How to Impact Initiation in Brain Injury Recovery
Fall 2017 NeuroInstitute

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Analytics & Outcomes
Objectives

• Participants will learn about the role of the frontal lobes and executive functions.
• Participants will learn about the impact of the frontal lobes with initiation and inhibition.
• Participants will learn strategies to assist individuals with initiation and inhibition deficits.
• Participants will learn about the role of medication to reduce the impact of these deficits in daily functioning.
Role of the Frontal Lobes & Executive Functions

“So how is that working for you?”
The frontal lobes are the executive manager!

Our entire system is regulated by the frontal lobes because of the involvement of decision making, self-regulation, and neurobehavioral management.

Results in cognitive, emotional, and behavior dysregulation. (Dimasio and Dimasio, 1990-2000; University of Iowa).

* Think of this massive region (30% of the brain mass) as the regulator and manager of the entire system
* Differences of left vs. right injury; differences with orbitofrontal vs. lateral vs. ventral.
* Social dysregulation; social awareness impairment; overestimation of skills and underestimation of deficit; impaired initiation.
Role of Frontal Lobes

Attention, moderate to complex processing, memory integration and storage, decision making, problem solving, initiation, inhibition, self-control, mood regulation, mood expression, and language processing.
Role of Frontal Lobes

Neurophysiology

Accounts for 1/3 of the mass of the brain.

Involves multiple subsections that cross into all other areas of the brain, and provides a management effect of signals that are both conscious and out of awareness.
Role of Frontal Lobes

Neurophysiology

Accounts for 1/3 of the mass of the brain.

Neurodevelopmental pathways are incomplete until age 24-25. Disruption of the pathways due to trauma, injury, illness will substantially change the outcomes of adult development.

Brain injury often results in deficits in executive functions. This can manifest as problems with self-directed cognitive functioning or they can manifest as problems with self-directed behavioral and emotional self-control.
Frontal Lobes and Initiation and Inhibition

Executive Functions and Dysexecutive Syndrome
The term “executive functions” refers to integrative cognitive processes that determine goal-directed and purposeful behavior.

Executive functions are subordinate to more basic cognitive processes such as memory and attention. By supervising and coordinating underlying cognitive, behavioral, and emotional processes, executive functions allow for the orderly execution of daily life functions. (Cicerone et al., 2000)

**This includes:**
Formulating goals, solving problems, anticipating consequences, planning and organizing behavior, initiating relevant behaviors, and monitoring and adapting behavior to fit a particular task or context, and having an intended outcome.
Disturbances in these functions is most likely to be evident in novel or unfamiliar situations (Godefroy & Rousseaux, 1997). Initiation is impacted by novelty and complexity.

Executive functions are necessary to adapt to deviations from an established routine, react to unexpected events, or correct mistakes.

**Brain injury – impairment of thinking before reacting!**

Rehabilitation of executive functions is necessary to teach metacognitive skills that can be applied across diverse situations.

**Rehabilitation has to incorporate the following, initiation of...**
- Cognitive skills
- Emotion regulation
- Behavioral control
Neurobehavioral Syndromes

Neurobehavioral Syndromes have been described in the literature for years. It includes a specific region of the brain and negative behavioral outcomes. It involves impairment of initiation and inhibition within executive dysfunction.

Criteria for this syndrome in post-acute care:
Injury must be > 8 months duration
The following behavioral features are present at least mildly:

- Irritability, Agitation, and Aggression
- Impaired Awareness
- Impaired Social Interaction
- Impaired Problem Solving
- Impaired Initiation

* Impaired Inhibition skills may also factor into this syndrome of impairment

**Initiation/Inhibition**

*Initiation is the starting* of an act, behavior, thought, or communication at the appropriate times and under the appropriate conditions.

*Inhibition is the stopping* of an act, behavior, thought, or communication at the appropriate times and under the appropriate conditions.

When this system has dysfunction, then the thoughts, mood, and behavior become easily triggered and somewhat random. Context no longer matters.

Initiation starts with basic activities such as brushing your teeth, washing, using the toilet appropriately, or checking mail. It is also within highly complex behaviors and actions such as driving a car, listening to a lecture, or making financial decisions.

Initiation and inhibition include cost-benefit analysis; when this system is not working, then immediate benefit may outweigh long-term benefit, and lead to loss overall.

Examples: cases, gambling, substance use.
Cognitive Hierarchy

Where is Initiation in the hierarchy?

