COGNITIVE COMMUNICATION DISORDERS
IN ADULTS WITH ACQUIRED BRAIN INJURY:
CURRENT PERSPECTIVES

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COGNITION
- The process of knowing
- Knowledge of thoughts, feelings, & ideas
- The process that is used to understand & interact with the world
- Used to describe how our brain functions to perceive & express experiences

COMMUNICATION
- Any means by which an individual relates experiences, ideas, knowledge and feelings to another
- Results from a complex interaction between cognition, language and speech

COGNITIVE-COMMUNICATION DISORDERS
- Cognitive-communication disorders encompass difficulty with any aspect of communication that is affected by disruption of cognition. Areas of function affected by cognitive impairments include behavioral self regulation, social interaction, activities of daily living, learning and academic and vocational performance.

ACQUIRED BRAIN INJURY
- Brain Injury Association of America:
  - An injury to the brain, which is not hereditary, congenital, degenerative, or induced by birth trauma. An acquired brain injury is an injury to the brain that has occurred after birth
  - Traumatic Brain Injury
  - Stroke
  - Hypoxic or Anoxic Brain Injury
  - Tumor
  - Substance Abuse
  - Illness

(COGNITION, COMMUNICATION, COGNITIVE-COMMUNICATION DISORDERS, ACQUIRED BRAIN INJURY)
PREVALENCE

- 1.7 people sustain a new traumatic brain injury each year
- Approximately 75% are concussions or mild TBIs
- Every year, more than 795,000 people in the United States have a stroke

COGNITIVE COMMUNICATION DEFICITS AFTER ABI

- As many as two-thirds of patients experience cognitive impairment or decline following ABI
- Cognitive rehabilitation serves to:
  1) reinforce, strengthen or re-establish previously learned patterns of behavior
  2) establish new patterns of cognitive activity through compensatory cognitive mechanisms for impaired neurological systems
  3) establish new patterns of activity through external compensatory mechanisms such as environmental structuring and support
  4) enable persons to adapt to their cognitive disability

COGNITIVE DOMAINS

- Awareness
- Attention
- Memory
- Problem Solving
- Pragmatics
- Executive Functions

ICF FRAMEWORK

- Internal Classification of Functioning, Disability, and Health (ICF) Framework
  - Implementation in 2001 with unanimous endorsement of the classification by the 54th World Health Assembly
  - Framework for describing and measuring health and disability
  - Used for functional status assessment, goal setting & treatment planning and monitoring, as well as outcome measurement in clinical setting

ICF FRAMEWORK: DEFINITIONS

- Impairments: problems in body function or structure such as a significant deviation or loss.
- Activity: the execution of a task or action by an individual.
- Participation: involvement in a life situation.
- Activity Limitations: difficulties an individual may have in executing activities.
- Participation Restrictions: problems an individual may experience in involvement in life situations.
- Environmental Factors: make up the physical, social and attitudinal environment in which people live and conduct their lives.
“EVALUATION” or “ASSESSMENT”

- Merriam-Webster, 2012
  - Evaluation: “to determine the significance, worth, or condition of, usually by careful appraisal and study”
  - Assessment: judgment based on understanding of a situation
  - Evaluation is the process, while assessment is the result

WHO CLASSIFICATION: IMPLICATIONS FOR ASSESSMENT

<table>
<thead>
<tr>
<th>WHO Category</th>
<th>Assessment Tool and Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impairment</td>
<td>Standardized tests to identify underlying neuropsychological and neurolinguistic strengths</td>
</tr>
<tr>
<td>Activity/Participation</td>
<td>Standardized or nonstandardized observation of individual performing functional activities and exploration of factors that influence performance such as possible compensatory strategies</td>
</tr>
<tr>
<td>Environmental Factors</td>
<td>Systematic documentation of environmental factors, including support of behaviors of communication partners</td>
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(Turkstra, et al, 2005)

FRAMEWORK

- Plan, Implement, and Evaluate
  - Basis for designing and implementing various interventions
  - Planning the therapy for optimal success
  - Implementation refers to methods utilized within the session that impact outcomes
  - Evaluation of client performance

