Objectives

At the conclusion of this presentation, the attendees will:

1. Be familiar and understand three common presentations of dementia: Alzheimer's disease, Dementia with Lewy bodies (DLB) and Frontotemporal Dementia (FTD)
2. Be able to recognize early signs of Dementia in individuals
3. Understand the Global Deterioration Scale (GDS) and recognize each of its stages
4. Understand clinically significant elements of each GDS stage
5. Be able to apply strategies for assessment, intervention and goal development that are GDS stage-appropriate to maximize function
6. Be able to apply principles and strategies for optimal communication with individuals with Dementia
7. Understand the critical importance of caregiver education
8. Be familiar with current recent research in the area of physical activity and cognition
9. Be able to document interventions and goals for patients with dementia that justify Medicare reimbursement
Normal Aging: Less physically and mentally flexible, takes more time to process information. Memory changes occur, with greater difficulty remembering names of people, places and other things as we age.

Mild Cognitive Impairment (MCI): Problems with memory or another core brain function. Problems are severe enough to be noticeable and show up on tests of mental function, but not serious enough to interfere with daily life.

Dementia: Symptoms that may be caused by a number of different brain disorders. Symptoms involve mental decline severe enough to disrupt daily life that affects more than one of the following core brain functions:

1. Recent memory
2. Language
3. Visuospatial Function
4. Executive Function

Dementia: Overview

Common Types
- Alzheimer's
- Lewy Body Dementia
- Fronto-temporal Dementia
- Vascular Dementia
- Parkinson's Disease
- Mixed Dementia

Reversible
- Depression
- UTI and dehydration
- Medication side effects
- Excess use of alcohol
- Thyroid problems
- Vitamin deficiencies
- Delirium
Dementia: The Medical Stuff

Dementia with Lewy Bodies (DLB)

Progressive cognitive decline, combined with:

- “Fluctuations” in alertness and attention: Frequent drowsiness, lethargy, lengthy periods of time spent staring into space, disorganized speech
- Recurrent visual hallucinations
- Parkinsonian motor symptoms, such as rigidity
- People may also suffer from depression.

- Caused by build-up of bits of alpha-synuclein protein Lewy bodies in brain neurons
- Lewy bodies often also found in the brains of people with Parkinson’s and Alzheimer’s diseases.
- DLB usually occurs sporadically, in people with no known family history of the disease.
Frontotemporal Dementia

Umbrella term for rare disorders that primarily affect the frontal and temporal lobes of the brain

- Dramatic changes in personality, socially inappropriate behavior, impulsive or emotionally blunted, loss of ability to use and understand language
- Occurs typically between the ages of 40 and 70.
- Memory deficits not as prominent in the early stages compared to Alzheimer’s Disease

- Portions of frontotemporal lobes atrophy, or shrink.
- In some cases, protein known as ‘tau’ collects in neurons known as ‘Pick bodies’ (Pick’s Disease)
- More commonly, there is an accumulation of cell protein, Ubiquitin that attaches to another protein called TDP-43, which has a fundamental role in the nuclei of brain cells.

Alzheimer’s Disease

- Most common type (60-80%)
- Modern medical description by Alois Alzheimer in 1906, who found plaques and tangles in the brain
- Rare in earlier times because few people lived to a very old age
Alzheimer’s Disease: Epidemiology

- 5.4 million Americans living with Alzheimer’s disease
- 5.2 million are age 65 or older
- One in nine people 65 or older has Alzheimer’s disease
- Someone in America develops Alzheimer’s every 67 seconds
- By mid century, number is projected to be every 33 seconds
- 60% of caregivers rate emotional stress as high or very high
- Kills more people than breast and prostate cancer combined

(Alzheimer Association website. 2017 http://www.alz.org/facts/#prevalence)

Alzheimer’s Disease: Brain Changes

- Cells die in vital areas of the brain as the result of plaques and neurofibrillary tangles
- The cortex shrivels up, damaging areas involved in thinking, planning and remembering.
- Shrinkage is especially severe in the hippocampus, an area of the cortex that plays a key role in formation of new memories

- Communication between parts of the brain is greatly reduced
Alzheimer’s Disease: Amyloidosis - Aβ peptides

- **Amyloid**: Protein fragments normally produced, deposits in tissue/organ
- **Amyloid precursor protein** (APP): Protein expressed in many tissues and concentrated in the synapses of neurons.
  - Primary function is not known, implicated as a regulator of synapse formation, neural plasticity and iron export.
- **Beta amyloid (Aβ)**: Protein fragment snipped from APP, in healthy brain, and broken down and eliminated.
- **Amyloidosis**: Disease caused by accumulation of amyloid fibrils
- **Alzheimer's disease**: Associated with increased production and aggregation of amyloid-b (Ab) peptides
- The abundance and solubility of Aβ peptides are critical determinants of amyloidosis in Alzheimer's disease (AD). Wang et al, 1999

Tangles in the Brain

- **Tangles**: Destroy vital cell transport system.
  - In healthy areas: In healthy areas, transport system is organized in orderly parallel strands. Food molecules, cell parts and other key materials travel along the "tracks."
- **Tau**: Protein that helps the tracks stay straight.
  - In areas where tangles are forming, Tau collapses into twisted strands called tangles.
  - Tracks can no longer stay straight and disintegrate
  - Unbound Tau clumps in neurofibrillary tangles
- Nutrients and other essential supplies no longer move through the cells, which eventually die.
Genetic Disposition to Alzheimer’s Disease (AD)

- **Apolipoprotein E (APOE):** Gene mediates cholesterol metabolism
- Polymorphic, with three major alleles (variant forms): ApoE2, ApoE3 and ApoE4 (E4)
  - **E4 variant:** Largest known genetic risk factor for late-onset sporadic Alzheimer’s Disease in a variety of ethnic groups
  - Individuals with genotype ApoE4,4 (two E4 variants): Odds ratio of 14.9 of developing Alzheimer’s disease
  - Nigerian black people (Yoruba) have highest observed frequency of APOE4 allele but AD is rare among them (*Ann Neurol.* 2006 Jan; 59(1): 182–185.)
    - Yoruba have low incidence of heart disease & high cholesterol
  - Any combination of ApoE alleles, high serum total cholesterol and high blood pressure in mid-life are independent risk factors which can nearly triple the risk later development AD.

