RST

Department of Rehabilitation Science and Technology

School of Health and Rehabilitation Sciences

Where Rehabilitation, Science and Technology changes lives!

Efficacy of Assistive Technology for Cognitive Disabilities and Polytrauma: Review of Current Outcomes

VA-PRC 8th Virtual Grand Rounds

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Learning Objectives

- Describe three assistive technologies for cognitive disabilities and polytrauma
- Describe two commercial, off the shelf technologies that support the rehabilitation of cognitive disabilities and polytrauma
- Summarize the efficacy of assistive technologies for cognitive disabilities and polytrauma
- Identify and discuss two clinician personal factors that impact the prescription of assistive technology for cognitive disabilities and polytrauma

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TBI

- 1.7 million people in the United States sustain a traumatic brain injury
- Estimated direct medical costs and indirect costs: Approximately $60 billion
- Polytrauma

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TBI Sequale

- Executive Function
- Memory
- Orientation and Attention
- Visual-Spatial Processing
- Sensory-motor Processing
- Language
- Emotions

Cognitive Dysfunction

- Memory
- Attention
- Language
- Concentration and attention
- Lost or diminished cognitive regulation
- Decreased ability in initiating self-directed behaviors
- Impaired sequencing
- Poor error detection
- Cognitive inflexibility with failure to self-correct
- Difficulty initiating, stopping or inhibiting, shifting, and adjusting tasks

Neurobehavioral and Emotional Difficulties

- Irritability
- Heightened anxiety
- Depression
- Disruptions in mood and affect
- Impulsiveness
- Impatience
- Restlessness
- Inappropriate social responses
- Asponaneity
- Sluggish
- Loss of interest
- Childishness
- Helplessness
- Lack of insight or awareness

Sensory Disruptions and Somatic Symptoms

- Changes in equilibrium and Somatosensory perception
- Blurred vision
- Dizziness
- Fatigue
- Sensitivity to light and to noise
- Balance problems
- Transient neurological abnormalities
- Epilepsy
- Chronic headaches
- Pain
- Nausea
- Vomiting
- Spasticity
- Dysphagia

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Functional Implications

- Self-awareness
- Quality of Life
- Community Integration and Participation
- Vocational Outcomes
- Psychosocial
- Behavioral

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Cognitive Rehab

- Systematic, functionally oriented service of therapeutic cognitive activities
  - Understanding of person's behavioral deficits.
  - Reinforce, strengthen or re-establish previously learned patterns of behavior
- Systematic, theory-based program of integrated didactic, experiential, procedural, and psychosocial training activities conducted to restore cognitively compromised adaptation.

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Assistive Technology (AT)

- Consists of devices, services, strategies, and practices that assist people with disabilities
- Used as alternative ways of performing actions, tasks, and activities
- Supports everyday activities in *living, learning, and working* – community re-entry and return to work

Cognitive Assistive Technology (CAT)

- Designed to be used for individuals with cognitive impairments as a means to support weakened or poor cognitive functions
- Reinforce an individual's residual abilities
- Provide alternative means for completing a desired activity
- Serve as an extrinsic support

Types of AT

- Electronic Aids for Daily Living
- Assistive Technology for Cognition
- Cognitive AT
- Cognitive Prosthetics/Orthotics
- Cognitive-behavioral orthoses
- Electronic memory devices

Domain	Cognitive Strategy	Low Tech	CAT
Memory/Executive Function	• Divide larger tasks into smaller tasks and steps • To-Do Lists/Check lists • Reduce/Minimize distractions • Detailed written Instructions • Rest Periods • Provide additional time to learn new responsibilities • Record meetings • Written summaries	• Data planners • Tape Recorders • Clocks • Calendars • Timers • Digital Watches	• PDA's / cell phones Specialized PDA's • Paging systems
Time Management/ Organization	• Additional Time • Written reminders • Divide large assignments into smaller tasks and steps • To-Do Lists/Check lists	• Alarms / timers • Pre-organized books/folders • Sticky notes • Color Coded	• Computer based reminders • PDA's / cell phones • Specialized PDA's • Paging systems

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AT for Cognitive Deficits

- PDA
  - Jogger®, PEAT®, Able Link® HP iPAQ
  - Pocket Endeavor Suite
  - Memory Compensation Pocket PC Book
- Smart Phones
- Paging Systems
  - Issac®, PageMinder®

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AT for Cognitive Deficits

- SMS/MMS Text
- Voice Organizers
  - Parrot Voice Mate, Psion
  - TADI, Pocket Coach
- Voice Recorders
  - Sony IC Recorder

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Methods How PDAs Can Function

- Planning and organization
- Task sequencing
- Way-finding (GPS)
- Behavioral cueing
- Wireless transfer of homework and other information
- Bimodal Prompts – sound and vibration

AT for Neurobehavioral and Emotional Difficulties

- Functionality of Devices
- Benefits
  - Explore situations from a safe environment
  - Experiment with different approaches to a situation
  - Explore differing viewpoints

