Executive Functioning Across the Lifespan: Older Adults

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Agenda

- Review of the construct of executive functioning
  - Applying conceptualizations to older adults
- Potential causes of impairment
- Common signs of need for evaluation
- Executive functioning assessment
- Interventions

The Construct of Executive Functioning

- **Executive Functioning**: The ability to think abstractly and to plan, initiate, sequence, monitor, and stop complex behavior.

- Higher-level cognitive skills used to control and coordinate other cognitive processes.
Components of Executive abilities

- **Lezak 1995** - Suggests there are 4 components of Executive function:
  - Volition
  - Planning
  - Purposeful behaviour
  - Effective performance

- **Stuss 1987** - Several skills necessary for goal-directed behaviour
  - Ability to shift from one concept to another
  - Ability to modify behaviour in light of new info
  - Ability to synthesize & integrate isolated details into coherent whole
  - Ability to manage multiple sources of information
  - Ability to make use of relevant acquired knowledge

Cognitive Processes involved in EF

- Initiation
- Planning
- Sequencing
- Monitoring self-directed behavior
- Insight
- Abstract thinking
- Judgment
- Regulation of behavior
- Attention
- Working memory
- Problem-solving
- Verbal reasoning
- Inhibition
- Mental flexibility

Dimensional Aspects of EF

- Can be divided into organizational and regulatory abilities:

  - Organizational – attention, planning, sequencing, problem solving, working memory, cognitive flexibility, abstract thinking, rule acquisition, selecting relevant sensory information.

  - Regulation – initiation of action, self-control, emotional regulation, monitoring internal and external stimuli, initiating and inhibiting context-specific behavior, moral reasoning, decision-making.
Executive Functioning

- Self-awareness of strengths and limitations (what’s hard to do; what’s easy to do)
- Goal setting
- Planning/organizing
- Initiating
- Inhibiting
- Self-monitoring and evaluating
- Strategic thinking
- Flexible shifting, adjusting, benefiting from feedback

(Feeney, 2005)

Activities Involving Executive Functioning

- Remembering a list of errands without writing it down
- Reading a book over a period of several days
- Managing a checking account
- Getting appliances fixed
- Organizing important personal papers, such as bills, insurance documents, and tax documents
- Handling an unfamiliar problem
- Planning an activity several days in advance
- Organizing what you want to say
- Checking the accuracy of financial documents
- Doing calculations in your head while shopping
- Planning for and completing regularly scheduled weekly tasks
- Managing time to enable completion of daily activities
- Counting the correct amount of money when making purchases
- Planning what to do in a day
- Learning new tasks or instructions

More Activities Involving EF

- Carrying on a conversation in a noisy environment
- Remembering where things were put away
- Using a local street map to locate a new store or physician’s office
- Putting words together to form a grammatically correct sentence
- Remembering to take medications at the appropriate time
- Planning for and keeping appointments
- Carrying on a conversation with a small group of people
- Dialing telephone numbers
- Reading and following complex instructions
- Composing a brief note or e-mail to someone
- Understanding pictures that explain how to assemble something
- Looking up a phone number or address in the phone book or on the computer
- Making yourself understood to other people during ordinary conversations
- Understanding other people during ordinary conversations
Executive Function

Executive function is reliant on the frontal lobes, the prefrontal cortex, and neuronal circuits. Reduced EF abilities are associated with frontal lobe dysfunction and damage involving the prefrontal cortex and limbic system.