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Earlier Detection: FDG PET Scans

**National Coverage Determination (NCD) for FDG PET for Dementia and Neurodegenerative Diseases (220.6.13)**

Medicare covers FDG Positron Emission Tomography (PET) scans for either the differential diagnosis of fronto-temporal dementia (FTD) and Alzheimer’s disease (AD) under specific requirements; OR, its use in a Centers for Medicare & Medicaid Services (CMS)-approved practical clinical trial focused on the utility of FDG PET in the diagnosis or treatment of dementing neurodegenerative diseases. Specific requirements for each indication are clarified below:

An FDG PET scan is considered reasonable and necessary in patients with a recent diagnosis of dementia and documented cognitive decline of at least 6 months, who meet diagnostic criteria for both AD and FTD. These patients have been evaluated for specific alternate neurodegenerative diseases or other causative factors, but the cause of the clinical symptoms remains uncertain.

BTW, FDG = fluorodeoxyglucose, LOL
Earlier Detection: CSF Biomarkers

Update on hypothetical model of Alzheimer’s disease biomarkers

- **Measures of brain Aβ deposition:** These are cerebrospinal fluid (CSF) Aβ42 and position emission tomography (PET) amyloid imaging
- **Measures of neurodegeneration** where neurodegeneration is defined as progressive loss of neurons or their processes (axons and dendrites) with a corresponding progressive impairment in neuronal function. These are increased levels of CSF total (t-tau) and phosphorylated (p-tau) tau, hypo metabolism on FDG PET and atrophy on structural MRI. FDG PET and MRI follow a modality specific topology that is characteristic of AD.
- Our AD biomarker model is predicated on the assumption that biomarkers reflect specific pathophysiological processes
- Not currently covered by CMS. Considered experimental

Alzheimer’s Disease: Brain Changes and Behavior

- **Hippocampus most affected**
  - Loss of memory
  - Loss of spatial orientation
- **Frontal lobe**
  - Loss of executive function, inhibitions
- **Parietal and temporal lobes**
  - Disorientation in space
  - Loss of language
  - Loss of memory
- **Occipital Lobe**
  - Progressive loss of peripheral vision/ binocular vision
- **Hypothalamus**
  - Loss of temperature regulation
Alzheimer’s Disease: Brain Changes and Behavior

- **Semantic Memory**: Learned knowledge
  - Highly impacted in Alzheimer’s Disease (AD)
- **Episodic Memory**: Memories of things you have personally experienced
  - Highly impacted in AD
- **Procedural Memory**: Memories based on repetitive activity
  - Action based, associated with environmental cues, “landmarks”
  - Often present well into late stages of AD
    - Highly impacted in PDD/LBD
- **Emotions**: Amygdala is the emotional center
  - Last area to be damaged
- **Music and Rhythm**: Stored opposite the language center
  - Often undamaged
- **Early Stages**: Older memories intact; impaired recent memories

Alzheimer’s Disease: Primary Medications

1. **Cholinesterase Inhibitors**

- **Acetylcholine**: Acts as a neurotransmitter that stimulate nerves (aka cholinergic activity)
- **Cholinesterase**: Breaks down Acetylcholine to allow a neuron to return to its resting state after activation (normal)
- **Cholinergic activity** is reduced in Alzheimer’s Dementia (and other dementias).
- **Cholinesterase Inhibitors** retards breakdown of Acetylcholine
  - Exelon (Rivastigmine)
  - Galantamine (Rasadyne)
  - Aricept (Donepezil)
Alzheimer’s Disease: Primary Medications

2. Glutamate Regulator

- **Glutamate**: Normally involved in neural transmission in the brain during cognitive functions as learning
- **Excess Glutamate** release from damaged cells, leads to chronic overexposure to calcium, and speeds up cell damage in Alzheimer’s Disease
- **Glutamate Regulator**: regulates glutamate activity, prevent destructive chain of events by partially blocking the NMDA receptors
  - Memantine

Combining Both Types of Medications

- Namzaric

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## Alzheimer’s Disease: Primary Medications

<table>
<thead>
<tr>
<th>Drug name</th>
<th>Brand name</th>
<th>Approved For</th>
<th>FDA Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. donepezil</td>
<td>Aricept</td>
<td>All stages</td>
<td>1996</td>
</tr>
<tr>
<td>2. galantamine</td>
<td>Razadyne</td>
<td>Mild to moderate</td>
<td>2001</td>
</tr>
<tr>
<td>3. memantine</td>
<td>Namenda</td>
<td>Moderate to severe</td>
<td>2003</td>
</tr>
<tr>
<td>4. rivastigmine</td>
<td>Exelon</td>
<td>All stages</td>
<td>2000</td>
</tr>
<tr>
<td>5. donepezil and memantine</td>
<td>Namzaric</td>
<td>Moderate to severe</td>
<td>2014</td>
</tr>
</tbody>
</table>

http://www.alz.org/research/science/alzheimers_disease_treatments.asp

- Pharmacological Interventions currently **retard** progression of disease. They are not curative *(It figures)*
Early Characteristics and Warning Signs

- **Increasing Pattern of:**
  - Decreased competence, judgment and execution
    - Difficulty with “way-finding”
    - Difficulty with “buzzing in”
    - Coordinating Family meals
  - Driving mishaps; car damage
  - Missing appointments
  - Frequent Repeating
  - Loosing items
  - Word finding difficulty
  - Changes in behavior
    - Social withdrawal
- **Family Interviews**

Frequently Used Cognition Assessment Tools

**Mini Mental State Examination (MMSE – Folstein)**

- Widely used in medical practice
- Takes 5 to 10 minutes
- Takes educational level into account
- Is NOT sensitive to mild cognitive impairment
- Psychological Assessment Resources (PAR) claims official version is copyrighted and must be ordered only through it.

