Cognitive Rehabilitation with Older Adults
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Pearson Clinical Assessment

Agenda
Cognition & Deficits
Cognitive Rehabilitation Overview
Cognitive Rehabilitation with Older Adults
Cognitive Deficits and Functional Abilities

Cognition & Cognitive Deficits
Cognition:

"The mental action or process of acquiring knowledge and understanding through thought, experience, and the senses"

Basics of Cognition

Cognition:

Encompasses:
- Knowledge
- Attention
- Memory
- Judgment
- Reasoning
- Comprehension
- Language

Human Cognition is:
- Conscious
- Unconscious
- Concrete
- Abstract
- Intuitive

Functional Areas of the Brain

Brain Stem
- Regulates vital functions (e.g., breathing, heart rate)

Cerebellum
- Coordinates voluntary movements

Temporal Lobe
- Processing speech

Frontal Lobe
- Executive functions (planning, decision-making, problem-solving)

Occipital Lobe
- Processes visual information
Mechanism of Cognition

- Formation of Connections between Neurons in the Brain
- Sending and Receiving of Signals between Connected Neurons

Any factor that interferes with these processes creates a Barrier to Cognition = “Cognitive Deficit”

Basics of Cognition

Cognitive Deficits

Durable Causes:
- Brain injury (stroke, TBI)
- Neurological Disorders
- Congenital Defects
- Psychiatric Disorders

Temporary Causes:
- Prescription Drugs
- Recreational Drugs
- Alcohol
- Nutritional Deficiency
- Dehydration

Cognitive Deficit:
“Any factor that acts as a barrier to the cognition process”

Causes of Cognitive Deficits

Ischemic Stroke
- Blood Clot or Other Blockage
- Can be “Focused” or “Global” (Depending on Location)
  - ~ 88% of Strokes

Hemorrhagic Stroke
- Ruptured Artery
- Usually “Global” 
  - ~ 12% of Strokes

Stroke:
“The sudden damage or death of brain cells due to lack of oxygen, caused by blockage of blood flow or rupture of an artery to the brain”

Leading Cause of Disability in the US; Fourth-Leading Cause of Death
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Long-term Effect of Stroke - Follow-up after 90 Days
- 14.7% died
- 18.5% heavy impairments
- 9.4% moderate impairments
- 87.2% mild impairments

Duration Determines Severity
- > 2 min. => Cell Death (Irreversible)
- < 2 min. => Cell Damage (Reversible?)

Pressure on Neighboring Areas => Damage (Reversible?)

Causes of Cognitive Deficits
- Stroke
- Traumatic Brain Injury (TBI)

Causes of Cognitive Deficits - Stroke
- Duration Determines Severity
- Pressure on Neighboring Areas

Causes of Cognitive Deficits – TBI
- Damage to the Brain from:
  - Bruising
  - Hemorrhage
  - Stretching
- Usually “Global”
- “Contre-Coup” Injury
  Opposite the Area of Impact

Traumatic Brain Injury:
“The sudden damage or death of brain cells due to a violent blow or jolt to the head OR by an object penetrating the skull”

Causes of Cognitive Deficits
- TBI Follow-up

TBI’s Reported thru ER Visits
- 32,000 Deaths
- 275,000 Hospitalizations
- 1,301,000 Emergency Department Visits

Opposite the Area of Impact
Causes of Brain Injury:

Physical
- Paralysis (quadriplegia) or weakness (quadriparesis) in both the arms and legs
- Paralysis (hemiplegia) or weakness (hemiparesis) on one side of the body
- Impaired fine motor skills, sometimes with tremors
- Poor overall body coordination (ataxia)
- Double vision (diplopia)
- Visual field cuts
- Motor speech disorders like dysarthria and difficulties in oral speech planning (oral apraxia)
- Inability to carry out learned movements (apraxia)

Cognitive
- Impaired attention and concentration
- Memory impairment for learning and recall of new information
- Impaired problem-solving and decision-making skills
- Slowed information processing speed
- Impulsive thinking without regard for consequences
- Poor organization, planning, and sequencing abilities
- Impaired concept formation and abstract thinking
- Inflexible thinking and mental rigidity
- Poor judgment, especially in social situations

