on telephone, do not hang up**. Follow your trial's chain of supervisory clinical contact in order to involve supervisory clinician right away. Then (with clinician if possible) follow the chain of contact below:

1. GP / out of hours GP; if not

2.Crisis team; if not

3. Clinician accompanies to A&E; if not (or interview is over telephone)

4. Call ambulance.

Risk Report

Patient name: _____ DOB: _____

Suicide risk information:

Include whether the participant has reported any of the following:

- *History of previous suicide attempts*
- *Current suicidal ideation*
- *Relevant inventory scores (e.g., BDI item 9)*
- *Suicide plans / preparations*
- *Protective factors*
- *Regular contact with GP?*

Date reported: ___/___/___

Additional notes / actions taken:

*As part of the MDC risk protocol, suicide risk is **managed** by the patient's GP.*

Date action taken: ___/___/___

Researcher / assessor: _____ Signed: _____ Date: ___/___/___

Supervisor: _____ Signed: _____ Date: ___/___/___

Appendix P

R Script for Statistical Analysis

Means and Standard Deviations

All computed using the 'tidyverse' package.

Means

```
x<-c()
x.mean<- mean(x)
print(x.mean)
round(x.mean,2)
```

Standard Deviations

```
x<-c()
sd(x)
```

Visual Analysis

Visual Analysis of Central Tendency R Script

```
graph.CL("AB",CL="bmed",tr,data=read.table(file.choose(new=FALSE)),xla
b="Data point",ylab="Mean
score",ylim=c(0,10),legendxy=NULL,labels=c("Baseline","Intervention"))
```

Visual Analysis of Trend R Script

```
graph.TREND("AB", TREND = "SM", CL="median", tr , data =
read.table(file.choose(new = FALSE)),xlab = "Data point", ylab = "Mean
score", ylim = c(0,10), legendxy = NULL, labels =
c("Baseline","Intervention"))
```

Randomisation Tests

Randomisation Tests for Combined Data

```
pvalue.random(design="MBD",statistic="B-A",number=1000)
```

Randomisation Tests for Individual Data

```
pvalue.systematic(design="AB",statistic="B-A",limit=5)
```

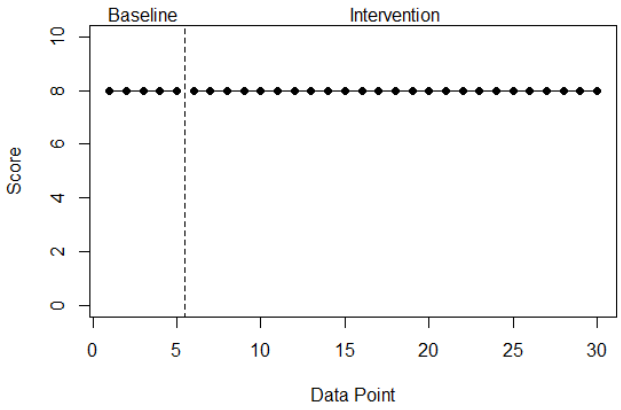
Appendix Q

Visual Analysis of Central Tendency

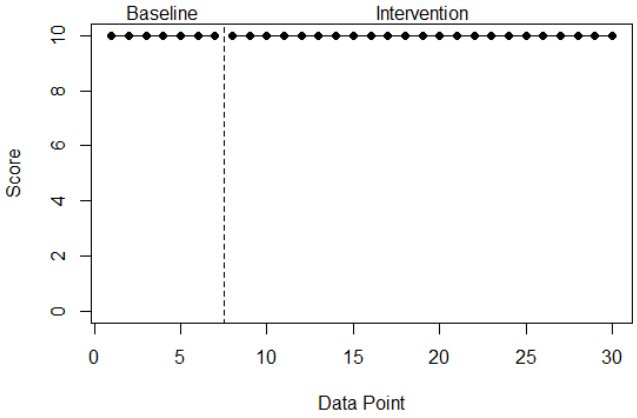
Central tendency analysis used the broadened median (Morley, 2018).