- Level of Impairment:
  - None: score = 24-30
  - Mild: score = 18-24
  - Severe: score = 0-17 [http://www.rehabmeasures.org/](http://www.rehabmeasures.org/)
Montreal Cognitive Assessment (MOCA)

- Gaining popularity
- More sensitive than the MMSE for early dementia
- Cutoff at 26 or greater = dementia not likely
- Extra point for less than 12 years education
- Takes 10 to 15 minutes

<table>
<thead>
<tr>
<th>Test</th>
<th>Sensitivity (95% CI)</th>
<th>Specificity (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCI</td>
<td>0.17 (0.06-0.34)</td>
<td>0.82 (0.66-0.89)</td>
</tr>
<tr>
<td>dementia</td>
<td>0.28 (0.15-0.39)</td>
<td>0.94 (0.83-0.98)</td>
</tr>
<tr>
<td>MMSE</td>
<td>1.00 (0.82-1.00)</td>
<td>0.50 (0.29-0.72)</td>
</tr>
<tr>
<td>MoCA</td>
<td>0.50 (0.29-0.72)</td>
<td>0.50 (0.29-0.72)</td>
</tr>
</tbody>
</table>

- The MoCA had better sensitivity (100%) identifying subjects with MCI who were diagnosed with dementia at a six month followup, than the MMSE with sensitivity of 25%.

http://www.rehabmeasures.org/
Frequently Used Cognition Assessment Tools

Other Short Assessments (thanks to Fox Rehabilitation)

1. The Short Blessed
2. Trails Making A
3. Clock Drawing
Frequently Used Cognition Assessment Tools

**TRAIL MAKING**

**PART B**

**CLOCK DRAWING TEST**
Clock Drawing

Frequently Used Cognition Assessment Tools

Staging Scales of Dementia

1. Allen Cognitive Scale
2. Fast Scale
3. Global Deterioration Scale

What’s the difference between staging scales and assessment tools?

Staging Scales of Dementia (Allen)

**Allen Cognitive Scale**  [http://www.allen-cognitive-network.org/]
- Developed by Claudia Allen, OTR/L
- Identifies six cognitive levels and 3 modes of performance/function within each level
  - Levels: 0 = coma, 6 = Independent in daily care, capable of learning
  - Modes: Attention, Motor performance, verbal performance

### Staging Scales of Dementia (Allen)

<table>
<thead>
<tr>
<th>ACL 0: Coma</th>
<th>Generalized Reflexive Actions</th>
<th>Total Assistance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total Assistance</td>
</tr>
</tbody>
</table>

ACL 1: Awareness  
Global cognition is profoundly impaired. Change in level of arousal is specific in response to external stimulus that produces pain or has instinctive survival value  
Total Assistance

ACL 2: Gross Body Movements  
Global cognition is severely impaired. Person’s awareness is limited to own postural actions (proprioceptive cues) to move body in space or overcome effects of gravity. Lack of awareness of effects that actions have on objects or other people.  
Maximum Assistance

ACL 3: Manual Actions  
Global cognition is severely impaired. Persons perform spontaneous manual actions in response to tactile cues. Repetitive actions demonstrate an awareness of material objects without awareness of cause and effect, end product, or goal. Attention span short (max 30 minutes) and actions are unpredictable.  
Moderate Assistance

ACL 4: Familiar Activity  
Global cognition is moderately impaired. Person aware of tangible cues (see and touch) and understands visible cause-and-effect relationships. Goal-directed actions demonstrate awareness of familiar end-product but fail to solve new problems, anticipate, or correct mistakes. No independent new learning, cannot invent new motor actions. Do not recognize errors unless clearly visible; may request help when mistakes are noticed. Attention span is usually good for up to one hour.  
Minimal Assistance

### Staging Scales of Dementia (Allen)

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stand by Assistance</td>
</tr>
<tr>
<td></td>
<td>Global cognition is mildly impaired. Person can learn through trial-and-error problem solving. Detects best effect by exploring distinctive properties of objects and trying different actions. Exer exercise poor judgment with no symbolic thought to plan actions or anticipate potential mistakes. Make hasty or impulsive decisions or make abrupt changes in their course of action. The determination of what is best may be made according to personal references or social standards. Can imitate a series of new directions, new learning is recognized and repeated during the process of doing an activity.</td>
</tr>
</tbody>
</table>

### Level 6: Planning New Activity  
No global cognitive impairment. Person anticipates errors and plans actions to prevent errors. Attention span is defined by desires and priorities. Spontaneous motor actions are preceded with a pause to think. Consider new information, imagine and reflect on possibilities, consider, and exhibit original approaches to task performance. Trial-and-error problem solving may be covert, and “good judgment” is demonstrated.  
None
Staging Scales of Dementia (Allen)

**Summary of the Allen Scale Modes of Performance**
Claudia K. Allen MA OTR FAOTA

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
<th>Pays Attention to</th>
<th>Motor Control of</th>
<th>Verbal Communication by</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Withdrawing from Stimuli</td>
<td>Inborn Sensory Stimulus</td>
<td>Inborn Withdrawal</td>
<td>Inborn Non-verbal Utterance</td>
</tr>
<tr>
<td>1.2</td>
<td>Responding to Stimuli</td>
<td>Any 1 of 5 Senses</td>
<td>Eyes, Nose, Mouth</td>
<td>Selective, Non-verbal Utterance</td>
</tr>
<tr>
<td>1.4</td>
<td>Locating Stimuli</td>
<td>Being Fed, Moving Sensory Stimuli</td>
<td>Head Turning, Tracking</td>
<td>Non-verbal Expression</td>
</tr>
<tr>
<td>1.8</td>
<td>Moving in Bed</td>
<td>Moving Trunk, Limbs</td>
<td>Head, Trunk, Legs, Arms</td>
<td>Non-verbal Expression</td>
</tr>
<tr>
<td>1.8</td>
<td>Raising Body Parts Protecting Self</td>
<td>Bullets</td>
<td>Point Transfer</td>
<td>Saying &quot;No&quot;</td>
</tr>
<tr>
<td>2.0</td>
<td>Overcoming Gravity</td>
<td>Comfort of Gross Body Movements</td>
<td>Sitting</td>
<td>Saying &quot;Yes&quot; or &quot;No&quot;</td>
</tr>
<tr>
<td>2.2</td>
<td>Standing and Righting Reactions</td>
<td>Security of Gross Body Movements</td>
<td>Standing, Righting Reaction</td>
<td>Naming Parts of Body</td>
</tr>
<tr>
<td>2.4</td>
<td>Walking</td>
<td>Freedom of Movement</td>
<td>Walking, Directing Movements</td>
<td>Using One Word to Start Communication</td>
</tr>
<tr>
<td>2.6</td>
<td>Walking to an Identified Location</td>
<td>Location of Freedom of Movement</td>
<td>Following Gross Motor Demonstration</td>
<td>Singing</td>
</tr>
</tbody>
</table>

