Executive functions: rehabilitation
Reviews and meta-analyses

Rehabilitation of executive disorders after brain injury: Are interventions effective?

D. H. E. Boelen, J. M. Spikman, and L. Fasotti

- The overall results show that many interventions yield positive outcomes and seem to be effective in reducing executive problems in brain-injured subjects. However, several studies have only an explorative intent and are based on less sophisticated experimental designs. The verification of their results is generally more tenuous.

- Primary evidence relating to ‘metacognitive strategy instruction’ (MSI)
- “These results, along with positive outcomes from the other group, single-subject design and single case studies, provided sufficient evidence to make the clinical recommendation that MSI should be used with young to middle-aged adults with TBI, when improvement in everyday, functional problems is the goal”
Evidence based rehabilitation is effective

Tate et al, 2014: INCOG (international team of researchers and clinicians)

Results: Intervention programs incorporating metacognitive strategy instruction for planning, problem-solving, and other cognitive-executive impairments have a solid evidence base. New evidence supports the use of strategies to specifically improve reasoning skills. Substantial support exists for use of direct corrective feedback to improve self-awareness.
Evidence based rehabilitation is effective

Recommendations

Practice Standard (substantive evidence of effectiveness)

Metacognitive strategy training (self-monitoring and self-regulation) is recommended for deficits in executive functioning after TBI, including impairments of emotional self-regulation, and as a component of interventions for deficits in attention, neglect, and memory.
Recommendations

**Practice Guideline** (probable effectiveness)

Training in formal problem-solving strategies and their application to everyday situations and functional activities is recommended during postacute rehabilitation after TBI.
The rehabilitation process

Key elements:
• Safety
• Education
• Awareness and acceptance
• Strategies, both general and specific
• Generalisation
Control the environment

Clients with poor awareness or severe impairments may require an approach that focuses on managing the environment or using behavioural management.
Does the Stuss model suggest rehabilitation strategies?

Psycho-education:
Learning the four domains

- Activation – *doing*
- Executive cognitive – *thinking*
- Emotional and behavioural self-regulation – *feeling and acting*
- Metacognition – *awareness and socialising*
Activation strategies

• Sleep and fatigue management
• Structured routines
• Alerts
• NeuroPage
Sleep

- Following brain injury, patients may experience a range of sleep problems.
- A proportion of cases will have a treatable sleep disorder which may be secondary to trauma or pre-existing.
- Hypersomnolence and parasomnia disorders can be managed by a sleep centre.
- Sleep centres can help with insomnia.
- Insomnia without fatigue rare, but fatigue without insomnia more common post TBI (Cantor, et al, 2012).
ActiWatch

• The Actiwatch device collects objective sleep/wake history information from patients.
• It offers clients a revealing look at their actual sleep/wake patterns and enables the therapist to make a quick, clear and concise assessment based on these patterns.
Sleep hygiene

• Establish a regular routine i.e. go to bed at the same time each day, and get up at the same time.
• <30min nap taken at same time each day, but ideally avoid naps!
• Reduce alcohol, caffeine (6 hours), & nicotine intake before bedtime
• Don’t eat large meals within 3 hours of bedtime
• Sleep ‘rituals’ e.g. warm bath, magazine
• Reduce external stimulation (light, noise)
• Follow the ‘20 minute rule’
• CBT for insomnia (Oullet & Morin, 2007)
• www.papworthrssc.nhs.uk
• Book: Overcoming Insomnia and Sleep Problems – Colin Espie
Evaluation of fatigue

Thorough assessment to determine:

• whether fatigue is ‘normal’ or pathological
• the impact on the individual
• the vulnerability and mediating factors e.g. cognitive, mood, physical impairments, environmental demands, biological (medication), that could be modified
Key points in fatigue management

• Understand why someone gets fatigued and work out which situations are likely to tire them out quickly
• Recognising the signs and symptoms of fatigue
• Work out what to do ‘in the moment’ when resources are draining to ‘recharge’ them
• Plan ahead and pace to help manage resources in advance
• Find out if medical factors are contributing to level of fatigue
Figure 1: Clinical model for understanding responses to fatigue following acquired brain injury

Malley, Wheatcroft & Gracey (2014) Fatigue after ABI: a model to guide clinical management. ACNR
Fatigue Battery

At 100% - Crack on with the day!