(Imagenetics.com)
Characteristics of Brain Injury: Behavioral

- Inability to engage in purposeful activity
- disinhibition
- Inability to respond appropriately to environmental cues
- Socially inappropriate behavior
- Social skills deficits
- Impulsivity
- Poor initiation and apathy
- Lack of insight into behavior and its consequences
- Inability to profit from experience
- Denial of deficits
- Poor self-esteem

(Courtesy of Neuroskills.com)

Causes of Cognitive Deficits - Neurodegenerative

- Slow Decline in Cognitive Function
- Multiple Sclerosis (~400,000 Cases)
- Dementia - 5,000,000+ Cases

Most Common Cause of Dementia = Alzheimer's

Causes of Cognitive Deficits - Neurodegenerative
Neuroplasticity:
Changes in Neural Pathways and Synapses due to changes in behavior, environment, thinking or emotions.

Cognitive Rehabilitation
Restoring Cognitive Function

Compensation
New Strategies / External Aids

Restitution
Re-establishing / Strengthening Damaged Neural Pathways

Reorganization
Developing / Strengthening NEW Neural Pathways

Cognitive Rehabilitation
Basics of Cognitive Rehabilitation

A therapy program to help cognitively impaired individuals restore normal functioning, OR to compensate for cognitive deficits

Cognitive Rehabilitation

Executive Function
Memory
Attention
Visuo-Spatial Processing
Visual Field
How is Cognitive Rehabilitation Different in Older Adults?

- Epidemiology
- Mechanism of injury
- Morbidity and mortality
- Functional outcomes
- Age-related brain changes
- Age-related cognitive outcomes
Epidemiology

Male: female injury rates

In younger adults males are much more likely than females to sustain traumatic brain injury (TBI). At around age 65, there is equal risk. After 80, women are more likely to have TBI.

Adults over 65 have highest rate of TBI-related hospitalization. Older adults have twice the mortality from TBI.

And, the number of older adults is on rise...

Mechanism of Injury

More common in older adults:
• Subdural hematomas
• Diffuse axonal injury
• Focal contusions

Falls are the 5th leading cause of death in people 65 and over.
Falls lead to 70% of accidental deaths in people over 75.
Falls are leading cause of hospitalization in individuals over 70.

Mortality/ Morbidity

More common in older adults:
• Cardiac problems
• Pulmonary problems
• Multisystem organ failure
• Possible decreased tolerance for blood pressure issues and hypoxia/pulmonary issues with age

Older adults are more susceptible to medical complications
• Cerebrovascular events in setting of trauma related hypotension
• Adverse effects of anemia due to blood loss in trauma
• More likely to have pulmonary/cardiac complications
### Sequelea

Compared to younger adults with brain injury, older adults (on average)

- Undergo more in-hospital procedures (including imaging and neurosurgery)
- Have longer acute care hospital stays
- Are more likely to require continued medical care

For every 10 years of age, there is a 40-50% increase in the odds of a poor outcome as a result of brain injury.

### Functional outcome

Compared to younger people, older adults with brain injuries have:

- Poorer short term functional outcomes
- Worse functional outcome
- Greater levels of disability

Study of 272 patients (195 had TBI and 82 had orthopedic injuries)

Older patients with brain injury may have a greater likelihood of becoming physically and financially dependent on others

This is likely affected by injury severity

### Aging and the brain

May be a decrease in synthesis of nerve growth factor, making neuronal repair more difficult.

- Age-related cerebrovascular changes can lead to reduction in cerebral perfusion and reduced regional cerebral metabolism.
- Overall brain shrinkage due to atrophy is more common.
- Decreased acetylcholine and impairment in acetylcholine activity.
- Decreased serotonergic function.
- Decreased norepinephrine function.
- Decreased dopaminergic activity and function.
Aging and TBI

Age-related factors:
- Mobility
- Functional loss
- Hearing/vision loss
- Memory problems
- Health problems
- Loss of independence
- Reduced income
- Depression
- Social withdrawal

TBI-related factors:
- Mobility
- Functional loss
- Memory/cognitive problems
- Sensory impairments
- Health problems
- Loss of independence
- Reduced income
- Depression
- Social withdrawal

Cognitive outcome

Older adults are at risk for poorer cognitive outcome following brain injury.

It's possible that cognitive impairment predisposed the injury or that there's some decreased cognitive reserve present.

Effects of medications need to be carefully considered.

