Lifestyle and Alzheimer’s Disease in Down Syndrome

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Alzheimer’s Disease

• Most common type of dementia

• 6.5 million Americans
  • 10% of individuals 65 yrs+
  • 120,000 people with Alzheimer’s disease in Wisconsin

• By 2050, estimated that 12.7 million Americans aged 65 yrs+ with Alzheimer’s disease
Down Syndrome and Alzheimer’s Disease

Sporadic late onset:
• Rare before age 50 years
• 80% of those affected aged 75 yrs+

Autosomal dominant populations
• Amyloid precursor protein (APP) on chromosome 21
• Presenilin 1 (PSEN1) on chromosome 14
• Presenilin 2 (PSEN2) on chromosome 1
• Mean age of onset in 40s and 50s

Down syndrome:
• 90% lifetime prevalence

Iulita et al., 2022; Alzheimer’s Association 2023
Timing of Alzheimer’s Disease in Down Syndrome

Cognitive decline is related to PET biomarkers of amyloid-beta (Aβ) and, especially, tau PET

Hartley et al., 2020; Hartley et al., 2022
Timing of Alzheimer’s Disease in Down Syndrome

Mean age prodromal Alzheimer’s disease ≈ 54 yrs

Meta-analysis
Estimated mean = 53.8 yrs

BUT, making up mean is 30+ yr range

Average age-trajectory in cognitive decline (Hartley et al., 2023)
Are modifiable aspects of lifestyle related to variability in the timing of Alzheimer’s Disease in Down syndrome?
Employment Activities

**Assembler (n = 2)**
Assembly line job

**Bakery Helper (n = 1)**
Helps bake; lift and carry

**Bracelet Maker (n = 1)**
Makes bracelets

**College Student (n = 2)**
Attends college

**Dishwasher (n = 5)**
Washes Dishes

**Dry Cleaning Attendant (n = 1)**
Gets stains out of clothes

**Nursery School Attendant (n = 2)**
Monitors and plays with children

**Janitor (n = 15)**
Cleaning; minor maintenance

**Scanner/Bagger, grocery store (n = 5)**
Scans items; puts items into bags

**Walmart Associate (n = 1)**
Greets; assists customers

**Garment Sorter (n = 1)**
Sorts merchandise; hangs clothes

**Hand Packager (n = 5)**
Folds and packages items

**Office Helper (n = 5)**
Shreds, sorts, creates labels, filing

**Warehouse Worker (n = 1)**
Sorting, organizing

**Library Aid (n = 2)**
Put books away; inventory, organize books

**Mailroom clerk (n = 1)**
Sorts and delivers mail, makes up gift packages

**Sheltered Workshop (n = 27)**
Sorting, assembly, shredding, cleaning, packaging

**Store Clerk (n = 1)**
Stocking and shelving items

**Fast Food Worker (n = 4)**
Cleans, stocks, clears dishes
Employment Activities

Data Complexity

People Complexity

Things Complexity

Most Complex

Least Complex

N = 87 Adults with Down syndrome (25-56 yrs)

Piro-Gambetti, Schworer et al. 2023
Does Employment Protect Against Cognitive decline?

<table>
<thead>
<tr>
<th></th>
<th>Change in Memory</th>
<th>Change in Dementia Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cued Recall Total</td>
<td>Cued Recall Intrusions</td>
</tr>
<tr>
<td><strong>Data Complexity</strong></td>
<td>r=-.007</td>
<td>r=-.026</td>
</tr>
<tr>
<td></td>
<td>p=.953</td>
<td>p=.836</td>
</tr>
<tr>
<td><strong>People Complexity</strong></td>
<td>r=.023</td>
<td>r=-.075</td>
</tr>
<tr>
<td></td>
<td>p=.853</td>
<td>p=.545</td>
</tr>
<tr>
<td><strong>Things Complexity</strong></td>
<td>r=.280</td>
<td>r=-.214</td>
</tr>
<tr>
<td></td>
<td>p=.022</td>
<td>p=.082</td>
</tr>
</tbody>
</table>

N = 87; Partial correlations controlling for age, intellectual disability level & hours spent in employment per week.
Are Leisure Activities Related to the Timing of Alzheimer’s Disease in Down syndrome?

- Bowling
- Crafts
- Ipad
- Cooking
- Walking
- Swimming
- Games
- Movies
- Eating out
- Drawing
- Guitar
- Knitting
- Latch hook
- Reading
- Emailing
- Blogging

Mihaila et al., (2017, 2019)
Implications

• Employment complexity and leisure are modifiable aspects of lifestyle shown to alter the risk of Alzheimer’s disease and aging-related cognitive decline outside of Down syndrome (Andel et al., 2005; Kröger et al., 2008; Smart et al., 2014).

• Adults with Down syndrome who were involved in more complex employment in terms of *People* and *Things* evidenced less cognitive decline across 16-20 months than did adults with DS involved in no employment activities or less complex activities.

• Leisure activity -- especially cognitively stimulating and social activities -- related to less decline in memory across 3 yrs even in the face of early AD pathology.