At 75% - take a 15 minute mindfulness break

Between 50% and 25% - I need to stop and find somewhere to take a nap

Below 25% - I need to take myself out of the situation

At 100% my battery is fully charged. I feel calm, serene, warm, safe, relaxed, loved, clear-headed, “bullet proof”

At 75% charged - I feel a bit irritable, hungry and thirsty, a bit fidgety and distracted

At 50% charged - I feel sleepy, slowed, flat, cold, a bit heavy and I need to stop, hide away and rest in a quiet place

At 25% charged = ‘alarm bell’ as I feel vulnerable, scared, overwhelmed, ‘fight or flight’ kicks in, verbal editor switches off, become more aggressive, impulsive and irrational

At 0-10% charge my battery is flat. I feel scared I might die, that it is dangerous to dip into any remaining emergency reserve. I am in physical pain, feel tearful and very cold with a jammed/non-functioning brain.

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Activation strategies

• Sleep and fatigue management
• **Structured routines**
• Alerts
• NeuroPage
Planning a routine

EXAMPLE: Client struggles to get to the programme on time.

Stop/Think: What is the goal? Programme readiness by 9:40 a.m.
Plan: Follow your text alerts; check the time you finish each step; do them in order
MESSAGES from Sunday to Thursday:

- Put meds, glass of water and blood sugar equipment near alarm 20:30
- Put meds for after breakfast and water in bathroom
- 20:45
- Prepare for taxi arrival
- 09:30

Now review it! Are things going well? If not, do you need to change your plan?
The morning routine

- Step 1: Wake up to alarm placed far away  7:15
- Step 2: Take first meds    7:20
- Step 3: Drink large glass of water    7:22
- Step 4: Check blood sugar     7:30
- Step 5: Shower     7:45
- Step 6: Shave     7:50
- Step 7: Get dressed     8:00
- Step 8: Get contact lenses or glasses     8:05
- Step 9: Go down for breakfast     8:40
- Step 10: Take medications with water    8:45
- Step 11: Ablutions after breakfast     8:55
- Step 12: Collect folder, phone, pens, coat for the day    9:25
- Step 13: Check e-mails (optional, if time)     9:30

Now review it!

Are things going well? If not, do you need to change your plan?
Activation strategies

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Activation strategies

• Alerts
Activation strategies

• Sleep and fatigue management
• Structured routines
• Alerts
• NeuroPage
Activation strategies

NeuroPage

• Currently 40 people using service regularly
• Useful for people with memory and executive difficulties
• Evidence based service
• Recent text to voice development - ideal for those who cannot read
• Text messaging developments, new “generations” of phones (eg video/image messages)
Executive cognitive strategies

- Memory and planning systems
- Stop Think
- Mental Blackboard
- Zoom In/Out Thinking
- Time Pressure Management
- Goal Management Framework
Executive cognitive strategies

Memory / planning aids
- Diary
- Filofax

Electronic organiser;
- Timetable;
- Pager;
- Computer;
- Message pad;
- Plus many more…

Calendar
- To do list,
- Checklist,
- Wall Chart

Alerts
Executive cognitive strategies

• Memory and planning systems
• **Stop Think**
• Mental Blackboard
• Zoom In/Out Thinking
• Time Pressure Management
• Goal Management Framework
Executive cognitive strategies

- Stop-Think

WAIT: What Am I Thinking?
Executive cognitive strategies

- Memory and planning systems
- Stop Think
- Mental Blackboard
- Zoom In/Out Thinking
- Time Pressure Management
- Goal Management Framework
Executive cognitive strategies

• Mental Blackboard

Reduces goal neglect, helps maintain focus
Mental blackboard

• Helps you keep the main goal in mind
• Mental pictures are a good way to keep things on the blackboard
• They make the images on the mental blackboard stronger.

