A Lifespan Perspective on Cognitive Reserve and Risk for Dementia

Matthew S. Panizzon\textsuperscript{1}, \textbf{Ida K. Karlsson}\textsuperscript{2}, Malin Ericsson\textsuperscript{2}, Marianne Nygaard\textsuperscript{3}, Margaret Gatz\textsuperscript{4}, Nancy L. Pedersen\textsuperscript{2}, & William S. Kremen\textsuperscript{1}

For the IGEMS Consortium

\textsuperscript{1}University of California, San Diego  
\textsuperscript{2}Karolinska Institutet (Department of Medical Epidemiology and Biostatistics)  
\textsuperscript{3}University of Southern Denmark  
\textsuperscript{4}University of Southern California
IGEMS consortium

- The Interplay of Genes and Environment across Multiple Studies (IGEMS) consortium
- Brings together twin studies of adult development and aging from Sweden, Denmark, Finland, Australia, the U.S.

- **Current study:**
  - Data from the Swedish Twin Registry
  - Led by Matt Panizzon at UC San Diego
Background and aims

- Higher education = well-established protective factor for dementia
- Higher education $\rightarrow$ cognitive reserve
- Causal association?
- Explained by higher cognitive abilities $\rightarrow$ higher education?

Karolinska Institutet – a medical university
Background and aims

• Higher education = well-established protective factor for dementia
• Higher education → cognitive reserve
• Causal association?
• Explained by higher cognitive abilities → higher education?

• Does education predict dementia if we account for early adulthood cognitive abilities?
Methods

- Swedish Twin Registry: Screening Across the Lifespan Twin (SALT) study, conducted 1998–2002
- Mean age: 52.7 (standard deviation: 5.6)

- Education information → International Standard Classification of Education (ISCED) system

- In addition: occupational complexity, adult socioeconomic status
Methods

- Linkage to the Conscription Register → cognitive abilities in early adulthood

- Dementia diagnoses: National healthcare registers, linkage through 2016
  → National Patient Register (inpatient + outpatient specialist care)
  → Causes of Death Register
  → Prescribed Drug Register (dementia medication, used as proxy for diagnosis)

- Cox proportional hazard model
  → Followed from age ≥50 to dementia diagnosis, death, or end of follow-up
Methods

![Diagram showing the relationship between education, occupational complexity, adult SES, general cognitive ability, late-life cognition (cognitive reserve), and dementia.]

Karolinska Institutet – a medical university
Results

**Young Adult GCA**

- Independent effect model: Hazard ratio (95% CI) 0.84 (0.75 – 0.94)
- Joint effect model: Hazard ratio (95% CI) 0.86 (0.76 – 0.99)

**Education (ISCED)**

- Independent effect model: Hazard ratio (95% CI) 0.88 (0.79 – 0.98)
- Joint effect model: Hazard ratio (95% CI) 0.95 (0.84 – 1.08)

Young adult general cognitive abilities: Continuous measure; mean 19.0 (SD 6.3)

Education (ISCED): Continuous measure, 5-point scale
Results

Occupational Complexity

- Independent effect model: Hazard ratio (95% CI) 0.90 (0.80 - 1.09)
- Joint effect model: 0.96 (0.85 - 1.08)

Adult SES

- Independent effect model: 0.86 (0.77 - 0.97)
- Joint effect model: 0.93 (0.82 - 1.05)

Occupational complexity: Continuous measure; mean 3.3 (SD 0.4)
Adult SES: Continuous measure; mean 46.2 (SD 21.3)
Discussion

• Lower education is one of the most well-established modifiable risk factors for ADRD

• Current study: Higher education → lower risk of ADRD

• However: No association when accounting for early adulthood general cognitive abilities

→ Supports confounding through general cognitive abilities
Discussion

- Further supported by similar findings for:
  - Occupational complexity
  - Adult socioeconomic status

- Findings align with prior work
  - Nygaard et al. *Influence of young adult cognitive ability on the association between lifetime education and later-life cognitive function – a study in Danish twins*. NKG, Thursday Ber2:P02; Poster tour: 12.45, Ber2:1.
Conclusion

• NOTE! Bidirectional association: Higher education → increased general cognitive abilities

• Early adulthood cognitive abilities robustly associated with lower risk of dementia, even when controlling for education, occupational complexity, or adult SES

• Education → dementia = downstream of general cognitive abilities (same for occupational complexity and adult SES)