.. maybe we should try to think out of the box?
Cognitive Data Hierarchy - Basics

Data Mining and Cognitive Hierarchy (Kendell & Kendell, 2013)
Cognitive Hierarchy – Brain Model

- Initiation/Inhibition

I/A
- Mood & Personality
- Integrate Executive Fxs.
- Judgment
- Problem Solving
- Memory (Visual, Verbal, Complex)
- Learning – Complex
- Learning - Immediate
- Visual-Perceptual Skills
  Dimension, Gestalt, Constancy, Topography
- Language - Express/Comprehension
  Speech Articulation/Dysarthria
- Information Processing - Immediate & Complex
- Sensory Perception
  Arousal – Alertness – Immediate Attention

(NAB, 2003)
Rehabilitation Hierarchy – A New Model

Audition
Dizziness
Motor Speech
Pain/Headache, Vision, Use of Hands

--
Inappropriate Social, Irritability, Symptom Sensitivity

**Depression**, Fund of Information, Visual Perception

**Anxiety**, Fatigue, Mobility, Non-Verbal Communication, Verbal Communication

--
Self-Care
Family Function

--

**Initiation**, Productivity
Attention, Impaired Awareness, Memory
Novel Problem Solving, Social Contact

--
Leisure and Recreation
Money Management
Home Skills
Transportation Use

Horn, Lewis & Malec, 2016
Rasch Analysis
### Hierarchical Regression

Outcome measure: Participation T-score at discharge

<table>
<thead>
<tr>
<th>Block numbers and Dependent Variables</th>
<th>Change in $R^2$ (variance/contribution to outcome)</th>
<th>Sig. Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Initiation</td>
<td>32%</td>
<td>.0005</td>
</tr>
<tr>
<td>2. Visual Spatial* Memory Fund of Info* Problem Solv* Attention Concentration</td>
<td>Block 2 combined 9%</td>
<td>.0005</td>
</tr>
<tr>
<td>3. Mobility</td>
<td>6%</td>
<td>.0005</td>
</tr>
<tr>
<td>4. Verbal Comm</td>
<td>&lt; 1%</td>
<td>.08 (n.s.)</td>
</tr>
<tr>
<td>5. Depression Anxiety</td>
<td>Block 5 combined 1%</td>
<td>.01</td>
</tr>
<tr>
<td>6. Irritability Inappropriate Social</td>
<td>Block 6 combined 1%</td>
<td>.01</td>
</tr>
<tr>
<td>7. Impaired Awareness</td>
<td>2%</td>
<td>.01</td>
</tr>
</tbody>
</table>

Visual spatial skills (6%), Fund of information (2%), and Novel Problem Solving (1%) were the largest cognitive contributors to outcome after initiation.
Sample: Neuro Rehabilitation (n = 1385)

Horn, Lewis & Malec, 2016
Regression
Strategies for Initiation and Inhibition deficits.
Goal: create a structured plan leading to the desired outcome; execution of responses; use of feedback to compare the plan with the achieved outcome.

1. Identify the demands of the task (identify)
2. Plan the appropriate sequence of responses (prediction → expected = awareness)
3. Implementation of the plan with self-monitoring of performance with use of strategies (structure and cues are flexible)
4. Comparisons are made between the effectiveness of their action with the predicted effects and consequences; incorporation of therapist feedback as well.
5. Change the approach if the information indicates to change.
Strategies – Decision Tree

Is person aware of deficits?

Yes, then proceed to problem solving strategies

No, then work on increasing awareness of deficit

Define the level of impairment

Increased awareness helps to get to functions such as initiating under appropriate conditions.
Strategies – Define Impairment

What is the level of impairment?

**Mild** – Use of internalized strategies; use of external strategies

*Example* – concussion; person is having headaches; pre-injury was running two businesses and now is having difficulty understanding why headaches are triggered. Internalized strategy is to learn pacing (*initiating*) and have a “stress scale” of when symptoms increase to 5-6/10 with the use of a “stop” (*inhibition*) strategy for rest.

**Moderate** – Use of internalized strategies; use of external strategies with assist

*Example* – moderate TBI with +LOC for 2 hours; person has difficulties with routine and managing daily needs/demands; requires the use of a phone for prompts and reminders (*Initiating*), and develops a pattern of reviewing his list of to-dos each night and each morning upon awakening (*Inhibition*).

**Severe** – Use of external strategies with assistance

*Example* – Moderate to severe TBI with +LOC for 24 hours with amnesia of 3 days. He requires the use of a prompting system (phone, computer), and has family prompt him each morning of the day’s activities (*External Initiation*); when he gets “stuck”, then he calls a family member for prompting. He also has daily reminders of his deficits. Supervision required (*External Inhibition*).
Internalized vs. Externalized Strategies

**Internalized** – this is when the injured individual is actively working on developing problem solving, planning, organization, and self-monitoring techniques. Top-down approach.

The goal is to develop strategies that continuously help to manage in changing conditions, which leads to appropriate initiation of thought, behavior, and mood.

**Externalized** – this is when the injured individual has initiation impairment that impacts simple to complex daily activities; outside sources are used to provides prompts, cues, and feedback of performance. This may include electronic aids, other persons, or an environment that allows and disallows certain activities or behaviors. Bottom-up approach.

The goal is to have continuous use of external aids to shape behavior and thoughts into appropriate outcomes.
Metacognition refers to “thinking about thinking.” It is a top-down approach.

This includes.... Knowledge and Control.

**Metacognitive Knowledge** – represents both the person’s moment-to-moment awareness of his or her thinking and more stable beliefs about one’s cognitive ability.