  (e.g. Main goal to make some toast)
Executive cognitive strategies

• Memory and planning systems
• Stop Think
• Mental Blackboard
• **Zoom In/Out Thinking**
• Time Pressure Management
• Goal Management Framework
Executive cognitive strategies

- **Zoom In/Out Thinking**

  Thinking *broadly* and *focusing* on the *detail*

  People with problems in executive functioning often find it difficult to use both of these ways of thinking.
Zoom in/out thinking

Think widely to come up with lots of different options = Zoom Out
Zoom in/out thinking

• Focus on detail of one option

• Zoom In
Who Am I?

I am thinking of a famous person…

• Try to work out who the person is
• You can ask up to 20 ‘yes’ or ‘no’ questions
• You must discuss together what questions to ask
• Take it in turn to ask the questions
Executive cognitive strategies

• Memory and planning systems
• Stop Think
• Mental Blackboard
• Zoom In/Out Thinking
• **Time Pressure Management**
• Goal Management Framework
Time Pressure Management (TPM) (Fasotti et al 2000) is a cognitive strategy designed to help brain injured people who have slowed information processing manage tasks in a way that reduces the time pressure on the tasks and therefore improves success and reduces stress.

Basically, TPM is way to make sure you have enough time to successfully complete a given task.
Time Pressure Management

TPM is also useful for people with executive functioning difficulties as a tool to improve planning, organization, and decision-making. It can help you be more aware of the steps that are needed and to think through a task in an orderly way. It can help you be more aware of everything that will be needed to complete the task. And it can help prevent potential problems with time pressure and manage them when they do occur.
Time Pressure Management

• TPM involves breaking a task down into elements that can be handled at three different levels: strategic, tactical and operational.

• Time pressure typically occurs if we have not planned enough time for a task, considered potential things that could go wrong, or thought through alternatives in case of emergency at the beginning.

• By thinking ahead strategically about the plan, it is possible to avoid these problems.
Time Pressure Management

• Fasotti et al (2000) designed this TPM protocol:
  • Are there two or more things to be done at the same time for which there is not enough time? If yes: go to step 2, else just do the task (awareness of time pressure)
  • Make a short plan of which things can be done before the actual ask begins (planning to prevent time pressure)
Time Pressure Management

- Make an emergency plan describing what to do in case of overwhelming time pressure (managing time pressure as quickly and effectively as possible)
- Plan and emergency plan ready? Then use it regularly! (monitoring)
Time Pressure Management

EXERCISE: You have the task of preparing a meal consisting of three items (entrée, veg, dessert).

What problems could create a time pressure crisis?

(Ask the clients to think of as many as they can)

• Forgetting to buy all the ingredients ahead of time
• Being unaware of the cooking time that is needed
• Needing extra time to prepare the ingredients
• Not having all the utensils or equipment you need
• The cooker failing to work properly
• Having trouble paying attention to two things at once
• Starting at the last minute
Time Pressure Management

• What can you do ahead of time to avoid time pressure (strategic level)?

• What can you do during the preparation of the ingredients to avoid time pressure (tactical level)?

• What can you do in the last minutes of cooking to avoid time pressure (operational level)?
Executive cognitive strategies

• Memory and planning systems
• Stop Think
• Mental Blackboard
• Zoom In/Out Thinking
• Time Pressure Management
• Goal Management Framework
Goal Management Framework (GMF)

• A tool for planning, making decisions, reaching goals, and problem solving.

• An executive management tool used in business.

• Has 6 steps.
Goal Management Framework (GMF)

1. Choose the main goal
2. Identify possible solutions
3. Weigh up the pros and cons and make a decision
4. Plan the steps
5. Do it
6. Review it
Problem Solving Framework

1. Notice the problem!
2. Define the main goal
   what am I trying to achieve?
3. Is there really only one solution?
   Yes          No
4. Identify the possible solutions
   » think flexibly and broadly; use past experience
5. Decide on your solution
   » weigh up the pro’s and cons of each solution
6. Plan the steps involved
   » think about the sequence and timing
   » what strategies will I use
7. Carry out the plan,
   monitor progress and adjust plan
   » am I still on track? is my solution working? Am I doing what I should be doing?
8. Overall evaluation
   » was it a success, what went well, what went badly
Step 1 → Main Goal

• Knowing the main goal is very important. It keeps us on the right track to achieve what we want. Needs to be as specific as possible.