(Sohlberg and Turkstra, 2011)

FRAMEWORK: PLAN

- Identify key learner characteristics
  - Cognitive linguistic functions, physical abilities, sensory abilities, psychological status, social connections
- Define the training target
- State the desired outcome
- Design individual training plan

(Sohlberg and Turkstra, 2011)

ANCDS PRACTICE OPTIONS

- Based on detailed review of test manuals, published studies and experts’ published opinions
- Define purpose of assessment
  - Design specific intervention
  - Create a support plan
  - Monitor progress towards objectives

(Turkstra, et al, 2005)

ASSESSMENT / PLAN

- ANCDS Guidelines (www.ancds.duq.edu)
- Internal consistency
- Test-retest reliability
- Construct validity
- Concurrent validity
- Predictive validity
**ASSESSMENT / PLAN**

- ANCDS Practice Options
  1. Take caution in using published, standardized, norm-referenced tests
  2. The committee identified several tests that met a majority of the stated criteria for reliability and validity
  3. Consider standardized testing with a broader framework, including assessment of pre-injury characteristics, stage of recovery and communication related demands of everyday activities
  4. Integrate cognitive assessments with other professionals whose scope of practice includes cognitive assessment (i.e. OT, neuropsychology)

(Turkstra, et al, 2003)

**SELF-REPORT / SELF-ASSESSMENT**

- Jamora, Young and Ruff, 2011:
  - Mild TBI: Self reported attention problems predicted performance on neuropsychological attention and concentration measures
  - Moderate to severe TBI: Self reported memory problems predicted performance on neuropsychological measures of memory and learning

**TREATMENT EFFICACY SUMMARY**

- Traumatic Brain Injury
  - Attention (82%)
  - Memory (81%)
  - Pragmatics (83%)
  - Problem Solving (80%)
- Right Hemisphere Dysfunction:
  - Attention (80%)
  - Memory (74%)
  - Problem Solving (73%)
  - Pragmatics (77%)

(ASHA NOMS)

**WHAT INFLUENCES LEARNING**

- Personal Characteristics
- Environmental Factors
- Program Characteristics

(Sohlberg and Turkstra, 2011)

**LEARNING: PERSONAL CHARACTERISTICS**

- Self efficacy
- Locus of control
- Therapy program beliefs and expectations
- Disease characteristics
- Cognitive status
- Psychosocial status

**LEARNING: ENVIRONMENTAL FACTORS**

- Facilities
- Social and cultural influences
- Collaboration
LEARNING: PROGRAM CHARACTERISTICS

- Intensity
- Timing of intervention
- Task complexity
- Practice conditions
- Cueing and feedback
- Maintenance and generalization
- Therapeutic relationships
- Supervision/accountability
- Use of technology

INSTRUCTIONAL METHODS

- Do SLPs need instruction on instruction?
  - Systematic Instructional Approach
    - Method of Vanishing Cues, Spaced Retrieval
  - Conventional Methods
    - Trial-and-Error Approach, Test and Correct

FRAMEWORK: IMPLEMENTATION

- Initial Acquisition
- Mastery and Generalization
- Maintenance

(Goldberg and Tardina, 2011)

FRAMEWORK: IMPLEMENTATION

- During each phase of training, consider:
  - Level of error control
  - Type of practice
  - Intensity and dose of practice

IMPLEMENTATION: ERROR CONTROL

- Systematic Approach: Errorless learning (EL)
  - Eliminate errors by providing models before the client attempts a response
  - Guessing is discouraged
  (Baddeley & Wilson, 1994)

- Conventional Approach: Errorful or Trial and Error Learning
  - “Teaching” versus “testing”

IMPLEMENTATION: ERROR CONTROL

- Growing evidence to support EL, particularly during acquisition phase
  - Lloyd, Riley & Powell, 2009
  - Campbell, et al, 2007
  - Bowman, et al, 2010
IMPLEMENTATION: TYPE OF PRACTICE

- How is a fixed amount of practice distributed over time?
  - Massed
    - Less time between practice trials or sessions
  - Distributed
    - More time between practice trials or sessions


IMPLEMENTATION: PRACTICE SCHEDULE

- Practice Schedule
  - Random
    - Different tasks/targets are produced on successive trials and target is not predictable to client for upcoming trials
  - Blocked
    - Client practices same tasks/targets before beginning practice on next tasks/targets


IMPLEMENTATION: INTENSITY AND DOSE

- How hard is client working?
- How many sessions and for what length of time?

