Cognitive Reserve and Sex Differences in an Alzheimer's Disease Population

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Introduction

The Problem

- The progression of Alzheimer's disease (AD) can last for three to ten or more years, negatively impacting an individual's functioning and memory abilities[1].
- The rate of decline in cognitive abilities is not equivalent for all individuals. Some AD patients are able to function longer than others despite having the same presence of the disease[2].

Past Research

- This variability in rate of decline is potentially explained by the cognitive reserve theory (CR)[3].
- CR: theory that there are factors — such as degree of education — that allow individuals to prolong lucid memory functioning when facing the risk of suffering memory loss, or to compensate when in the midst of memory loss[4,5].
- In addition, variability might be explained by other demographic factors, as research has found that women perform better on verbal memory tasks and men perform better on visuospatial memory tasks[2].

Present Study

- The present study sought to:
  - 1) investigate relations between cognitive functioning and education within an AD sample
  - 2) analyze the impact of education was influenced by participant age and sex
- Hypotheses:
  - Higher levels of educational attainment will be related to better cognitive functioning
  - The relationship between educational attainment and cognitive functioning will vary by age and sex respectively, as indicated by an interaction effect

Method & Results

Participants

- Data were collected from 251 AD patients (M = 102, F = 149) that reside in Texas.
- Participants had an average age of 76.6 (SD = 8.1), and the majority (42.6%) of participants fell between the ages of 70 to 79. The sample was 90% Caucasian, and the majority of participants (34.3%) had a high school education.

Design and Measures

- *Predictor Variables:* CR Indicators
  - Educational Attainment: highest level of education completed
  - Sex (Due to the archival nature of the data, the variable was coded as binary)
  - Age
- *Outcome Variables*: Cognitive Functioning
  - Wechsler Memory Scale-IV (WMS-IV)[6]
  - Trail Making Test A and B[7]
  - Animal Fluency[8]

Procedure

- Data were collected through archival records from a neuropsychology clinic in Texas.
- Two-way ANOVA analyzes were conducted in SPSS to examine the differences between scores of memory, executive functioning, and verbal fluency based on the predictor variables: sex, education, and age.
- Bonferroni correction: $p < .007$

Predictor Variable	Outcome Variable	*F*-statistic, *p*-value
Age	Memory (WMS-IV Delayed)	(F = 2.374, p = .053)
	Executive Function (Trail Making B Errors)	(F = 3.705, p = .006)*
	Verbal Fluency (Animal Fluency)	(F = 3.961, p = .004)*
Sex	Memory (WMS-IV Delayed)	(F = .154, p = .695)
	Executive Function (Trail Making B Errors)	(F = 3.277, p = .072)
	Verbal Fluency (Animal Fluency)	(F = 9.058, p = .003)*
Education	Memory (WMS-IV Delayed)	(F = .651, p = .627)
	Executive Function (Trail Making B Errors)	(F = 2.258, p = .064)
	Verbal Fluency (Animal Fluency)	(F = 2.342, p = .056)
Age*Education	Memory (WMS-IV Delayed)	(F = .787, p = .674)
	Executive Function (Trail Making B Errors)	(F = .907, p = .540)
	Verbal Fluency (Animal Fluency)	(F = .788, p = .672)
Sex*Education	Memory (WMS-IV Delayed)	(F = 1.394, p = .237)
	Executive Function (Trail Making B Errors)	(F = 1.020, p = .398)
	Verbal Fluency (Animal Fluency)	(F = 2.339, p = .056)

Discussion

Findings

- Contrary to past literature and our hypothesis, we did not observe the classic effect of education among AD patients.
- The relationship between educational attainment and cognitive functioning did not appear to vary by age or sex respectively, in our sample.

Limitations

- Limitations of the present study include similarity of the sample demographics, including that participants were largely Caucasian and all data was gathered from a single clinic.

Future Research

- Future research should examine education as a CR factor in a more diverse sample — including those with other forms of dementia and memory disorders — and those from a wider range of racial and ethnic backgrounds.

Key Takeaways

- Age might be able to explain some of the variance of executive functioning performance in an AD sample.
- Congruent with past AD literature, men outperformed women on the Animal Fluency task, suggesting a sex difference on verbal fluency skills.

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