Step 2 → Possible Solutions

• Deciding on ways to achieve main goal. Might need to encourage creativity and push those who struggle to generate ideas.
Step 3 → Pro and Cons/Make Decision

- Weighing up good points and bad points of each way of achieving the main goal. Not just the quantity of each pro and con as each pro and con have different weights.

Step 4 → Planning the steps

- What are the steps?
- In what order should the steps be carried out?
- Which other strategies can be use?
Step 5 → Do it!

- Might need support to check in with themselves. How are you going to make sure that you are on track?

Step 6 → Monitor and evaluate progress

- Reflect on what you learnt from the task
- Could you have done anything differently?
- What did you do especially well?
Problem solving – when things go wrong

• It’s early evening. You have a group of friends coming over for dinner. You’ve spent the weekly shopping money on the meal. You start preparing the meal and find that the cooker doesn’t work. Your landlord had said he would replace your cooker next week. The guests arrive in two hours. What do you do?
Does Problem-solving Therapy work?

- von Cramon, Matthes-von Cramon and Mai (1991)
  - compared a PST group (N=20) with a control 'memory therapy' (MT) group (N=17).
  - Significant improvement of PST group on ratings of problem solving ability and some test performance (e.g. Tower of Hanoi).

  - 60 outpatients, all at least 1 year post-injury
  - ‘Conventional group neuropsychological rehabilitation’ vs. problem solving group.
  - PS group improved on exec test, self-appraisal, role play.
Does Problem-solving Therapy work?

- Spikman et al (2010)
  - RCT - Multifaceted treatment program for executive dysfunction
  - 75 patients randomised.
  - Treatment focused on self-awareness, goalsetting, planning, self-initiation, self-monitoring, self-inhibition, flexibility, and strategic behavior. Used GMT/PST
  - Improvements of Role Resumption List, Goal Attainment, Executive Secretarial Task
Strategies for emotional and behavioural dyscontrol

• Understand the problem

• Recognise early signs of rising emotions

• Use strategies
Education is the starting point: Emotion and the brain

- Behavioural and emotional dysregulation are extremely distressing experiences for both the person with the injury and those around them.

- The essential first step in helping clients manage these problems is education about the nature of emotional and behavioural changes following brain injury.
Education: Emotion and the brain

• The key brain parts in the emotion regulation system are the:

  – Amygdala (automatic response)
  – Hypothalamus (hormones, e.g. adrenaline)
  – Insular cortex (understanding & interpreting body sensations)
  – Parts of the frontal lobe (logic, reasoning)
  – Temporal lobes (for memory)
Emotion and the brain

- Insular Cortex
- Hypothalamus
- Amygdala
- Frontal Lobe
- Temporal Lobe
Two routes to emotion

• Quick route – straight to the amygdala
  e.g. Barbara’s fear of spiders!

• Slower route to amygdala via frontal lobes and hippocampus
  e.g. Walking down the street and someone you know doesn’t say hello …
Effects of brain injury

A brain injury can disrupt the delicate circuitry linking the frontal lobes with the limbic system

This leads to problems with emotional and behavioural control

Relatively minor stressors can result in experiences of strong emotions
Strategies for emotional and behavioural dyscontrol

- *Understand* the problem
- *Recognise* early signs of rising emotions
- Use *strategies*
Emotion thermometer

- Following brain injury changes in emotion can be much more rapid.
- It can be harder to think and problem solve.
- Tracking emotions, as if we were measuring the temperature, can help us to manage our feelings before we get to “boiling point”.