Damage to the Executive System Often Leads to:

- Socially inappropriate behavior
- Inability to apply consequences from past actions
- Difficulty with abstract concepts (the inability to make the leap from the symbolic to the real world)
- Difficulty in planning and initiation (getting started)
- Difficulty with verbal fluency

Definition of Dementia

- Memory impairment and at least one of the following:
  - Aphasia
  - Apraxia
  - Agnosia
  - Disturbances in executive functioning.
- In addition, the cognitive impairments must be severe enough to cause impairment in social and occupational functioning.
- Importantly, the decline must represent a decline from a previously higher level of functioning. Finally, the diagnosis of dementia should NOT be made if the cognitive deficits occur exclusively during the course of a delirium.
- DSM IV TR of the American Psychiatric Association
Dysexecutive Syndrome

- impulsiveness
- poor social judgment
- social disinhibition
- Egocentrism
- difficulty interpreting the behavior of others
- Perseveration
- poorly regulated attention
- disorganization (in thinking, talking, and acting)
- weak goal formulation
- ineffective planning
- decreased flexibility/shifting
- slowed processing
- diminished divergent thinking
- concrete thinking
- immature problem solving
- weak self-monitoring
- inefficient responses to feedback/consequences
- reduced initiation
- dulled emotional responses

Behavior Associated with Deficits in Executive Functions

- Disinhibition—lacks behavioral control, impulsive
- Perseveration—repeats non-functional behavior, inability to change behavior despite corrective feedback, difficulties learning from experience
- Forgetfulness—off-task behaviors, mental errors, loses track of what they were doing
- Anticipatory Behavior—failure to shift to new demands of situation
- Inefficiency—takes more steps to complete task than necessary
- Difficulty understanding consequences and cause-effect relationships
- Frequently violate rules despite apparent knowledge of the rules
- Apathetic—lacks motivation, does not set goals, engages in behavior only when prodded
- Difficulties accessing knowledge
- Concrete thinking
- Emotional lability
- Poor frustration tolerance
- Disorganized
- Inconsistent performance on tasks within ability range
- Difficulties coping with change
- Poor judgment
Adults with Executive dysfunction

- Cannot solve problems
- Cannot learn a new task
- Are disorganized
- Have impaired judgment
- Exhibit concrete thinking, mental inflexibility
- Have no insight
- Cannot incorporate feedback
- Cannot see their mistakes
- Make unsafe decisions when driving, spending, etc.

Causes and related conditions

- A sampling of conditions involving EF deficits:
  - Autism/Asperger’s Syndrome
  - ADHD and ADD
  - Conduct Disorder
  - Oppositional Defiant Disorder
  - Depression and/or Anxiety
  - Obsessive-Compulsive Disorder
  - Fetal Alcohol Syndrome
  - Bipolar Disorder
### Cognitive Aging by Domain: Executive Functions

- **Aging:**
  - **Intact:**
    - Set shifting for visual information
    - Some abstract verbal reasoning
    - Some cognitive flexibility
  - **Some Decline in**
    - Some adaptation to new situations
    - Some set shifting for verbal information
    - Divided attention
    - Complex problem solving
    - Inhibition

### Other Conditions Associated with Executive Dysfunction

- Cardiovascular disease
- Ischemia
- Heart Failure
- Peripheral Vascular Disease
- COPD, Dialysis,
- Diabetes, Hypertension
- Sleep apnea
- Carotid disease
- HIV
- Cancer
- Lupus
- Dementias

### Areas affected by Executive Impairments include:

- Falls
- Hypertension related disability
- Mood
- Behaviors
- Functional Status
- Capacity
- Driving
Executive Function and Instrumental Activities of Daily Living (IADL)

- EF impairment is predictive of IADL impairment
- Deficits in EF result in poor IADL scores
  - managing medications
  - using the telephone
  - managing finances
  - shopping and preparing meals
  - transportation
  - housekeeping

(Royall, Palmer, Chiodo, & Polk 2005)

Executive Function & IADL's

- IADL impairment corresponds with presence of mild executive dysfunction
- While memory and executive function correlate to current IADL ability, longitudinal studies revealed only EF independently predicted rate of decline in IADL scores
- Level of IADL impairment predicts the incidence of dementia at 5yr follow-up independent of other global test scores for cognition
- Measures of executive function in elderly subjects predict performance in instrumental activities of daily living (IADLs)