• Efforts to alter social policy and design interventions that increase employment and leisure could potentially contribute to healthy cognitive aging for adults with DS.
## Physical Activity and Cognitive Performance

<table>
<thead>
<tr>
<th></th>
<th>Sedentary (% time)</th>
<th>Moderate (% time)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r</td>
<td>partial r</td>
</tr>
<tr>
<td>Cat and Dog Stroop Errors</td>
<td>0.305*</td>
<td>0.569**</td>
</tr>
<tr>
<td>Free Recall + Cued Recall</td>
<td>-0.113</td>
<td>-0.0233</td>
</tr>
<tr>
<td>Cued Recall Intrusions</td>
<td>0.107</td>
<td>0.0302*</td>
</tr>
<tr>
<td>VMI</td>
<td>-0.187</td>
<td>-0.404**</td>
</tr>
<tr>
<td>Block design</td>
<td>-0.276*</td>
<td>-0.465**</td>
</tr>
<tr>
<td>Purdue pegboard</td>
<td>-0.019</td>
<td>-0.194</td>
</tr>
<tr>
<td>DSMSE</td>
<td>-0.317*</td>
<td>-0.387*</td>
</tr>
<tr>
<td>DLD social</td>
<td>0.377**</td>
<td>0.417*</td>
</tr>
<tr>
<td>DLD cognitive</td>
<td>0.471**</td>
<td>0.572**</td>
</tr>
</tbody>
</table>

* P < .05; **P < .01. Partial r models controlled for age and premorbid ID level

Fleming et al., 2020
### Physical Activity and White Matter Impairment

<table>
<thead>
<tr>
<th></th>
<th>Sedentary (% per day)</th>
<th>Moderate (% per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r</td>
<td>Partial r</td>
</tr>
<tr>
<td>Superior longitudinal fasciculus</td>
<td>-0.182-0.387*</td>
<td>0.407*</td>
</tr>
<tr>
<td>Right Fractional Anisotropy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inferior longitudinal fasciculus</td>
<td>-0.183-0.387*</td>
<td>0.385*</td>
</tr>
<tr>
<td>Left Fractional Anisotropy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inferior longitudinal fasciculus</td>
<td>-0.158-0.419*</td>
<td>0.356*</td>
</tr>
<tr>
<td>Right Fractional Anisotropy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superior longitudinal fasciculus</td>
<td>0.073</td>
<td>0.400*</td>
</tr>
<tr>
<td>Right Mean Diffusivity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Partial rs control for age and premorbid ID. * P<.05  
Fleming et al., 2020
Stay Active

- Adults with Down syndrome engaged in more physical activity, and who are less sedentary, have better cognitive performance and higher white matter integrity.

- Social policy and interventions aimed at being active may have the potential to promote healthy cognitive and brain aging.

**Cat/Cow:** Increases the flexibility of the neck, shoulders, and spine.

**Side Stretches:** Lengthens the abdominal muscles, hips, and thigh muscles while improving flexibility in the spine.

**Stomach Twist:** Stretches the neck, chest, shoulders, and back. Opens up the hips and improves posture.

**Leg/Knee Lifts:** Activates quadriceps, hamstrings, calves, glutes, and hip flexors.
Acknowledgements

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Resources for Alzheimer’s Disease in People with Down syndrome

- [https://ndss.org/resources?topical=49](https://ndss.org/resources?topical=49)
  - NDSS (National Down syndrome Society) has a variety of resources about aging including a practical guidebook for caregivers and an informational resource on Alzheimer’s Disease and Down syndrome. The caregiver guide in particular has lots of practical tips for helping with different challenges associated with Alzheimer’s Disease.

  - This webinar provides information about Down syndrome and Alzheimer’s disease. Recommendations for managing these issues once they have arisen begins at (26:03).

- [https://adscresources.advocatehealth.com/assets/1/13/Orientation_Book.pdf?60](https://adscresources.advocatehealth.com/assets/1/13/Orientation_Book.pdf?60)
  - This template shows you how to create an orientation book, which can be helpful for anyone with dementia, but particularly for individuals with Down syndrome. This can help them remember important people and places in order to make everyday life less stressful for them.

- [https://www.amazon.com/Down-Syndrome-Dementia-Stud/Practice/dp/178963167X/ref=sr_1_7?crid=1HLL6ZEHPS7MX&keywords=alzheimer%27s+disease+and+down+syndrome&qid=1665521444&qu=eyJxc2MiOiIwLjAwIiwicXNhIjoiMC4wMCIsInFzcCI6Ij6lAuMDAifQ%3D%3D&refinements=p_n_condition-type%3A1294423011&rnid=1294421011&s=books&sprefix=alzheimer%27s+disease+and+down+syndrome%2Caps%2C113&sr=1-7](https://www.amazon.com/Down-Syndrome-Dementia-Stud/Practice/dp/178963167X/ref=sr_1_7?crid=1HLL6ZEHPS7MX&keywords=alzheimer%27s+disease+and+down+syndrome&qid=1665521444&qu=eyJxc2MiOiIwLjAwIiwicXNhIjoiMC4wMCIsInFzcCI6Ij6lAuMDAifQ%3D%3D&refinements=p_n_condition-type%3A1294423011&rnid=1294421011&s=books&sprefix=alzheimer%27s+disease+and+down+syndrome%2Caps%2C113&sr=1-7)
  - “Down syndrome and Dementia: A Guide for Family Members, Social and Health Care Staff and Students (Sharing Good Practice)” by Bob Dawson is a quick read but covers a great deal of information. Chapters include tips on communication and managing different specific challenging behaviors.