Staging Scales of Dementia (GDS)


**The Global Deterioration Scale for Assessment of Primary Degenerative Dementia**

By Barry Reisberg, M.D., Steven H. Ferris, Ph.D., Mony J. De Leon, M.D., and Thomas Crook, Ph.D.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Cognitive State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No Cognitive Decline</td>
</tr>
<tr>
<td>2</td>
<td>Very Mild Cognitive Decline</td>
</tr>
<tr>
<td>3</td>
<td>Mild Cognitive Decline</td>
</tr>
<tr>
<td>4</td>
<td>Moderate Cognitive Decline</td>
</tr>
<tr>
<td>5</td>
<td>Moderately Severe Cognitive Decline</td>
</tr>
<tr>
<td>6</td>
<td>Severe Cognitive Decline</td>
</tr>
<tr>
<td>7</td>
<td>Very Severe Cognitive Decline</td>
</tr>
</tbody>
</table>
Staging Scales of Dementia (FAST)

Functional Assessment Staging Test (FAST)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Stage Name</th>
<th>Characteristic</th>
<th>Expected Untreated AD Duration (months)</th>
<th>Mental Age (years)</th>
<th>MMSE (score)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Normal Aging</td>
<td>No deficits whatsoever</td>
<td>--</td>
<td>Adult</td>
<td>29-30</td>
</tr>
<tr>
<td>2</td>
<td>Possible Mild Cognitive Impairment</td>
<td>Subjective functional deficit</td>
<td>--</td>
<td>20-29</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Mild Cognitive Impairment</td>
<td>Objective functional deficit interferes with a person’s most complex tasks</td>
<td>84</td>
<td>13+</td>
<td>24-28</td>
</tr>
<tr>
<td>4</td>
<td>Mild Dementia</td>
<td>SCA becomes affected, such as bill paying, cooking, cleaning, traveling</td>
<td>24</td>
<td>8-12</td>
<td>19-20</td>
</tr>
<tr>
<td>5</td>
<td>Moderate Dementia</td>
<td>Needs help selecting proper attire</td>
<td>6</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>6a</td>
<td>Moderately Severe Dementia</td>
<td>Needs help putting on clothes</td>
<td>4-8</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>6b</td>
<td>Moderately Severe Dementia</td>
<td>Needs help bathing</td>
<td>4</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>6c</td>
<td>Moderately Severe Dementia</td>
<td>Needs help toileting</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6d</td>
<td>Moderately Severe Dementia</td>
<td>Liminary incontinence</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>6e</td>
<td>Moderately Severe Dementia</td>
<td>Fecal incontinence</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>7a</td>
<td>Severe Dementia</td>
<td>Speaks 5-6 words during day</td>
<td>12</td>
<td>1,2,5</td>
<td>6</td>
</tr>
<tr>
<td>7b</td>
<td>Severe Dementia</td>
<td>Speaks only 1 word cleanly</td>
<td>18</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>7c</td>
<td>Severe Dementia</td>
<td>Can no longer walk</td>
<td>12</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7d</td>
<td>Severe Dementia</td>
<td>Can no longer sit up</td>
<td>12</td>
<td>0.5-0.8</td>
<td>0</td>
</tr>
<tr>
<td>7e</td>
<td>Severe Dementia</td>
<td>Can no longer smile</td>
<td>18</td>
<td>0.2-0.4</td>
<td>0</td>
</tr>
<tr>
<td>7f</td>
<td>Severe Dementia</td>
<td>Can no longer hold up head</td>
<td>12+</td>
<td>0-0.2</td>
<td>0</td>
</tr>
</tbody>
</table>


FAST Scale Evidence for PT Now

SRU DPT Student EBP Research Project

- **Reliability:** Intraclass correlation coefficient (ICC)
  - Two examiners alternately rated 16 subjects
    - Intra-rater = 0.86
    - Inter-rater = 0.87
  (Sclan et al. *International Psychogeriatrics*. 1992; 4 (supp.1))

- **Validity:** Concurrent Pearson Correlation with (N-464):
  - MMSE = -.71 (N= 464)
  - Global Deterioration Scale (GDS) = .75
### FAST Scale Evidence for PT Now

**SRU DPT Student EBP Research Project**  

#### Table 2a. Correlations between Clinical Assessments and Plaque Densities for AD Only

<table>
<thead>
<tr>
<th>Brain Region</th>
<th>FAST Spearman</th>
<th>GDS Spearman</th>
<th>MMSE Spearman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frontal</td>
<td>.30**</td>
<td>.43**</td>
<td>−.36**</td>
</tr>
<tr>
<td>p value</td>
<td>&lt;0.05</td>
<td>&lt;0.001</td>
<td>0.02</td>
</tr>
<tr>
<td>Temporal</td>
<td>.24**</td>
<td>.36**</td>
<td>−.41**</td>
</tr>
<tr>
<td>p value</td>
<td>0.06</td>
<td>0.006</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Parietal</td>
<td>.21**</td>
<td>.34**</td>
<td>−.32**</td>
</tr>
<tr>
<td>p value</td>
<td>0.12</td>
<td>&lt;0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>Hippocampal</td>
<td>.26**</td>
<td>.33**</td>
<td>−.34**</td>
</tr>
<tr>
<td>p value</td>
<td>&lt;0.05</td>
<td>0.01</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Entorhinal</td>
<td>.09**</td>
<td>.18**</td>
<td>−.15**</td>
</tr>
<tr>
<td>p value</td>
<td>0.59</td>
<td>0.17</td>
<td>0.33</td>
</tr>
<tr>
<td>Total</td>
<td>.22**</td>
<td>.32**</td>
<td>−.30**</td>
</tr>
<tr>
<td>p value</td>
<td>0.10</td>
<td>0.01</td>
<td>0.05</td>
</tr>
</tbody>
</table>

### FAST Scale Evidence for PT Now

**SRU DPT Student EBP Research Project**  

Correlations between Clinical Assessments and Tangle Densities for AD Only

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Staging Scales of Dementia: What to Expect?