(Crowell et al., 2002; Cahn-Weiner et al., 2007; Cahn-Weiner et al 2000; Royall et al 2004, 2005)

Independent Living

- Intact executive functioning is necessary for an adult to remain independent
  - Taking medications appropriately
  - Making and keeping medical appointments
  - Fulfilling financial responsibilities and bill paying
  - Completing self-care tasks
    - Bathing
    - Grooming
    - Hygiene
    - Laundry
    - Meal preparation
    - Housekeeping
EF is Relevant to Decision Making Capacity

- EF associated with frontal systems
- Frontal lesions affect planning, hypothesis testing, judgment and insight
- Frontal impairment can be demonstrated in many medical/psychiatric disorders

Skills required for driving:

- Visual-perceptual skills
- Visual acuity
- Information processing
- Judgment
- Decision-making
- Performance of appropriate motor responses
- Sequencing
- Cognition
- Executive Functioning skills
- Memory
- Attention to detail

Common Reasons for Evaluation of Executive Functioning
Core Functions Involved in Executive Functioning

- Controlling acquisition of new memories
- Divergent thinking – choosing different ways of approaching a situation
- Environmental control of behaviour – using cues and information from the environment to direct, control or change personal behaviour.
- Directing interpersonal behaviour

Acquisition Deficits

- Impaired working memory
- Poor associative learning – difficulty associating varying facets of memory about facts or events, thus finding it hard to make use of external cues to direct behaviour

Divergent Thinking Deficits

- Loss of spontaneous behaviour – e.g. speaking and verbal fluency decreased; decreased ability to produce graphic designs or doodling; reduced behavioural output shown by lethargy, inability to initiate or maintain
- Impaired strategy formulation and planning, especially in response to novel situations
- Poor abstract thinking e.g. concept formation
Deficits in Environmental Control of Behaviour

- Ability to inhibit responses is impaired, so perseverative on tasks
- Breaking rules and taking risks
- Unable to follow instructions
- Gambling
- Poor error perception
- Amotivation and apathy

Impaired Interpersonal Behaviours

- Inappropriate social and sexual behaviour, or altered behaviours in comparison to premorbid patterns.
- Pseudodepression
- Pseudopsychopathy

Signs and Symptoms of Impairment

- Perseveration
- Organic Sameness
- Inflexibility
- Catastrophic Anxiety
- Emotional Dysregulation
- Working Memory Deficits
- Poor judgment
- Low threshold for frustration
- Impulse control difficulties
- Dyspraxia – Speech / motor
- Difficulty in postponing gratification
- Emotional 'incontinence'
**Indications of Need for Driver Evaluation**

- Confusion about operating the vehicle
- Trouble noticing cars or pedestrians on either side of the road
- Near misses
- Side swipes
- Accidents

**Assessment Issues**

- Consider screening
  - All patients over 65
  - When planning discharge from medical setting
  - Repeat admissions
  - All patients with Vascular conditions, COPD, dialysis
- In many geriatric medical clinics, EF is one component of a thorough functional evaluation, along with ADLs, IADLs, and gait and balance.
- Occupational therapy can assess function (i.e., perform a "kitchen assessment" or an "apartment weekend").
- Assess for ability to self-administer medications
- Cornerstone is the history
Task Assessment

- Planning: finding the exit to a maze
- Decision-making: simulated gambling.
- Working memory: the ability to hold and manipulate a group of items—adding up a list of numbers or repeating a span of numbers or words backwards.
- Feedback/Error correction: rules of a task are determined by whether responses are correct or incorrect—correct to shape for 5 items changes to correct by placement in next 5 items.
- Overriding habits: choosing a more complex and effortful solution to be correct e.g., looking away from the direction indicated by an arrow, naming ink colors of words,
- Mental flexibility: ability to shift between two tasks or response rules, e.g., from verbal to key-press response, from adding numbers to ordering numbers, from ordering by size to ordering by color.