How importance is this goal to you?

a. P01

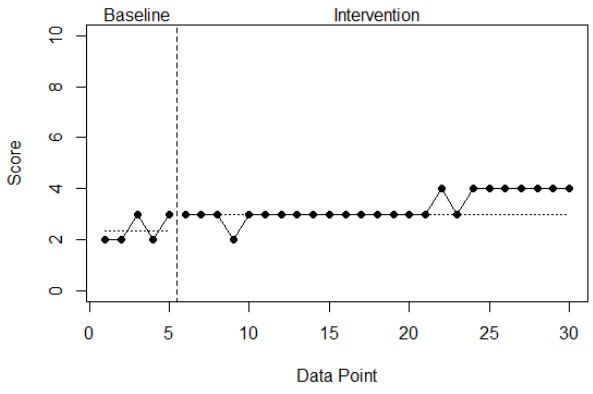


b. P03

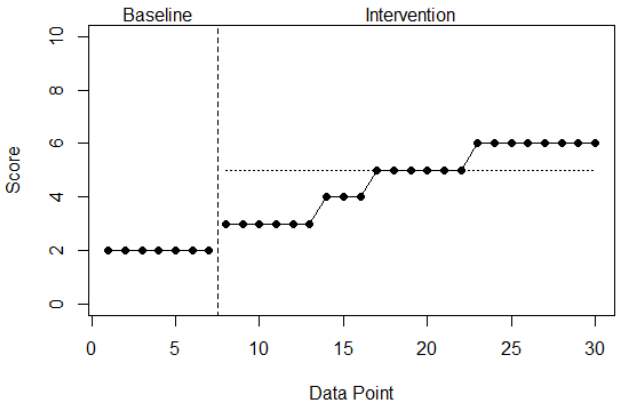


How close are you to achieving this goal?

a. P01

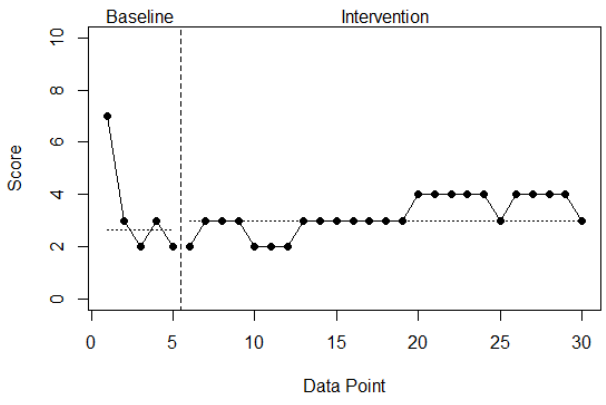


b. P03

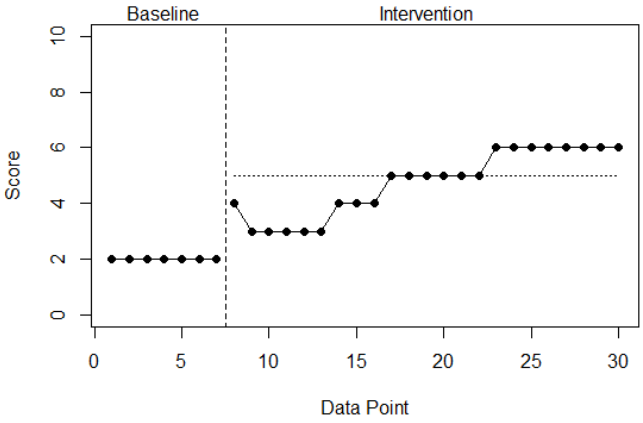


How difficult is achieving this goal?

a. P01



b. P03



Appendix R

Standard Error of The Difference Calculations for the QOLIBRI

Standard error of the difference (SE_{diff}) was calculated using the following equation:

$$SE_{diff} = \sqrt{2}xSEM^2$$

Where $SEM = SD\sqrt{(1-r)}$

QOLIBRI Subscale	Standard Deviation	Reliability Coefficient	SE_{diff}
Cognition	21.77	0.92	8.71
Self	21.96	0.90	9.82
Daily Life and Autonomy	22.38	0.93	8.37
Social Relationships	22.64	0.88	11.09
Emotions	24.69	0.88	12.10
Physical Problems	23.47	0.80	14.84
QOLIBRI Total	18.24	0.97	4.47

These SE_{diff} can be used to calculate the Reliable Change Index (RCI) for the QOLIBRI.