Rehabilitation in Older Adults

- Rehabilitation evaluation
- Functional assessment
- Interventions need to be appropriate for medical and overall functional status
- Preventing falls and additional injuries
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Cognitive Rehabilitation with Older Adults

Goals of Cognitive Rehabilitation

• Enhance capacity to process and interpret information

• Improve ability to function in all aspects of family and community life

Cognitive Rehabilitation with Older Adults

“Future research should move beyond the simple question of whether cognitive rehabilitation is effective, and examine the therapy factors and patient characteristics that optimize the clinical outcomes of cognitive rehabilitation.” — The Cognitive Rehabilitation Task Force of the American Congress of Rehabilitation Medicine Brain Injury Interdisciplinary Special Interest Group

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Assessing and restoring cognitive functions early after stroke

Chiara Zucchella, PsyD, Annarita Capone, PsyD, Valentina Codella, PsyD, Carmine Vecchione, MD, Giovanni Buccino, MD, PhD, Giorgio Sandrini, MD, Francesco Pierelli, MD, and Michelangelo Bartolo, MD, PhD

Summary
Cognitive impairment is a frequent complication of stroke. The aim of this study was to evaluate the effectiveness of cognitive training performed early after stroke.

Ninety-two patients were randomly assigned to either the study group (SG) or the control group (CG). Cognitive rehabilitation consisted of 16 individual one-hour sessions in which patients performed therapist-guided computer exercises. The patients in the CG performed a sham intervention. After four weeks all the patients were re-evaluated.

In the Study Group, significant improvements were detected in all neuropsychological measures at the post-training evaluation, while the Control Group showed mild (not statistically significant) improvements on cognitive tests. Between-group analysis revealed statistically significant differences in the domains of memory and visual attention.

Cognitive training performed early after stroke seems to be a viable option for improving cognitive outcomes in stroke survivors. Further studies should assess whether this may favor their reintegration into everyday life.

"The results of this randomized controlled study show that (computerized) cognitive training performed in the first few weeks after stroke is effective in inducing improvements in cognitive functions."

Functional Status

• **Activities of Daily Living (ADLs):**
  - Bathing, dressing, transferring, toileting, grooming, feeding

• **Instrumental Activities of Daily Living (IADLs):**
  - Using telephone, preparing meals, managing finances, taking medications, doing laundry, doing housework, shopping, managing transportation
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**Cognitive Rehabilitation Impact of Cognitive Deficits on ADL’s / QoL**

- Independent Living
- Collisions/Falls
- Mood
- PT/OT
- Socializing
- Reading/Computer/TV
- Marriage/Family
- Work
- Driving

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**Attention**

- Sustained Attention
- Visual Scanning
- Change of Focus

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**Memory**

- Problem Solving
- Calculating
- Reasoning

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**Selective Attention**

- Working Memory

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**Working Memory**

- Focused Attention
- Divided Attention

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Additional images and text are present in the diagram, but the main focus is on the concepts of attention and memory, along with the impact of cognitive deficits on ADL’s and QoL.
Memory Therapy
Memory and ADL's

Telephoning

Meal Management

Dressing / Grooming

Money Management

Memory Therapy
Memory and ADL's

Navigation

Executive Function
Executive Function Areas of the Brain

Information Processing
Attention (Maint & Shift)
Working Memory
Integrating Cog Functions
Problem Solving
Response Inhibition

Executive Function
Executive Function Areas of the Brain

Decision Making
Eval. Reward/Punishment
Eval. Emotional Experiences
Emotional Regulation
Self-Monitoring
Impulse Control

Motivation
Reward Anticipation
Emotional Awareness
Empathy
Impulse Control

Eval. Reward/Punishment
Eval. Emotional Experiences
Emotional Regulation
Self-Monitoring
Impulse Control

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Executive Function Therapy
Dorsolateral PFC and ADL's

Problem Solving
Reasoning
Calculating
Verbal Comprehension

Executive Function Therapy
Dorsolateral PFC and ADL's

Planning & Follow Thru
Abstract Thinking
Cognitive Flexibility

Executive Function Therapy
Anterior Cingulate and ADL's

Lack of Motivation
Blunted Affect
Poor Impulse Control

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Executive Function Therapy

Orbitofrontal/Ventromedial and ADL’s

Emotional Outbursts

Executive Function Therapy

Social Inappropriateness

Risky Behavior

VisuoSpatial Processing

Identifying “Incomplete” Objects

Mental Imagery

Mental Maps

Depth Perception, Vertical, Horizontal

Mental Rotation

VisuoSpatial Processing

“Visuo-Constructive Skills”