Evaluating Executive functions

- Card sort tasks, such as the WCST and the D-KEFS Card Sorting Test
- Insight/judgment
- Tower
- Inhibition
- Clock drawing
- Similarities/proverbs

Clinical Assessment Instruments

- Delis-Kaplan Executive Function System
  - Comprehensive 9 subtest system
- WAIS-IV
  - Digit Span
  - Figure Weights
- WAIS-IV/WMS-IV Advanced Clinical Solutions
  - Trail making
  - Verbal Fluency
Delis-Kaplan Executive Function System

- D-KEFS was the first nationally standardized set of tests to evaluate executive functions
- Assesses higher level thinking and cognitive flexibility
- Game-like format
  - Does not use the right/wrong paradigm
  - Yet do obtain insight into ability to use feedback
- Extensive normative data
- Verbal and Non-verbal measures in the same test
- Two forms are available to limit practice effects when used for pre- and post-testing.

Overview of DKEFS Tests

- Comprehensive battery of tests measuring skills associated with executive functioning
- The battery is composed of 9 independent tests designed to assess unique and overlapping executive functions using verbal and non-verbal stimuli
- Component skills and multiple higher-order functions are assessed in each test enabling the examiner to isolate specific strengths and weaknesses-designed using a process approach

Overview of DKEFS Tests

- Trail-Making Test (8-89)
- Verbal Fluency (8-89)
- Design Fluency (8-89)
- Color-Word Interference Test (8-89)
- Card Sort Test (8-89)
- Word Context Test (8-89)
- Twenty-Questions (8-89)
- Tower Test (8-89)
- Proverbs Test (16-89)
Integrate All Information

- Results from EF measures should always be integrated with functional information such as that gathered from measures/techniques such as:
  - Texas Functional Living Scale (TFLS)
  - Linked with the WAIS-IV and WMS-IV
  - Used to assess activities of daily living (ADLs)
  - Clinical Interviews
  - Caregiver/family information
  - Objective social-emotional/psychiatric
  - Example = Beck Scales
  - Thorough history
  - Medical information
- Remember to check for vision, hearing, motor, medication contributions to performance.

Interventions or Considerations

Planning Ahead

- After evaluation and diagnosis, education and planning ahead are essential for long-term care management.
- Family matters, such as financial, legal, and health planning should be discussed and organized.
- People with a decline in executive function may be vulnerable to scams.
- Family and other caregivers should try to keep schedule as routine, simple, and safe as possible.
Considerations

• Compensation vs. remediation, or both
• Generalization does not ‘just happen’
• Client’s goals are central
• Self-efficacy, coping, locus of control, and optimism all impact cognition and real-world performance

An Evidence-based intervention for working memory training.

www.CogMed.com

What is Helpful?

• Medical interventions
• Behavior Therapy
• Environmental
• Caregiver
Categories of interventions

- Environmental Modifications
  - Reduce distractions
  - Check lists
  - Cueing devices
  - Random alerting tones
- Task-specific training
  - E.g., verbal self-instruction
- Meta-cognitive training
  - E.g., CO-OP
- Process-specific training
  - Limited evidence for generalization to daily life

Educating Patient, caregiver, staff

- Educating caregiver is critical – they need to understand the nature of the impairment.
- Staff who work with patient also needs to understand the impairment and its impact and ramifications.

Environmental Modifications

- Reducing background noise
- Overwhelming visual stimuli
- Physical constraints
- Other people
- Posted reminders, reducing clutter
- Arrange items in an orderly, organized fashion
- Place things in strategic locations -- “in their place”
- Keep paper and pen handy by telephones
- Label important items (storage, family photos, boxes, cabinets, drawers)
Compensatory Strategies

Medication management

Recalling medicine schedule
- Use pill box
- Have a written schedule
- Use watch or PDA/Phone timers
- Take meds at same time each day and pair with timing of a daily meal or other routine (brushing teeth, shaving)
- Put meds in visible location

References

References cont.


