Reserve and Resilience

an epidemiologic approach using longitudinal cognitive testing and brain autopsy data

Data from the Honolulu-Asia Aging Study (HAAS, n=331) and the Nun Study (NS, n=288)

• Repeated testing with the Cognitive Assessment and Screening Instrument (CASI) or the CERAD battery.

• Neuropathology -- comprehensive brain autopsy, defining distributions and severities of dementia-associated lesions to define the total neuropathology burden:
  -- Alzheimer lesions: neocortical neuritic and diffuse amyloid plaques, neocortical neurofibrillary tangles.
  -- Lewy bodies (alpha synuclein) neocortex, brain stem, limbic.
  -- vascular ischemic injury: infarcts – large, lacunar and micro.
  -- hippocampal sclerosis, TDP-43 (LATE).
  -- brain weight, generalized brain atrophy.
definitions applicable to epidemiologic analyses

Reserve \(\rightarrow\) structural and functional resources existing prior to a pathologic assault or injury, and that define a “starting point” for decline, erosion, or degeneration due to the pathology.

Measurements of cognitive reserve are based on pre-morbid neuropsychologic testing or imputed cognitive competence attributable to primary intelligence, or to learned or cultivated abilities that provide more efficient, more redundant, or alternative (default) systems to support or augment accomplishment of cognitive tasks.

Measurements of brain reserve are based on pre-morbid brain structure or function, normal brain anatomy, including gray and white volumes, bicameral functions, corpus collosum thickness, reaction time, etc.

Resilience \(\rightarrow\) cognitive resilience is recognizable only with demonstrable neurologic injury or assault; it becomes apparent when the individual’s observed cognitive performance is (or was) less distorted or impaired than expected, given the type and severity of the neuropathology.

We view cognitive resilience as a dynamic phenomenon distinct from cognitive or brain reserves.
Epidemiologic and neuropathologic data measuring resilience

- **Concept**: resilience
- **Measure**: observed vs expected final cognitive score ratio
- **Operational definition**: A resilience index = observed final test score / expected final score, from a statistical model taking age at death, baseline test score (pre-morbid), interval last observed score to death, and the total neuropathologic burden based on 5 lesion types assessed at brain autopsy.