- Hybrid synthesis of three scales for functionally clinical utilization

GDS/FAST Stage 1   ACL 6

I forget things because I’m stressed

No Cognitive Decline
Mental Age: Adult
ACL6: Planning New Activity
Independent
- Occasional short-term memory problems/loss is normal
- More stress associated with greater memory problems become
GDS/FAST Stage 2  ACL 5

**Uses compensatory strategies**

Possible Mild Cognitive Impairment
Mental age: Adult
ACL5: Learning New Activity
Stand by Assistance

- Generally memory problems addressed through *compensatory strategies*
- Subjective functional deficit
- Decision-making through trial and error
- No symbolic thought to plan or anticipate

---

GDS/FAST Stage 3  ACL 5

**I know, but nobody else does**

Mild Cognitive Impairment
Mental age: 12+
ACL5: Learning New Activity
Stand by Assistance

- Realizes memory errors not due to stress
- Compensatory strategies breaking down
- Interferes with complex tasks
- Determining best options based on personal references or social standards
- Social withdrawal starts to occur
Lost in Space: “What’s happening?”

Moderate Cognitive Decline,
Mild Dementia
Mental Age: 8-12
ACL 4: Familiar Activity
  Minimal Assistance
  • IADLs (Paying bills, cooking, cleaning, travelling) affected
  • May continue socially appropriate
  • May be depressed
  • Substantial social withdrawal, flattening affect
  • May get lost, “elope”
  • Others are aware

GDS/FAST Stage 4  ACL 4

Lost in Space: “What’s happening?”

Moderate Cognitive Decline,
Mild Dementia
Mental Age: 8-12
ACL 4: Familiar Activity
  Minimal Assistance
  • Learned “helplessness” can occur (3 Day Decline)
  • Initial incontinence may occur
  • Potential elopement risk
  • No Independent learning
  • Goal-directed actions lead to familiar end products, but...
  • No new problem solving
GDS/FAST Stage 5  ACL 4

Dressed & ready, with nowhere to go

Moderate Dementia
Mental Age: 5-7

ACL 4: Familiar Activity
  Minimal Assistance
  • Often no longer self-aware of cognitive decline
  • Less frustration, depression
    • More for caregiver
  • Cannot sustain independent, catastrophe-free, community survival
  • Needs help selecting proper attire
  • Maintains social graces and appearance

GDS/FAST Stage 5  ACL 4

Dressed & ready, with nowhere to go

Moderate Dementia
Mental Age: 7-5

ACL 4: Familiar Activity
  Minimal Assistance
  • Constant repetition, retains information briefly
  • Always “just visiting”
  • Follows goal directed actions but with limited attentions span (up to hour)
  • Does not recognize errors unless very visible
  • Potential balance deficits emerging
### GDS/FAST Stage 6

**Let’s Get Relaxed**

**ACL 3 and ACL 2**

Moderately Severe Dementia (broad range)

Mental age: 5 -2

ACL 3: Manual Actions

ACL 2: Gross Body Movements

Moderate to maximal assistance

- Cannot accomplish basic ADL
  - First sign dressing, disheveled
  - Progressive decline in bathing, washing, grooming
  - Requires assist to regulate or accommodate to temperature

- Progressive incontinence and continence issues (90 second rule)

- Gait pattern: Small step length – shuffle

- Transfers: Difficult, risky

---

### GDS/FAST Stage 6

**Let’s Get Relaxed**

**ACL 3 and ACL 2**

Moderately Severe Dementia (broad range)

Mental age: 5 -2

ACL 3: Manual Actions

ACL 2: Gross Body Movements

Moderate to maximal assistance

- Visual changes:
  - Lose peripheral vision
  - Visual gaze drops
  - Depth perception erodes

- Repetitive actions without awareness of cause or goal

- Aware of and responds to tactile and proprioceptive cues

- Inertia

- Egocentric
GDS/FAST Stage 7  ACL 1

If it looks, feels or tastes good, I’ll do it

Severe Dementia
Mental age: 1-0
ACL 1: Awareness
Total Assistance
- Dominated by senses
- Not all behaviors are self evident (moaning could be pain or self entertainment)
- Unable to express needs verbally
- Physically dependent
- Progressives to poor trunk control, primitive reflexes
- Responds to survival value stimulus

Specific Interventions and Goals
International Classification of Functioning, Disability and Health (WHO, 2001)
Specific Interventions and Goals
International Classification of Functioning, Disability and Health (WHO, 2001)

I forget things – because I am stressed

Intervention
- Typically referred to PT for other reasons
- Screen
  - Cognition: (Short Blessed)
  - Dynamic Balance (TUG, DGI, 4 Stage Balance Test)
  - Dual Tasking for higher challenge
  - Increase speed to assess power
  - Functional Strength (30sec STS, Arm Curl)
  - Posture (Occiput to Wall Distance)
  - Endurance (6 or 2 min walk)
  - Gait Speed

Interventions and Goals: GDS/FAST Stage 1    ACL 6

No Cognitive Decline
Mental Age: Adult
ACL6: Planning New Activity
Independent
Interventions and Goals: GDS/FAST Stage 1  ACL 6

I forget things – because I am stressed

**Intervention:**
- Determine Participation Priorities
- Consider Environmental and Personal Factors
  - Integrate strength and balance training into daily functional activities ([Clemson, BMJ 2012;345:e4547 doi: 10.1136/bmj.e4547](http://www.bmj.com/content/bmj/345/bmj.e4547.full.pdf))
- Utilize activities that stimulate (with structure) multiple systems - Visual - Auditory - Somatosensory - Basal ganglia, SMA