IMPLEMENTATION ACROSS THE PHASES

- Acquisition
  - Errorless learning
  - Massed, high repetition, blocked practice
- Mastery and Generalization
  - Error control, feedback
  - Distributed practice over longer periods of time
- Maintenance
  - Trial and error, feedback
  - Introduction of strategies
  - “Booster” session

(Sohlberg & Turkstra, 2011)

IMPLEMENTATION: EVIDENCE BASED PRACTICE

- Identify and translate best research evidence
- In the absence of evidence:
  - Design treatment based on theories of underlying deficit
  - Base treatments on deficits rather than etiology

(Blake, 2007)

THEORIES OF UNDERLYING DEFICITS: AN EXAMPLE

COGNITIVE RESOURCES HYPOTHESIS

- Amount of cognitive effort affects performance after brain damage
- Cognitive resources contribute to language abilities on the complex end of the continuum
- Should be considered with hypotheses for specific abilities
- Suggests complexity of tasks and stimuli should be carefully considered

(Monetta, Oueller-Plamodon & Joannette, 2003)
COGNITIVE RESOURCES HYPOTHESIS

- IMPLEMENTATION ACROSS THE PHASES -
  - Acquisition
    - Errorless learning
    - Massed, high repetition, blocked practice
  - Mastery and Generalization
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FRAMEWORK: EVALUATION OF OUTCOME

- Session data
- Generalization probes
- Maintenance probes
- Impact data
- Efficacy data
- Uses of clinical data

MEMORY DEFINED

- Reflects our experience of the past
- Allows us to adapt to the present
- Allows us to look forward to the future
- Critical to the acquisition and utilization of new information
- Important brain areas for memory function:
  - Amygdala & Hippocampus

COMPONENTS OF MEMORY

- Sensory Memory
  - Initial processing of information following registration by the sensory organs
- Short Term or Working Memory
  - Temporary storage of information in use
  - Recent memory
- Long Term Memory
  - Permanent storage of information
  - Declarative vs. procedural

LEARNING AND MEMORY DEFICITS:
EVIDENCE BASED PRACTICE

- WHAT WORKS?
  - External Strategy Use
  - Internal Strategy Use
  - Memory Programs
- WHAT DOESN’T WORK?
  - Cranial electrotherapy stimulation
  - Computer assisted training
  - VR Programs

OPERATIONS OF MEMORY

- Encoding
  - Set of processes by which the representation of an event is formed and constructed
  - Two stages
    - Holding
    - Acquiring
- Storage
  - Process of transferring a transient memory into permanent storage
- Retrieval
  - Involves the activation of the memory traces in the permanent memory so they are available for use
EXTERNAL AIDS

- RCTs:
  - Calendar use
  - Paper: Diaries, memory notebooks, log books, “to do” lists
  - Paging systems
  - Hand held recorders
  - PDAs and smart phones

EXTERNAL AIDS

- Memory, attention and executive functions
- Evidence to support use of technology and external aids to improve life participation for individuals with cognitive impairments
- Indicators for successful device use:
  - Device selection
  - Age
  - Severity
  - Specificity of deficit
  - Premorbid functioning

EXTERNAL AIDS: PLAN/ASSESSMENT

- Matching Person and Technology Assessment
  - www.matchingpersonandtechnology.com/index.html
  - Contains a series of instruments:
    - Self report checklists
      - Environments in which the client will use technology
      - Individual characteristics and preferences
      - Technology’s features and functions
    - Technology specific forms
      - Assistive Technology Device Predisposition Assessment (ATD PA)
      - Educational Technology Predisposition Assessment (ET PA)
      - The Workplace Technology Predisposition Assessment (WT PA)
      - The Health Care Technology Predisposition Assessment (HCT PA)