Navigation Aides

- Functionality of Devices
- Benefits
  - Support individuals in community
  - Provided additional supports for safety

Dimensions of CAT Recommendation

- Assessment of organizational skills
- Environments
- Potential partners
- Opportunities
- Functions might be needed
- Skill outcomes and independent task response
- When device might be used
- Possible Customization

EFFICACY OF CAT

Abandonment

- 90% of AT for cognitive compensation is discarded after only brief use
  - Psychosocial factors

NeuroPage®

- Wilson, Emslie, Quirk,& Evans (2001)
- Wilson, Emslie, Quirk, Evans, & Watson (2005)
  - **Outcome Measure**: % successful with task achievement
  - **Results**:
    - 2001 Study: 80% of participants more successful in completing everyday outcome measures
    - 2005 Study: Significantly reduces everyday memory and planning problems
      - Without NeuroPage – 47% success rate
      - With NeuroPage – 72% rate

NeuroPage®

- Emslie, Wilson, Quirk, Evans, & Watson (2007)
  - **Outcome Measure**: % successful with task achievement, self-care, self-medication, and keeping appointments
  - **Results**
    - 2-81% success without pager
    - 45-96% with pager

NeuroPage®

- Wilson, Evans, Emslie, & Malinek (1997)
  - **Outcome Measure**: Client real life problems in memory failures
  - **Results**: More tasks achieved
- Evans, Emslie, & Wilson (1998)
  - **Outcome Measure**: Target behaviors: medication, watering plants, washing underwear
  - **Results**: Increased timely achieved target behaviors

Pagers

- Kirsch, Shenton, & Rowan (2004)
  - **Intervention**: alphanumeric paging system
  - **Outcome Measure**: % entries in memory log about scheduled therapy activities during a treatment day.
  - **Results**: Substantial increase of entries during intervention.

Voice Recorders

- Oriani, Moniz-Cook, Binetti, et al. (2003)
  - **Intervention**: Voice Recorder (electronic memory aid)
  - **Outcome Measure**: Remembering 7 tasks at specified time
  - **Results**: Increased performance as compared to written list and free recall
- Yasuda, Misu, Beckman, Watanabe, Ozawa, & Nakamura (2002)
  - **Intervention**: Sony IC Voice Recorder
  - **Outcome Measure**: Successful completion of various daily tasks
  - **Results**:
    - Successful for 5/8
    - Unsuccessful for 3/8

Voice Organizers

- van den Broek, Downes, Johnson, Dayus, & Hilton (2000)
  - **Outcome Measure**: Recall of message passing task and domestic task after set delay period
  - **Results**:
    - All improved on message passing
    - 4/5 improved on domestic task
- Hart, Hawkey, & Whyte (2002)
  - **Outcome Measure**: Remembering therapy goals.
  - **Results**: Recorded Goals were remembered better and associated with better awareness or follow through with therapy objectives

Wrist Watch

- Van Hulle and Hux (2006)
  - **Intervention**: Wristwatch alarm (WatchMinder®) and/or digital voice recorder (VoiceCraft™)
  - **Outcome Measure**: % independent regularly-prescribed medication requests
  - **Results**:
    - One case showed no effect
    - Two case showed slow but continuous improvement in remembering to take medications

Navigation Aids

- Sohlberg, Fickas, Hung, & Fortier (2007)
  - **Intervention**: 4 kinds of navigation prompt modes via wrist-worn navigation device
  - **Outcome Measure**: Accuracy and confidence during navigation
  - **Results**:
    - Participants do best with speech-based audio directions and
    - Method also preferred by majority of participants

PDA

- Gentry, Wallace, Kvarfordt, & Lynch (2008)
  - **Intervention**: PDA use and PDA use plus additional 8 week training
  - **Outcome Measure**: COPM, CHART-R
  - **Results**: Increased performance, satisfaction, cognitive independence, mobility, occupation

PDA

- Gorman, Dayle, Hood, & Rumrell (2003)
  - **Intervention**: Isaac PDA
  - **Outcome Measure**: FIM
  - **Results**: Increased FIM scores from needing assistance to modified independence
- Davies, Stock, & Wehmeyer (2002)
  - **Intervention**: Schedule assistant PDA vs. Paper schedule
  - **Outcome Measure**: Completion of 8-item schedule
  - **Results**: Less assistance. Fewer schedule errors. Timely completion

PDA

- Thone-Otto and Walther (2003)
  - **Intervention**: MEMOS PDA and cell phone with calendar functions
  - **Outcome Measure**: Execution of tasks, Usefulness
  - **Results**: Decreases in forgotten intentions for daily and experimental tasks

PDA

- DePompei, Gillette, Goetz, et al. (2008)
- Gillette and DePompei (2008)
  - **Intervention**: 2 types of PDAs, paper planner, and times and task lists
  - **Outcome Measure**: on-time response rate
  - **Results**: Students were on time more frequently using PDA as compared to list and to planner