**Goals**
- Establish baseline gold standard
  - For future reference
  - To justify medical necessity

Interventions and Goals: GDS/FAST Stage 2  ACL 5

**Uses Compensatory Strategies**

**Intervention**
- Screens may illuminate subtle changes
  - Cognition
  - Balance
  - Gait speed
- Capitalize on compensatory strategies to foster movement
  - Routines (park in same spot, put keys in refrigerator, cane next to door)
  - Lists (“turn on slim and six”)
  - “Pill box” binder for Home Exercise Program
- Community Activities that are challenging and fun
  - Line dancing
  - Power Exercises *(working on ideas)*
- Proactive home safety strategies and precautions

**Possible Mild Cognitive Impairment**
- Mental age: Adult
- ACL-5: Learning New Activity
- Stand by Assistance
Interventions and Goals: GDS/FAST Stage 2  

Uses Compensatory Strategies

Possible Mild Cognitive Impairment
Mental age: Adult
ACL5: Learning New Activity
Stand by Assistance

Balance Considerations

• Provide insight into deficits without overwhelming
• Incorporate strengthening and balance components into routine activities
  – Laundry down steps (if safe, with or without assistance of partner or caregiver)
  – Carrying groceries, helping to put dishes away
  – Dancing, bowling, singing in choirs
• Posture awareness and remediation
  - Impairment level
  - Yoga

Sample Goals for Stage 2

• Caregiver will verbalize understanding of environmental adaptations to eliminate clutter and minimize fall risk
• Patient will ambulate independently outdoor uneven surfaces for >1,000 feet without loss of balance during house care activities (participation)
• Patient and/or caregiver will adhere to home physical activity program to maintain activity levels consistent with AHA guidelines
• Objective measures on standardized tests (e.g. TUG, 6 minute walk, sit to stand)
I know, but nobody else does

Interventions

• Screens illuminate more significant changes
  • Early gait deficits and falls
  • Dual tasking difficulties
• Caregiver Education critical now because
  • Compensatory strategies may not work consistently
  • “I know but nobody else does”
• Driving considerations
  • Familiar routes
  • New routes
  • When familiar routes become new routes (yikes)
  • Increased incidences of fender benders, scrapes, accidents

Interventions

• Begin the conversation with caregiver
  • Probably suspects – difficult, perhaps refer
• Consider alternative strategies for communication and reminders
  • Color coding, signs.
  • Consult Occupational Therapy
  • “Pill box” binder for Home Exercise Program
• **Patient is still capable of learning**
  • Repetitive routines crucial at this stage for later
• Community Activities that are challenging and fun
• Medications effective at early stage: Exelon and Aricept
Interventions and Goals: GDS/FAST Stage 3  ACL 5

I know, but nobody else does

Interventions

• Adapt environment to make movement easy
  • Cushions on favorite chairs to raise seat height
  • Hand rails on stairs
  • Grab bars near showers, toilet, bathroom sink
  • Stander security pole near bed

• Looking Ahead
  • Introduce concept of new devices (rollator walker, stair glides)
  • Introduce new strategies for bed mobility (supine to sidelying to sit)
  • Community Activities that are challenging and fun
  • **Anything** that avoids inertia

Mild Cognitive Impairment
Mental age: 12+
ACL5: Learning New Activity
Stand by Assistance

Interventions

• Balance (as in fall risk) Considerations
• Fall risk greater, education critical
• Incorporate safety equipment and protocols into all functional activities
  • Stair rails
  • Hand rails in bathroom
  • Clear pathway (good luck)
Sample Goals for Stage 3

- Caregiver will verbalize understanding of potential and progression of Dementia process
- Patient and caregiver will transition/tolerate use of alternative devices (be specific about device and activity)
- Patient and/or caregiver will adhere to home activity program to maintain physical activity levels consistent with AHA guidelines
- Objective measures on standardized tests (e.g. TUG, 6 minute walk, sit to stand, posture)
  - With alternative devices or adaptations

Caregiver Education

- On a serious note, encourage caregivers to seek support as early as possible
Interventions and Goals: GDS/FAST Stage 4

Lost in Space: What’s Happening?

Interventions

Screening

- Medications: May be on Aricept, Exelon, Razadyne
  - Side effects: Headache, constipation, dizziness, skin irritation
- Depression prevalent, increased: Physical activity may mitigate
- Cognition: Short Blessed, clock drawing
- Balance: Utilize simple standard test: (TUG, DGI, Romberg)
- Assess functional activities focusing on burden of care
  - Highlight assistance of spouse, caregiver
  - Duration of each task (forever...)
  - Document and differentiate **types of assistance** (e.g., min physical, mod verbal)

Interventions and Goals: GDS/FAST Stage 4

Lost in Space: What’s Happening?

Interventions

- Have the discussion about Senior Living Community (SLC) Placement
  - Discussion points: Health of spouse, family and community resources, type of home (will discuss more later)
- To remain at Home:
  - Safety adaptions: Wearable alert device, lighting, wandering strategies, bathroom safety
  - Utilize signs (pictures) and landmarks to facilitate spatial awareness. **Optimal color**
  - Consider if these can be translatable to new environment
- Consult Speech Language Pathology (SLP) to assess swallowing
Lost in Space: What’s Happening?

Interventions

- Use repetitive, relevant, familiar tasks
  - No independent learning per Allen
  - But might be conditioned to repetitive motor experiences
    - e.g., Sit to stand with forward COG and arm rests
- Optimize all sensory systems
  - Transfer sit to stand example
  - Minimize toxic and irrelevant distractors (TV, radio noise, annoying people)
  - Utilize pleasant and incentivizing facilitators (music, cooking smells (olfactory may be diminished), colors, circumstance validation, pleasant familiar pictures)

Future Discussion about Placement

- Moving results in immediate decline in functional level
  - Learned helplessness
- “Just visiting”
- Minimized through
  - Advance orientation and integration
  - Way finding
  - Familiar objects and layout from home
- May lead to depression and anxiety
**Interventions and Goals: GDS/FAST Stage 4**  
ACL 4

**Lost in Space: What’s Happening?**

**Sample Goals**
- Intervention focus shifts away from patient independence
  - Patient activity always requires assistance
  - Caregiver performance with independence
- Patient will ambulate 500 feet from bedroom to dining room, using a Rollator walker with minimal physical assistance and verbal cues of caregiver
- Patient will ascend/descend 12 steps from bathroom to living room with a cane and railing, with minimal physical assistance and moderate verbal cues of caregiver
- Caregiver will assist patient to adhere to home activity program safely consistent with AHA guideline