EXTERNAL AIDS: PLAN/ASSESSMENT

- Matching Person and Technology Assessment Process
  - Assesses limitations, strengths, goals and potential interventions in conjunction with:
    - Body functions
    - Activities
  - Screen or complete assessment

EXTERNAL AIDS: PLAN/ASSESSMENT

- Matching Person and Technology Process:
  - User goals and preferences drive the MPT process
  - Providers are guided into considering all relevant influences on the use of a technology while focusing on the user’s life participation
  - Mismatches between a proposed technology and a potential user are identified
  - The most appropriate technology is selected when there is a choice of several
  - Appropriate training strategies are identified for an individual’s optimal use of a technology

(Scherer, et al, 2007)

EXTERNAL AIDS: PLAN/ASSESSMENT

- TechMatch
  - www.coglink.com/techmatch
  - Computer survey
  - Goal: Assist healthcare providers in matching people with cognitive deficits to computer tools that will help with life participation
  - Assessment:
    - Technology experience and abilities
    - Environment
    - User needs
    - Cognitive ability
    - Personal situation
INTERNAL STRATEGY USE

- RCTs:
  - Visual imagery
  - Verbal labeling / elaboration
  - Mnemonics

INTERNAL AIDS: PLAN/ASSESSMENT

- Consider personal learning characteristics
- Consider environmental learning factors
- Saliency matters
- User goals and preferences should drive the selection process

MEMORY AIDS: IMPLEMENTATION

- Acquisition
  - Establish motivation and procedures for using aid
  - Client involved in selection of aid
  - Systematic instruction of procedures
  - Relevant training examples
  - Error control
  - Fade cues
  - Intensive massed practice initially
  - Distribute practice once steps are learned

- Mastery and generalization
  - Strengthen use
  - Broaden contexts
  - Lengthen distributed practice
  - Correct errors, repeat practice before further fading cues
  - Provide opportunities to use aid
  - Maintenance
    - Schedule follow up sessions

MEMORY AIDS: EVALUATE OUTCOMES

- Frequency of use
- Self-report or ratings of satisfaction and life participation
- Performance on tasks in which aid is to be utilized

MEMORY RE-TRAINING PROGRAMS: THE EVIDENCE

- Memory-retraining programs appear effective, particularly for functional recovery although performance on specific tests of memory may or may not change
- Although several mnemonic strategies have been used to help improve memory post ABI, retrieval practice seems to be the most effective
- Recall and recognition of words can be enhanced by using a spaced learning condition
MEMORY RE-TRAINING PROGRAMS

- Error Control
- Method of Vanishing Cues
- Spaced Retrieval

MEMORY RE-TRAINING: ERROR CONTROL

- Research supports errorless learning for individuals with moderate to severe impaired explicit memory
- Trial and error learning may be indicated
  - Update knowledge of performance based on feedback
  - Ability to monitor and detect errors

(Claire & Jones, 2008)

METHOD OF VANISHING CUES

- Error controlled
- Systematically reduce cues until target is acquired
- Client is discouraged from using strategies or guessing
- If client gives incorrect response, clinician returns to level that client is successful at and begins again
- Learning proceeds until there are no visible cues, then distractors are introduced systematically until the target can be expressed in functional contexts

(Sohlberg & Turkstra, 2011)

METHOD OF VANISHING CUES

Example: Teaching a client your or another staff member's name

MARIA

METHOD OF VANISHING CUES

MARI_

METHOD OF VANISHING CUES

MAR_ _
METHOD OF VANISHING CUES

MA_ _ _

INTERVENTION: MEMORY

- Training techniques vary based on declarative memory and executive functions
- Strategy Use: High-Declarative Memory & Executive Function Demands
- Systematic Approach: Implicit or Procedural Memory

INTERVENTION: MEMORY

- Evidence based practice:
  - Implicit learning techniques: for clients with severe memory impairments, systematic, error control methods with spaced retrieval are most effective
  - Declarative learning techniques: for clients with mild to moderate impairments, internal strategies may be most effective