Appendix S

Dissemination Statement

Following a pass from the Doctorate in Clinical Psychology, this empirical paper will be shortened and submitted to the Neuropsychological Rehabilitation academic journal. The research findings will also be presented to peers and research tutors at the University of Exeter, staff at the IPV charities involved in recruitment, and Somerset NHS Foundation Trust. Participants will have the opportunity to request a copy of the study results.

Appendix T

A Copy of Instructions for Authors of the Nominated Journal:

Neuropsychological Rehabilitation

Instructions for authors

Thank you for choosing to submit your paper to us. These instructions will ensure we have everything required so your paper can move through peer review, production and publication smoothly. Please take the time to read and follow them as closely as possible, as doing so will ensure your paper matches the journal's requirements.

AUTHOR SERVICES
Supporting Taylor & Francis authors

For general guidance on every stage of the publication process, please visit our Author Services website.

EDITING SERVICES
Supporting Taylor & Francis authors

For editing support, including translation and language polishing, explore our Editing Services website

SCHOLARONE MANUSCRIPTS™

This journal uses ScholarOne Manuscripts (previously Manuscript Central) to peer review manuscript submissions. Please read the guide for ScholarOne authors before making a submission. Complete guidelines for preparing and submitting your manuscript to this journal are provided below.

This title utilises format-free submission. Authors may submit their paper in any scholarly format or layout. References can be in any style or format, so long as a consistent scholarly citation format is applied. For more detail see the format-free submission section below.

Contents

About the Journal

Neuropsychological Rehabilitation is an international, peer-reviewed journal publishing high-quality, original research. Please see the journal's Aims & Scope for information about its focus and peer-review policy.

Please note that this journal only publishes manuscripts in English.

Neuropsychological Rehabilitation accepts the following types of article: original articles, scholarly reviews, book reviews.

Open Access

You have the option to publish open access in this journal via our Open Select publishing program. Publishing open access means that your article will be free to access online immediately on publication, increasing the visibility, readership and impact of your research. Articles published Open Select with Taylor & Francis typically receive 32% more citations* and over 6 times as many downloads** compared to those that are not published Open Select.

Your research funder or your institution may require you to publish your article open access. Visit our Author Services website to find out more about open access policies and how you can comply with these.

You will be asked to pay an article publishing charge (APC) to make your article open access and this cost can often be covered by your institution or funder. Use our APC finder to view the APC for this journal.

Please visit our Author Services website or contact openaccess@tandf.co.uk if you would like more information about our Open Select Program.

*Citations received up to Jan 31st 2020 for articles published in 2015-2019 in journals listed in Web of Science®.
**Usage in 2017-2019 for articles published in 2015-2019.

Peer Review and Ethics

Taylor & Francis is committed to peer-review integrity and upholding the highest standards of review. Once your paper has been assessed for suitability by the editor, it will then be single blind peer reviewed by independent, anonymous expert referees. Find out more about what to expect during peer review and read our guidance on publishing ethics.

Preparing Your Paper

All authors submitting to medicine, biomedicine, health sciences, allied and public health journals should conform to the Uniform Requirements for Manuscripts Submitted to Biomedical Journals, prepared by the International Committee of Medical Journal Editors (ICMJE).

Clinical trials: must conform to the Consort guidelines http://www.consort-statement.org. Submitted papers should include a checklist confirming that all of the Consort requirements have been met, together with the corresponding page number of the manuscript where the information is located. In addition, trials must be pre-registered on a site such as clinicaltrials.gov or equivalent, and the manuscript should include the reference number to the relevant pre-registration.

Systematic reviews: submitted papers should follow PRISMA http://www.prisma-statement.org/ guidelines and submission should also be accompanied by a completed PRISMA checklist, together with the corresponding page number of the manuscript where the information is located.

Single-case studies: submitted papers should follow SCRIBE guidelines (http://psycnet.apa.org/fulltext/2016-17384-001.html) and include a completed SCRIBE checklist together with the corresponding page number of the manuscript where the information is located.

