Lifestyle Variables and Age-Related Cognitive Changes

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Objectives

• Cognitive aging overview
• Cognitive reserve model of cognitive aging
• Cognitively stimulating activity and cognitive reserve
• Neural reserve
Cognitive Aging

• Cognitive impairment in old age (<65)
  ~ 10% dementia
  ~ 20% mild cognitive impairment
  ~ 20% with intact cognition but pathologic AD

• Rate of cognitive decline in old age associated with increased morbidity (e.g., disability, hospitalization) and mortality
Models of Cognitive Aging

• Normal and Pathological
  – Neuropathologic lesions related to all phases of cognitive aging, especially early phases.

• Cognitive/Neural Reserve & Pathological
  – Cognitive aging partitioned into variability related to pathology and residual variability (which is cognitive reserve)
Cognitive Reserve

Neuropathologic Lesions

Change in Cognitive Function
Lifestyle and Cognitive Decline

• Activity Frequency
  Cognitive activity
  Social activity
  Physical activity

• Personality
  Neuroticism
  Conscientiousness
  Purpose in life
Cognitively Stimulating Activity

• Measurement
• Association with cognitive outcomes
Cognitive Stimulating Activity

• Measurement
• Association with cognitive outcomes
• Direction of association
Cognitively Stimulating Activity

• Measurement
• Association with cognitive outcomes
• Direction of association
• Association with cognitive reserve
Rush Memory and Aging Project

- 578 deaths/1661 participants
- 456/578 (79%) brain autopsy
- Neuropathologic examination complete in first 440
- Exclusions:
  - 27 with dementia at baseline, 23 without longitudinal cognitive data, 83 missing cognitive activity data, 13 missing pathologic data
- Study group n = 294
  - Age at death  89.3 (5.9)
  - Education    14.4 (2.7)
  - % women      67.7
  - Years followed 5.8 (2.7)
Cognitive Reserve Hypothesis

• Cognitive Activity
  - late life
  - early life

• Neuropathological examination
  - amyloid
  - tangles
  - neocortical Lewy bodies
  - gross cerebral infarction
  - microscopic cerebral infarction
Cognitive Reserve Hypothesis

<table>
<thead>
<tr>
<th></th>
<th>residual variance</th>
<th>total variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuropathologic burden</td>
<td>-</td>
<td>33%</td>
</tr>
<tr>
<td>Late life cognitive activity</td>
<td>10%</td>
<td>7%</td>
</tr>
<tr>
<td>Early life cognitive activity</td>
<td>9%</td>
<td>6%</td>
</tr>
<tr>
<td>Early + late life cognitive activity</td>
<td>14%</td>
<td>10%</td>
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Childhood Cognitive Activity

Young Adulthood Cognitive Activity

Middle Age Cognitive Activity

Old Age Cognitive Activity
Figure 1 Composition of study cohort sampled from community population.

Longitudinal cognitive testing of population:

1 → 2 → 3 → 4 → 5

Clinical evaluation of different population subsets:

1 → 2 → 3 → 4 → 5

Composition of study cohort:

1,508 clinically classified
- 253 died before follow-up
- 98 lost to follow-up
- 1,157 with longitudinal cognitive function data from population interview
Neural Reserve

• Longitudinal neuroimaging studies
• Key neural circuits
  • Brainstem aminergic nuclei
Summary

• Cognitive impairment is common in old age
• Neuropathologic lesions traditionally associated with dementia
  – Related to all phases of cognitive aging
  – Account for <50% of variance in cognitive aging
• Level of cognitive activity across the lifespan accounts for substantial residual variability in cognitive aging
• Understanding the neurobiologic mechanisms linking patterns of activity to cognitive reserve may suggest novel strategies for optimizing cognitive function in older persons with chronic neurologic conditions