**Metacognitive Control** – represents the person’s self-monitoring of their thinking and the ability to adapt to changes in the environment or task-demand(s).

**Highly complex behaviors are the product of self-regulation skills including...**

*(Initiation)* Setting goals >>
Comparing performance >>
Making decisions to change or select an alternative approach >>
Executing the behavior or change in behavior *(outcome leads to stopping)*
Strategies – Metacognition

Framework for Metacognition Training (reference guide)


Awareness Intervention (Cheng & Man, 2006)
Awareness of knowledge, performance prediction, perform and monitor, feedback with short-term goals.

Self-Awareness Training (Goverover et al., 2007)
General self-awareness, define-predict-anticipate errors, choose strategy and assess assistance need, self-assess and therapy assess, keep a journal

Time pressure Management (Winkens et al., 2009)
Awareness of processing speed; Time pressure management (competing tasks, feeling overwhelmed or distracted, loss of priority, plan); monitor performance and expect the unexpected; generalize the outcome to differing tasks and differing levels of complexity.
Strategies – Metacognition

Framework for Metacognition Training (reference guide)

*Guide – 4 parts including Awareness, Planning, Execute and self-monitor, Self-evaluate.*

Social Problem-solving (Von Cramen, Von Cramen & Mai, 1991)

- Problem orientation, generate alternatives, decision making and solutions, and solution verification (did it work?).

Goal Management Training [stop-think-plan] (Levine et al., 2000)

- Stop – raise awareness; Define or think through the problem (what am I doing?); learn the steps and reduce anxiety and pressure; Check – what is the main goal and how will this help?

ICRP Activity Analysis (Cicerone et al., 2008)

- What is the task to be accomplished?; What are the parts of the task or activity (anticipate success); Identify strategies for use during the task – perform – self-monitor limits and application; Self-evaluate with feedback from others.
Recognize the deficits by having someone point them out and showing difference between what is perceived versus what is actual (use of exam results can help).

**Show how the deficits impact daily functioning** – have the person perform a task.

If behavior, emotion, or cognitive control is lost, then comment and bring this to the person’s attention to improve awareness of the impact of the problem.

**Provide education** – this can be through written material, through internet articles or websites that are intended for education. Use of YouTube to show examples of problems and their impact.

Provide evidence or examples of when the impairment has impacted performance.

**Alternative Explanations for outcome** – I am not interested, may mean the task is beyond the level of the individual.
Strategies – Additional Thoughts

Consider resistance to be cognitive rather than psychological...

Psychological resistance is related to “not wanting to do it”.

Cognitive resistance is related to being “cognitively overwhelmed” by the task and not being able to formulate a response to make a change.

Example:
1. If I tell you that you have to go to work by a new route, but I do not tell you which route to take or when you have to do this by, then you will come up with various options without much effort. You initiate the task almost immediately because the solution is relatively simple and you have already done this in the past.

2. If I tell you that you have to go to work by a new route, and the route can only be using side roads and only roads that travel north, and it must be done by tomorrow, then initiation of the task becomes difficult because you calculate the probability of being correct and having a response – there is no answer to this problem – when you figure this out, then you do not initiate the act.
Medication(s) reduce the impact of deficits in daily functioning
Stimulant type medication

Stimulants may help, but there focus is within the frontal systems only. However, initiation may be a lack of dopamine in multiple locations, not just in the frontal lobes. Stimulants include Ritalin/ Methylphenidate, Cylert, Vyvanse, etc. The effect is mostly dopamine and norepinephrine in the frontal systems.

Broad based medication that can be used may impact initiation and other cognitive functions that serve initiation have a broader impact. Amantadine is a long-standing medication that has been used in brain injury recovery and rehabilitation to help enhance the processing within dopamine pathways throughout the brain.
Dopamine Receptors

- Caudate nucleus
- Putamen
- Globus pallidus
- Corpus striatum
- Ventricles
- White matter
- Cerebral cortex
- Thalamus
- Hypothalamus
- Limbic system
- Substantia nigra
- Cerebellum
- Midbrain
- Pituitary gland

D1 - D5: Cerebral cortex, limbic system
D3 + D5: Hypothalamus
D1 + D2: Corpus striatum
Mood Stabilizers / Mood changers

Types of medication to consider for behavioral and mood initiation and inhibition control.

1. Mood stabilizers that are seizure medication (regulates the integration of frontal and temporal centers for behavior control, impulsivity reduction, and improved insight regarding behavior).

2. Antidepressants (for depression)

3. Anxiolytics (anti-anxiety)

4. Antipsychotics for severe behavioral dyscontrol
Final thoughts...

Initiation is a complex cognitive, behavioral, linguistic, and emotional function that requires integrity of other functions before you can externally and self-regulate effectively.

Initiation is complex because it is influenced by the environment and by processing of information.

Inhibition is the converse of initiation and these two functions work hand and glove to produce appropriate outcomes.

In executive functions, initiation is the planning and beginning part of problem solving, while inhibition is the end of the act or behavior (stopping appropriately). Decision making is using initiation and inhibition.
References


Questions

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