PDA

- Kim, Burke, Dowds, & George (1999)
  - **Intervention**: PDA
  - **Outcome Measure**:
    - Arrive on time
    - Ask for medication
  - **Results**:
    - Punctual without assistance
    - Asked for all medication
- Kirsch, Shenton, Spirl, Simpson, LoPresti, & Schreckenghost (2004)
  - **Intervention**: PDA with voice recording "be brief"
  - **Outcome Measure**: Decrease in verbose communication
  - **Results**: Decrease in number of lengthy utterances

Cell Phones

- Stapleton, Adams, & Atterton (2007)
  - **Intervention**: Cell phone: individual reminder messages
  - **Outcome Measure**: Individual memory target behaviors
  - **Results**: 2/5 success: 50-90%
- Wade & Troy (2001)
  - **Intervention**: Cell phone: reminder voice messages
  - **Outcome Measure**: Individual target behaviors
  - **Results**: Increased achieved target behaviors

Cell Phones

- Svoboda and Richards (2009)
  - **Intervention**: Training (skill acquisition and skill generalization) on smartphone
  - **Outcome Measure**: 10 phone calls over 2-week period. Memory mistakes questionnaire
  - **Results**: Successful outcome on both objective and qualitative measures of memory functioning
- Taber-Doughty – navigation for students who are lost

SMS and MMS

- Fish, Evans, Nimmo, et al. (2007)
  - **Intervention**: Text messages reading STOP
  - **Outcome Measure**: Prospective memory tasks: phoning a voice-mail at set times
  - **Results**: Significantly better performance on cued days
- Culley and Evans (2010)
  - **Intervention**: Text messages about client rehab goals
  - **Outcome Measure**: Client recall of rehab goals
  - **Results**: Goals in text condition were recalled better

Synthesis of CAT Research

- Promising results have been reported
- Potential users and clinicians optimistic about use of CAT

Limitations of Research

- Efficacy
  - Limited context of trials
- Effectiveness
  - Needs real life
  - Longer period of time
- Quality and Strength of research limited
  - Few Randomized clinical trials
  - Limited studies with follow up
  - Majority of studies are pre/post
  - Many do not perform statistical analyses

Potential Benefits of CAT

- Lasting Benefit
- Portability
- Consumer Acceptance
- Psychosocial Benefits

Limitations of CAT

- Cost
- Complexity
- Fact that many commercially available organizers show small text and have small buttons

Clinical Question

- Can Persons with TBI manage their own technology?

RETHINKING ASSISTIVE TECHNOLOGY

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AT Defined

- Public Law 100-407
  - Any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain or improve the functional capabilities of individuals with disabilities.

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Commercial/Off-the-shelf Technologies

- Smart Phones
- Tablet PCs
- Gaming Systems

- Benefits
- More acceptable
- Decreases stigma of AT

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Smart Phones and Tablet PCs

- iPod Touch
  - iPrompts®, AutismTrack
- Smart Phones
  - iPhone
  - Droid X
  - Blackberry Bold and Tour
  - HTC Touch 2
- Tablet PCs
  - iPad
  - Samsung Galaxy
  - Motorola Xoom

Smart Phones and TBI

- Mobile phones used in therapy should include
  - Soft finger touch
  - Large buttons
  - Icons supported by titles
  - Single level menu structure

Virtual Reality (VR)

- Rose, Brooks, & Rizzo (2005)
  - Executive Dysfunction
  - Memory
  - Spatial Ability
  - Attention Deficits
  - Unilateral Visual Neglect

Virtual Reality

- Grealy, Johnson, & Rushton (1999)
  - Exercise and VR in TBI Rehab
- Rizzo, Buckwalter, Bowerly, Van Der Zaag, et al. (2001)
  - Virtual classroom and assessment and rehabilitation of attention deficits
- Brooks and Rose (2003)
  - VR and Memory Rehab

Computer and Video Games

- Reduction in reaction times
- Improved hand-eye coordination
- May raise self-esteem
- Spatial resolution and number of objects being tracked
- Can assist in setting goals, goal rehearsal, providing feedback, and reinforcement (children)

"Wii-hab"

- *Stroke*
- Hemiplegia
- Balance Disorders
- Cerebral Palsy
- Burn
- TBI

"Wii-hab" Outcomes

- Physical
- Psychosocial
- Cognitive

Usability of CAT

- Cost
- Clinician Confidence
- Client Preferences
  - Simplicity of use, technical support, long-lasting battery power
  - Keeping track of money spent, remembering things to do, and remembering conversations

Clinician Factors

- Clinicians' use CAT in rehabilitation
  - Clinician's training
  - Confidence in training individuals with TBI in the use of CAT
- 95% of the clinicians' believed CAT could be used in TBI rehabilitation
- Only 36% of the clinicians utilize CAT

Summary

- Research has found CAT to be beneficial for persons with TBI
- Additional research regarding the efficacy needs to be conducted
  - Real world situations
- Potential CAT devices that may increase outcomes
  - Smart phones and tablet PCs
  - Gaming systems

Thank You…Any Questions?

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