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**Interventions and Goals: GDS/FAST Stage 5**  
ACL 4

**Dressed and Ready, with Nowhere to Go**

**Typical Profile**
- Likely progressed to Namenda (if still on Aricept, Exelon, may be too long and ineffective)
- Unaware of their dementia (in the moment)
- Dependent to live
- No recall of relatively recent information (grand children, death of friends)
- Disoriented to time and place
- Can’t travel independently but may wander away
- Might have trouble picking out appropriate clothes
  - Mismatched shoes
### Interventions and Goals: GDS/FAST Stage 5

**Dressed and Ready, with Nowhere to Go**

**Typical Profile**

- Beginning of visual field loss
- Fall risk
- Know spouse and children
- Can eat, dress, and often toilet after set-up
- Act and converse appropriately
- Enjoy social activities, music, singing, dancing
- Mobile

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**Intervention Strategies**

- Get into the individual's visual field **first**
- Cues to move slowly, gentle voice
- Employ situation-specific and purposeful strategies
- Use old photographs, familiar objects
- Modify environment to increase shape and color contrast
  - Tape on grab bars
  - Strategic placement of grab bars
  - Enhance lighting
  - Eliminate clutter
  - Eliminate access to heat sources, medication, cigarettes
Interventions and Goals: GDS/FAST Stage 5  

Dressed and Ready, with Nowhere to Go

Intervention Strategies
- Change to more stable ambulatory device
  - Should be familiar from earlier stage
  - Rollator walker
- Caregiver education to provide much assistance
- Caregiver counseling:
  - Don’t correct, don’t get mad
  - Seek assistance and support
- Home activity program
  - Caregiver led
  - Music
  - And familiar simple tasks

Sample Goals for Stage 5
- Caregiver will transfer patient sit to stand, bed to chair safely and independently
- Caregiver will assist patient to ambulate 500 feet from bedroom to dining room with appropriate device safely and independently
- Caregiver will assist patient in adhering to home physical activity program daily

Moderate Dementia  
Mental Age: 5-7
ACL 4: Familiar Activity  
Minimal Assistance
Let’s Get Relaxed

Typical Profile

- Gait deviation, motor coordination, significant
- Visual perceptual skills degrade, include depth perception loss
- Poor kinesthetic awareness (unaware of chair location during turning)
- Startles easily
- Still wanders
- Responds better to tactile and visual cues
- Needs more time (90 second rule)
- Sexual urges
- Increased physical sensitivity

Interventions and Goals: GDS/FAST Stage 6  ACL 3 & ACL 2

Moderately Severe Dementia (broad range)
Mental age: 5 - 2
ACL 3: Manual Actions
ACL 2: Gross Body Movements
Moderate to maximal assistance

Interventions and Goals: GDS/FAST Stage 6  ACL 3 & ACL 2

Let’s Get Relaxed

Typical Profile

- Pain: Pain Assessment in Advanced Dementia (PAINAD)
  https://www.healthcare.uiowa.edu/igec/tools/pain/PAINAD.pdf
Interventions and Goals: GDS/FAST Stage 6  ACL 3 & ACL 2

Let's Get Relaxed

**Intervention**
- Primarily caregiver training
- Position in patient’s view (on side 30°)
- Cue slowly, step by step to initiate task
  - Moderate and modify tactile cues and assistance
  - To accommodate decreased kinesthetic awareness and cognition
- Ambulation on level surfaces and stair still possible with assistance
  - Employ safe precautions
  - Most stable assistive device
  - Remove distractions and potential physical hazards
  - Expect agitated and fearful behavior

---

Interventions and Goals: GDS/FAST Stage 6  ACL 3 & ACL 2

Let’s Get Relaxed

**Interventions**
- Caregiver education
  - Don’t correct
  - Expect agitation and fear
  - Don’t get mad
  - Seek assistance and support

*Please*
Interventions and Goals: GDS/FAST Stage 6  ACL 3 & ACL 2

Let’s Get Relaxed

Sample Goals
• Caregiver will transfer patient sit to stand, bed to chair safely and independently
• Caregiver will assist patient to ambulate 50 feet from bed to wheelchair with appropriate device independently
• Caregiver will follow home physical activity program daily to avoid range of motion loss, wound risk
• Wound care and Range of Motion (e.g. contracture goals) prevention goals

Interventions and Goals: GDS/FAST Stage 7  ACL 1

If It Looks Good or Feels Good, I’ll Do It

Typical Profile
• Patient’s cognition at level of child
• Driven by basic tactile and sensory needs
• Expect inertia
• May be ambulatory, but a great fall risk

Intervention
• Continued Caregiver Education
• Situation and circumstance specific
• Basic ADLs, bed mobility
• Chair and bed positioning for skin integrity
• DME assessment
• Home activity program for maintenance
Sample Goals for Stage 7

- Caregiver will transport patient from bed to/from chair with appropriate device (e.g., Hoyer lift) independently and safely with minimal patient agitation
- Caregiver will utilize protective equipment (e.g., hip protector) to enable safe mobility and transfers

Communication Strategies: Basic Concepts

**Working with Individuals with Cognitive Impairment**

- Control the environment
- Speak slowly, clearly, simply, and respectfully
- Speak from your diaphragm
- Talk less, listen and watch more
- Don’t interrupt unless it’s the 3rd time (personal suggestion)

**Early stages**

- Supplement instruction with pictures and written simple words
- Ask individual to read, repeat and demonstrate
- Be patient, don’t correct error or jump in unless there is risk of injury
- Wait for evidence of processing
- Avoid multiple instructions
- Avoid instructions too much in advance
Communication Strategies: Basic Concepts

Working with Individuals with Cognitive Impairment

- **Mid to Later stages**
  - Ask “yes” or “no” questions. For example, “Would you like some coffee?” rather than “What would you like to drink?”
  - Don’t correct (whose reality is it?)
  - Acknowledge and validate
  - Distract and validate
  - Answer questions
    - Over and over
    - Then distract and validate
  - Supplement verbal instruction with tactile cues and visual cues ("Errorless Learning" [http://pxpinc.net/ErrorlessLearning](http://pxpinc.net/ErrorlessLearning))
Communication (Per Teepa Snow, OTR/L)