Observational studies: submitted papers should follow the STROBE guidelines (https://www.strobe-statement.org/index.php?id=strobe-home) and also include a completed checklist of compliance, together with the

corresponding page number of the manuscript where the information is located.

Qualitative studies: should follow the COREQ guidelines (http://www.equator-network.org/reporting-guidelines/coreq/) and be accompanied by a completed COREQ checklist of compliance, together with the corresponding page number of the manuscript where the information is located.

The EQUATOR Network (Enhancing the Quality and Transparency of Health Research) website provides further information on available guidelines.

Structure

Your paper should be compiled in the following order: title page; abstract; keywords; main text introduction, materials and methods, results, discussion; acknowledgments; declaration of interest statement; references; appendices (as appropriate); table(s) with caption(s) (on individual pages); figures; figure captions (as a list).

Word Limits

Please include a word count for your paper. There are no word limits for papers in this journal.

Style Guidelines

Please refer to these quick style guidelines when preparing your paper, rather than any published articles or a sample copy.

Please use American spelling style consistently throughout your manuscript. Please use single quotation marks, except where 'a quotation is "within" a quotation'. Please note that long quotations should be indented without quotation marks.

Alt Text

This journal is now including Alt Text (alternative text), a short piece of text that can be attached to your figure to convey to readers the nature or contents of the image. It is typically used by systems such as pronouncing screen readers to make the object accessible to people that cannot read or see the object, due to a visual impairment or print disability. Alt text will also be displayed in place of an image, if said image file cannot be loaded. Alt Text can also provide better image context/descriptions to search engine crawlers, helping them to index an image properly. To include Alt Text in your article, please follow our Guidelines

Format-Free Submission

Authors may submit their paper in any scholarly format or layout. Manuscripts may be supplied as single or multiple files. These can be Word, rich text format (rtf), open document format (odt), or PDF files. Figures and tables can be placed within the text or submitted as separate documents. Figures should be of sufficient resolution to enable refereeing.

- There are no strict formatting requirements, but all manuscripts must contain the essential elements needed to evaluate a manuscript: abstract, author affiliation, figures, tables, funder information, and references. Further details may be requested upon acceptance.
- References can be in any style or format, so long as a consistent scholarly citation format is applied. Author name(s), journal or book title, article or chapter title, year of publication, volume and issue (where appropriate) and page numbers are essential. All bibliographic entries must contain a corresponding in-text citation. The addition of DOI (Digital Object Identifier) numbers is recommended but not essential.
- The journal reference style will be applied to the paper post-acceptance by Taylor & Francis.
- Spelling can be US or UK English so long as usage is consistent.

Note that, regardless of the file format of the original submission, an editable version of the article must be supplied at the revision stage.

Taylor & Francis Editing Services

To help you improve your manuscript and prepare it for submission, Taylor & Francis provides a range of editing services. Choose from options such as English Language Editing, which will ensure that your article is free of spelling and grammar errors, Translation, and Artwork Preparation. For more information, including pricing, visit this website.

Checklist: What to Include

15. **Author details.** Please ensure everyone meeting the International Committee of Medical Journal Editors (ICMJE) requirements for authorship is included as an author of your paper. All authors of a manuscript should include their full name and affiliation on the cover page of the manuscript. Where available, please also include ORCiDs and social media handles (Facebook, Twitter or LinkedIn). One author will need to be identified as the corresponding author, with their email address normally displayed in the article PDF (depending on the journal) and the online article. Authors' affiliations are the affiliations where the research was conducted. If any of the named co-authors moves affiliation during the peer-review process, the new affiliation can be given as a footnote. Please note that no changes to affiliation can be made after your paper is accepted. Read more on authorship.
16. Should contain an unstructured abstract of 200 words.

17. You can opt to include a **video abstract** with your article. Find out how these can help your work reach a wider audience, and what to think about when filming.
18. Between 5 and 5 **keywords**. Read making your article more discoverable, including information on choosing a title and search engine optimization.
19. **Funding details.** Please supply all details required by your funding and grant-awarding bodies as follows:
    For single agency grants
    This work was supported by the [Funding Agency] under Grant [number xxxx].
    For multiple agency grants
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Updated 30-09-2022