Copying a Drawing

Assembling 2-Dimensional Objects

Assembling 3-Dimensional Objects

Mental Rotation

Depth Perception, Vertical, Horizontal

Mental Maps

Mental Imagery

Identifying “Incomplete” Objects

VisuoSpatial Processing
VisuoSpatial Therapy
VisuoSpatial Processing and ADL's

Grasping Objects (Depth Perception)

Navigating (Mental Imagery / Mapping)

Reading a Clock (Angles)

Reading (Shapes, Positions)

Dressing (Mental Imagery, 3D Assembly)

Collisions, Trips and Falls

Patients Often Unaware of Visual Field Deficits

Patient May Notice Consequences (e.g. Bumping into Things)

Often Blame Problems on Other Causes (e.g. Poor Lighting)

Recognizes Visual Field Loss, But Thinks it is a Vision Problem

Visual Field Deficits
Visual Field Therapy
Visual Field Deficits and ADL's

Telephonin

Dressing / Grooming

Meal Prep

Money Management

HemiSpatial Neglect
Basics of Neglect

HemiSpatial Neglect
Neglect and ADL's

Visual Field Therapy

Dressing / Grooming

Meal Prep

Money Management

HemiSpatial Neglect
Neglect and ADL's
Evidence for Cognitive Rehabilitation

Evidence-Based Cognitive Rehabilitation: Updated Review of the Literature From 2003 Through 2008

Cognitive Rehabilitation Components

Restitution
Re-establishing / Strengthening Damaged Neural Pathways

Compensation
Using New Strategies / External Aids

Reorganization
Developing / Strengthening New Neural Pathways

Evidence-Based Recommendations for Cognitive Rehabilitation: Practice Standards

Table 1: Evidence-Based Recommendations for Cognitive Rehabilitation: Practice Standards

<table>
<thead>
<tr>
<th>Cognitive Functioning</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention</td>
<td>Recommended for persons with mild to moderate attention deficits associated with visual neglect after right hemisphere stroke</td>
</tr>
<tr>
<td>Memory</td>
<td>Recommended for persons with memory deficits as a result of right hemisphere stroke</td>
</tr>
<tr>
<td>Executive Function</td>
<td>Recommended for persons with executive function deficits as a result of right hemisphere stroke</td>
</tr>
<tr>
<td>Social Skills</td>
<td>Recommended for persons with social skills deficits as a result of right hemisphere stroke</td>
</tr>
<tr>
<td>Communication</td>
<td>Recommended for persons with communication deficits as a result of right hemisphere stroke</td>
</tr>
<tr>
<td>Activities of Daily Living</td>
<td>Recommended for persons with activities of daily living deficits as a result of right hemisphere stroke</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>Recommended for persons with rehabilitation deficits as a result of right hemisphere stroke</td>
</tr>
</tbody>
</table>

Evidence-Based Recommendations for Cognitive Rehabilitation: Practice Guidelines

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensory training</td>
<td>Recommended as an important, even critical, element for persons with</td>
</tr>
<tr>
<td></td>
<td>severe neuropsychological impairment that includes visual neglect</td>
</tr>
<tr>
<td></td>
<td>after right hemisphere stroke or TBI</td>
</tr>
<tr>
<td>Cognitive interventions for specific language impairments such as reading</td>
<td>Should be considered as a key factor in the rehabilitation of language</td>
</tr>
<tr>
<td>comprehension and language formulation</td>
<td>skills after left hemisphere stroke</td>
</tr>
<tr>
<td>Treatment intensity</td>
<td>Recommended for persons with severe memory impairment after TBI</td>
</tr>
<tr>
<td>Use of external constraints with direct application</td>
<td>Recommended during poststroke rehabilitation to reduce cognitive and</td>
</tr>
<tr>
<td></td>
<td>functional disability for persons with moderate to severe TBI or stroke</td>
</tr>
<tr>
<td>Training in formal problem-solving strategies and their application to</td>
<td>NPT recommended: does not appear effective</td>
</tr>
<tr>
<td>emotional situations and functional roles</td>
<td></td>
</tr>
<tr>
<td>Comprehensive neuropsychological rehabilitation</td>
<td></td>
</tr>
<tr>
<td>Individually derived exercises to meet unilateral left neglect</td>
<td></td>
</tr>
</tbody>
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