ATTENTION

- The ability to focus on certain aspects of the environment that one considers important or interesting & to flexibly manipulate this information. Prerequisites to attention are alertness & arousal. (Sohlberg & Mateer, 1987)

ATTENTION: EVIDENCE BASED TREATMENT

- Specific structured training programs are ineffective (Cicerone, et al, 2005, 2011)
- Dual Task Training and Reaction Time
  - Individuals with ABI perform poorly on dual task activities
  - Individuals with ABI have slower reaction times than individuals without (Couillet et al, 2010)
  - (Azouli et al, 2004)
ATTENTION HIERARCHY

- Arousal / Alertness
- Focused Attention
- Sustained Attention
- Selective Attention
- Alternating Attention
- Divided Attention

DUAL TASK TRAINING FOR ATTENTION

- Train 2 sustained attention tasks separately then combine
  - Walking and having a conversation
  - Listening while taking notes
  - Texting while having a conversation
  - Watching TV while talking on the phone

DUAL TASK TRAINING FOR ATTENTION

- Cognitive-motor interference (CMI)
  - Simultaneous performance of cognitive and motor task interferes with one or both tasks
  - Demands for attention resources compete
  (Woollacott & Shumway-Cook, 2002)

DUAL TASK TRAINING FOR ATTENTION

- Couillet et al, 2010
  - 12 patients with TBI in subacute/chronic phases
  - 6 weeks - 4 sessions, each 1 hour in length
  - Experimental group trained first on single tasks, then dual tasks of progressing difficulty
  - Outcome measures included attentional tests, executive and working memory tests and dual-task measures
  - Significant training related effect on divided attention

DUAL TASK TRAINING FOR ATTENTION

- Positive effect on divided attention
- Effective on the speed of processing
- Assists individuals in dealing with dual task situations rapidly and accurately

TIME PRESSURE MANAGEMENT

- Increase awareness of errors and relation to slow processing
- Compensation for slowed information processing through anticipation and self management
- Reduce experience of 'information overload' in daily tasks

(Fasotti et al, 2000)
TIME PRESSURE MANAGEMENT

- Increased use of self-management strategies (interrupting, repeating essential information) after TPM
- Improvements apparent on more complex tasks, but not basic reaction time

(Fasotti et al, 2000)

TIME PRESSURE MANAGEMENT

- Stage 1: Identify the problem
- Stage 2: Teach the strategy
- Stage 3: Generalization

(Winkins et al, 2009)

TIME PRESSURE MANAGEMENT

- Strategies:
  - Priority is always- “Let me give myself enough time to complete the task”
  - Therapist introduces strategies and provides example / talks the patient through using a simple task (i.e. preparing a meal)
  - Specifics strategies are:
    - analyzing time pressure
    - preventing time pressure
    - handling time pressure
    - monitoring task performance

(Winkins et al, 2009)

TIME PRESSURE MANAGEMENT

1. Analyze task for time pressures and determine where strategies may help (“Are there 2 or more things to be done at the same time?” “Might I become overwhelmed or distracted?”)
2. Determine which decisions or actions can be performed before actually starting the activity
3. Make a plan for anything unexpected that may occur (list and create plans for possible scenarios)
4. Learn to monitor performance

(Winkins et al, 2009)

TPM: COOKING A MEAL

1. WHAT ARE TIME PRESSURES? WHICH STRATEGIES MAY HELP?
   - Cutting and preparing ingredients while reading a recipe and watching for water to boil; plan and sequence steps prior to beginning
2. WHAT CAN BE DONE AHEAD OF TIME?
   - Read the recipe, cut vegetables and measure out ingredients
3. WHAT UNEXPECTED COULD OCCUR?
   - Phone could ring; let it go
4. EVALUATE PERFORMANCE
   - Did I complete the task? What went well? What did not?