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ActiHeart

- The Actiheart is a compact, chest-worn monitoring device that records heart rate, Inter-Beat-Interval (IBI), and physical activity
- Records heart rate and activity for up to 21 days
- Compact and lightweight: less than 10 grams
- Clips onto two ECG electrodes worn on the chest
- Can also be worn on a belt
- Noninvasive technology
- Waterproof design
Strategies for emotional and behavioural dyscontrol

• **Understand** the problem

• **Recognise** early signs of rising emotions

• **Use** *strategies*
Emotional and behavioural self-regulation strategies

• Stop Think and other cognitive strategies

• Mood strategies
Cognitive strategies

STOP-THINK!

My goal is...

GMF
1. Set the goal
2. Consider options
3. Choose the best
4. Plan the steps
5. Do it and review it!
Mood strategies

• Calming breathing
• Visual imagery
• Progressive muscle relaxation
• Mindfulness
The calming breath exercise can be helpful for halting the sensations of anxiety and panic when they begin to emerge, and can help you achieve a deep state of relaxation quickly.
Breathing

• Breathing from your abdomen, inhale slowly as you count you count up to five e.g. “one…two…three…four…five…”
• Pause and hold your breath to a count of five
• Exhale slowly, through your nose or mouth, to a count of five. Be sure to exhale fully.
• Now take two normal breaths.
• Keep up the exercise for around 5 minutes, going through the steps 1 to 4 above around ten times. If you feel light-headed at any stage, stop for thirty seconds and then try again.
• Throughout the exercise keep your breathing smooth and regular, without gulping in breaths or breathing out suddenly.
• You may also want to try saying a calming word every time you exhale, for example “calm, “Let go”, or “relax”.

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Mood strategies

- Calming breathing
- **Visual imagery**
- Progressive muscle relaxation
- Mindfulness
Visual imagery
Mood strategies

- Calming breathing
- Visual imagery
- **Progressive muscle relaxation**
- Mindfulness
Progressive muscle relaxation
Mood strategies

- Calming breathing
- Visual imagery
- Progressive muscle relaxation
- Mindfulness
Strategy: Mindfulness

- Mindfulness is about being aware of our thoughts and feelings, a bit like leaves flowing in a stream.
Why be mindful?

• Being mindful is being fully in contact with present experience, both to external events and to one’s internal response.

• If we are more aware of thoughts, emotions and physical sensations, we can react more objectively and less automatically.
Metacognition

- Awareness of one's own changes – physical, cognitive, emotional, behavioural
- Awareness of other people – their thoughts and their feelings
Metacognition strategies

• Zoom In/Out thinking
• Feedback from others, both clients and staff
• Video feedback
• Behavioural experiments
Metacognition strategies

• Zoom In/Out thinking
• Feedback from others, both clients and staff
• Video feedback
• Behavioural experiments
Feedback/Video feedback

- Helps to increase awareness
- Includes strengths and challenges
- Gives options for making changes
- Should be immediate and direct
- Video feedback is best
Metacognition strategies

- Zoom In/Out thinking
- Feedback from others, both clients and staff
- Video feedback
- Behavioural experiments
Behavioural experiments

Put your knowledge into practice

• Plan task
• Predict performance
• Try it out
• Rate how you did
• Reflect on lessons learned:
  Did you predict accurately?
  Did your strategies help?
  Did your confidence shift?
  What would you change next time?
# Behavioural experiment template

<table>
<thead>
<tr>
<th>Date Time</th>
<th>Situation Task</th>
<th>Predictions</th>
<th>WHAT HAPPENED</th>
<th>What I learnt from this about:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Self-Monitoring</td>
<td>Others’ Feedback</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>My sense of identity</td>
<td>Strategy use</td>
</tr>
</tbody>
</table>
Example from our group: Your task

To create a buffet lunch for yourselves plus group facilitators.
Rules

• Include hot and cold items in the buffet
• You should have one sweet item
• You may need to take into account any dietary requirements or allergies
• Your budget is £25

USE YOUR STRATEGIES!
Freedoms

• You may include any items that you wish in the buffet
• You may buy items from the buffet from anywhere you wish
• You have access to the kitchen here all morning
Roles

• Group leader - Donna
• Note taker - Sue
• Budget manager - Leyla
• Time keeper - Clare
Results!