Communication Strategies: Basic Concepts

Working with Caregivers (Eng experience only)

- **Early Stage**
  - Questions mostly
  - Paraphrase and validate
    - Try to focus organize caregiver priorities
  - Present options not recommendations
  - Address denial gently by re-articulating discrepancies
  - For Instruction:
    - Simple
    - Allow caregiver credit of knowing (even if he/she doesn’t know)
    - Seek feedback
Communication Strategies: Basic Concepts

Working with Caregivers (Eng experience only)

- **Mid to Late Stage**
  - Acknowledge changes
  - Acknowledge stress, anxiety
  - Allow venting
  - Provide options and resources (“do you know about...”)
  - For Instruction:
    - Simple
    - Allow caregiver credit of knowing (even if he/she doesn’t know)
    - Focus on body mechanics
    - Seek feedback

Documentation Strategies

- Show skilled intervention
- Emphasize objective data
  - Particularly itemizing level of assistance
  - Distinguish between different types of assistance
  - Verbal and physical may progress or decline differently
- Utilize standard tests frequently
- Be specific about activities
  - How many trials or repetitions
  - Explain why extra time/ trials are needed (“secondary to...”)
- Document progress or decline from baseline
  - In terms of mobility dependence
  - In terms of balance and fall risk
  - In terms of endurance
- Focus on caregiver safety, level of assistance and progress
Recent Research

**Vitamin D deficiency as a risk factor for dementia: a systematic review and meta-analysis**

(Sommer et al. BMG Geriatr. 2017 Jan 13;17(1):16.)

- **No studies** found investigating the association between sunlight exposure and dementia risk. **Six cohort studies provided data** on the effect of serum vitamin D concentration on dementia risk. A **meta-analysis of five studies showed a higher risk for persons with serious vitamin D deficiency** compared to persons with sufficient vitamin D supply.
- The strength of evidence is very low due to the observational nature of included studies and their lack of adjustment for confounders (e.g. ApoE ε4 genotype)...
- The results show that **low vitamin D levels might contribute to the development of dementia.**

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Recent Research

**Resilience to Alzheimer’s disease: the role of physical activity.**


- **Comprehensive PubMed search** was conducted to identify studies about the role of exercise in AD resiliency.
- **Seventy-three studies were included.** Five papers defined Alzheimer’s resilience, 15 papers brain resilience, five cardiovascular resilience, one metabolic resilience, 11 mitochondrial resilience, and 7 exercise resilience. Other twenty-six paper were identified from reference list of authors’ knowledge.
- **Conclusion:** Knowing that disturbances in brain, neuroendocrine, vascular and mitochondria metabolism are important events in neurodegeneration and dementia development, **the ability of exercise to trigger adaptive mechanisms might represent an important non-pharmacological strategy to improve resilience to AD.**
Recent Research

Physical Activity and Alzheimer’s Disease: A Systematic Review.

- The review limited to prospective observational & intervention studies.
- Twenty-four studies met the inclusion criteria. The number of participants ranged from 176 to 5,698.
- Physical activity was inversely associated with risk of AD in most studies (n = 18). Leisure-time physical activity was particularly protective against AD, but not work-related physical activity.
- The risk of bias assessment showed that overall quality of evidence was moderate for 16 and low for 8 studies.
- Beyond all the available general recommendations for health promotion, current evidence does not allow to draw specific practical recommendations concerning the types, frequency, intensity, or duration of physical activity that may be protective against AD.

Recent Research

Physical Exercise Moderates the Relationship of Apolipoprotein E (APOE) Genotype and Dementia Risk: A Population-Based Study

- We assessed the interactive relationship of apolipoprotein E (APOE) genotype and physical exercise on dementia risk over a 5-year period in 1,646 older adults.
- Physical exercise moderated the relationship between genotype and dementia (p<0.01).
- For APOE e4 non-carriers, the odds of developing dementia were higher in non-exercisers than exercisers.
- For APOE e4 carriers, the odds of developing dementia were not significantly different between non-exercisers and exercisers.
- Given that most individuals are not at genetic risk, physical exercise may be an effective strategy for preventing dementia.
**Recent Research**

**Exercise Prevents Amyloid-β-Induced Hippocampal Network Disruption by Inhibiting GSK3β Activation.**

- Tested whether voluntary exercise changes hippocampal population activity and prevents its alteration in the presence of Aβ...
- We found that the hippocampal population activity recorded in slices obtained from mice that exercised voluntarily (with free access to a running wheel for 21 days) exhibits higher power and faster frequency composition than slices obtained from sedentary animals.
- Moreover, the hippocampal network of mice that exercised becomes insensitive to Aβ-induced inhibition of spontaneous population activity.
- We conclude that voluntary exercise produces a lasting protective state in the hippocampus *(in mice).*

**Recent Research**

**Cerebrospinal Fluid Amyloid Beta and Tau Concentrations Are Not Modulated by 16 Weeks of Moderate- to High-Intensity Physical Exercise in Patients with Alzheimer Disease**
(Steen et al. Dement Geriatr Cogn Disord, 2016;42(3-4):146-158. Epub 2016 Sep 20)

- ...elucidate the effect of 16 weeks of moderate- to high-intensity physical exercise on the biomarkers of AD/amyloidogenic pathway
- 53 patients with AD participated.
- Analyzed cerebrospinal fluid samples for Aβ species, total tau (t-tau), phosphorylated tau (p-tau) and soluble amyloid precursor protein (sAPP)
- found no effect of 16 weeks of physical exercise on selected biomarkers
- Our findings suggest that the possible effect of physical exercise on cognition in patients with AD is **not due** to modulation of Aβ, t-tau, p-tau and sAPP species
Recent Research


Table 1

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<th>GROUP</th>
<th>CASE</th>
<th>NUMBER OF ABDOMINAL WATERS</th>
<th>NUMBER OF TRUE ADULTS</th>
<th>ENHANCED EXECUTIVE FUNCTION</th>
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Recent Research

Local Research

- Pittsburgh Alzheimer’s Disease Research Center (ADRC)
- University of Pittsburgh Department of Psychology