EXECUTIVE FUNCTIONS

- John gets up off of the couch and heads to the kitchen, where he forgets why he even headed there in the first place!
- Katie starts to clean her apartment when she sees an unpaid bill sitting on her table. She promptly pays her bill and then sits down to watch her favorite TV show. When her sister shows up later that evening and comments on how dusty the apartment is, Katie realizes that she never finished cleaning.
Mary went to the grocery store to get the items to make spaghetti for friends coming to dinner that evening. After picking up the items for a salad, she ran into a friend from high school. They talked for almost 15 minutes before Mary went to the checkout and paid for her items. When Mary got home about an hour before her friends were to arrive, she realized that she did not get all of the items on her list.

The direction and organization of all cognitive and emotional processes in order to attain goals and regulate behavior that is consistent with attaining such goals includes setting realistic goals based on accurate self appraisal, monitoring your behavior and evaluating your performance in relation to these goals, problem solving and changing behavior to come about obtaining the best solutions. A set of cognitive abilities that control and regulate other abilities and behaviors; executive functions are necessary for goal directed behavior (Ready, et al. 2001).

A CLINICAL MODEL OF EXECUTIVE FUNCTIONS
- Initiation and drive (Starting behavior)
- Response inhibition (Stopping behavior)
- Task persistence (Maintaining behavior)
- Organization (Organizing thoughts and actions)
- Generative thinking (Creativity, fluency, flexibility)
- Awareness (Monitoring and modifying one’s own behavior)

A FUNCTIONAL MODEL OF EXECUTIVE FUNCTIONS
- Grocery Shopping
  - Does not initiate going to the store even when refrigerator is empty
  - Impulsive shopping, buys unnecessary items
  - Does not maintain focus and does not get all items
  - Does not organize a grocery list, use aisle headings or use time efficiently when gathering groceries
  - Lacks flexibility to substitute appropriate items if desired items are unavailable
  - Is not aware that getting groceries is a concern

EXECUTIVE FUNCTIONS: EVIDENCE BASED TREATMENT
- WHAT MAY WORK?
  - Group Treatment
  - Pharmacological Intervention
  - Goal Management Training
  - Teach-M

FURTHER RESEARCH IS NEEDED!
GOAL MANAGEMENT TRAINING

- Duncan’s Theory of Disorganization (1986)
  - Goal management deficits or “goal neglect”
- Goal Management Training
  - Primary Objective: Train patients to stop ongoing behavior in order to define goal hierarchies and monitor performance
  - 5 stages

(Robertson, 1996)

GOAL MANAGEMENT TRAINING

1. “Stop. What am I doing?”
2. “Define the goal”
3. “List the steps”
4. “Learn the steps”
5. “Check. Am I doing what I planned?”

(Robertson, 1996)

TEACH-M

- Framework for teaching new, multistep skills to patients with impaired memory and executive functions
- Derived from current research on instructional techniques
- Combines instructional techniques into a protocol for teaching specific tasks to individuals with ABI

(Enhardt, et al, 2005)

TEACH-M

- Task Analysis
  - Know the instructional content, break it up into small steps, chain steps together
- Errorless Learning
  - Error control
- Assessment
  - Assess skills prior to initiating intervention, probe performance at start of each session or prior to teaching new step

TEACH-M

- Cumulative Review
  - Regularly integrate and review new skills with previously learned skills
- High Rates of Correct Practice
  - Practice skills, consider distributed practice
- Metacognitive Strategy
  - Encourage self-reflection and problem solving
**TEACH-M**

- **Initial Probe**
  - Probe: Can patient perform all components of the target task?

- **Task-Analysis, Errorless Learning, High Rates of Practice and Assessment**
  - Therapist analyzes task and breaks it into steps
  - Therapist models each step multiple times
  - Patient practices each step multiple times, while therapist fades cues (errorless learning)
  - High amounts of isolated, blocked practice for any steps that are problematic
  - Probe at the start of each session for retention from previous session

**REFERENCES**


**CONCLUSIONS**

- **Best practice for assessing and managing cognitive communication deficits after ABI, means considering:**
  - What we should assess (ICF framework) and how we should assess it (ANCDS Practice Options)
  - Personal, environmental and program characteristics
  - Instructional techniques best suited to person, cognitive domain and phase of implementation

**REFERENCES**