

# Variability in simulator driving speed may predict changes in executive function performance at 2-year follow-up in older adults.

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## Background

- The predicted rise in Alzheimer’s disease and related dementias (ADRD) emphasizes the importance of identifying early predictors of future ADRD-related cognitive decline
- Driving, a complex task of daily living, or subtle changes in driving behavior, may be an early predictor of ADRD-related cognitive change
- Amyloid, the pathological hallmark of AD, can be used to identify cognitively normal individuals at risk of cognitive decline, as amyloid deposits in the brain many years before symptom onset

### Project Objective

Explore whether baseline driving, or changes in driving over time, predict change in executive functions at two-year follow-up in cognitively normal older adults with known amyloid status.

## Methods

### Participants:

- $N = 48$  consensus diagnosed, cognitively normal adults aged 65+ who completed a 20-minute computer-based simulator drive and NIH-Toolbox Cognition battery at baseline and two-year follow-up

|                                                | Aβ negative<br>( $n = 27$ ) | Aβ positive<br>( $n = 21$ ) | Overall<br>( $N = 48$ ) |
|------------------------------------------------|-----------------------------|-----------------------------|-------------------------|
| Age                                            | 71.3 (5.19)                 | 72.9 (3.37)                 | 72.0 (4.51)             |
| Education                                      | 16.3 (2.66)                 | 17.2 (1.72)                 | 16.7 (2.32)             |
| City Variability (SD) of speed – Baseline      | 5.98 (.60)                  | 5.72 (.62)                  | 5.87 (.62)              |
| City Variability (SD) of speed – Raw Change    | -.09 (.51)                  | -.26 (.56)                  | -.16 (0.53)             |
| Highway Variability (SD) of speed – Baseline   | 2.69 (.80)                  | 2.37 (0.47)                 | 2.55 (.69)              |
| Highway Variability (SD) of speed – Raw Change | -.40 (1.09)                 | 0.14 (0.78)                 | -.16 (0.99)             |
| NIHTB Card Sort Change (uncorrected SS)        | 2.37 (4.09)                 | -0.81 (4.31)                | 0.98 (4.44)             |
| NIHTB Flanker Change (uncorrected SS)          | 2.30 (4.12)                 | 0.71 (2.83)                 | 1.60 (3.67)             |

**Table 1.** Descriptive statistics for demographic variables, driving behaviors at baseline, and raw change in driving behaviors over two years. Data are shown as mean (SD).

### Statistical Analysis: Hierarchical linear regression

- Covariates:
  - age, education, amyloid status
- Independent Variables:
  - highway and city simulated speed variability (SD) at baseline and raw change (follow-up – baseline)
- Dependent Variable:
  - composite executive function (z-score) change over two years
- Interaction:
  - amyloid status



**Figure 1.** Computer-based driving simulator.

## Results

Results revealed a main effect of age ( $p = .022$ ) and amyloid status ( $p = .031$ ) on change in executive functions. After controlling for age, education, and amyloid status, there was a trend-level main effect of change in the variability of city driving speed over two years ( $p = .066$ ), which accounted for 5.9% of the variance in change in executive functions. The overall model was significant ( $p = .006$ ) and explained 28.3% of the variance in change in executive functions.

- Baseline driving behaviors, as well as changes in highway speed variability over two years, were not significant predictors of change in executive functions over two years

- All interactions with amyloid status were not significant

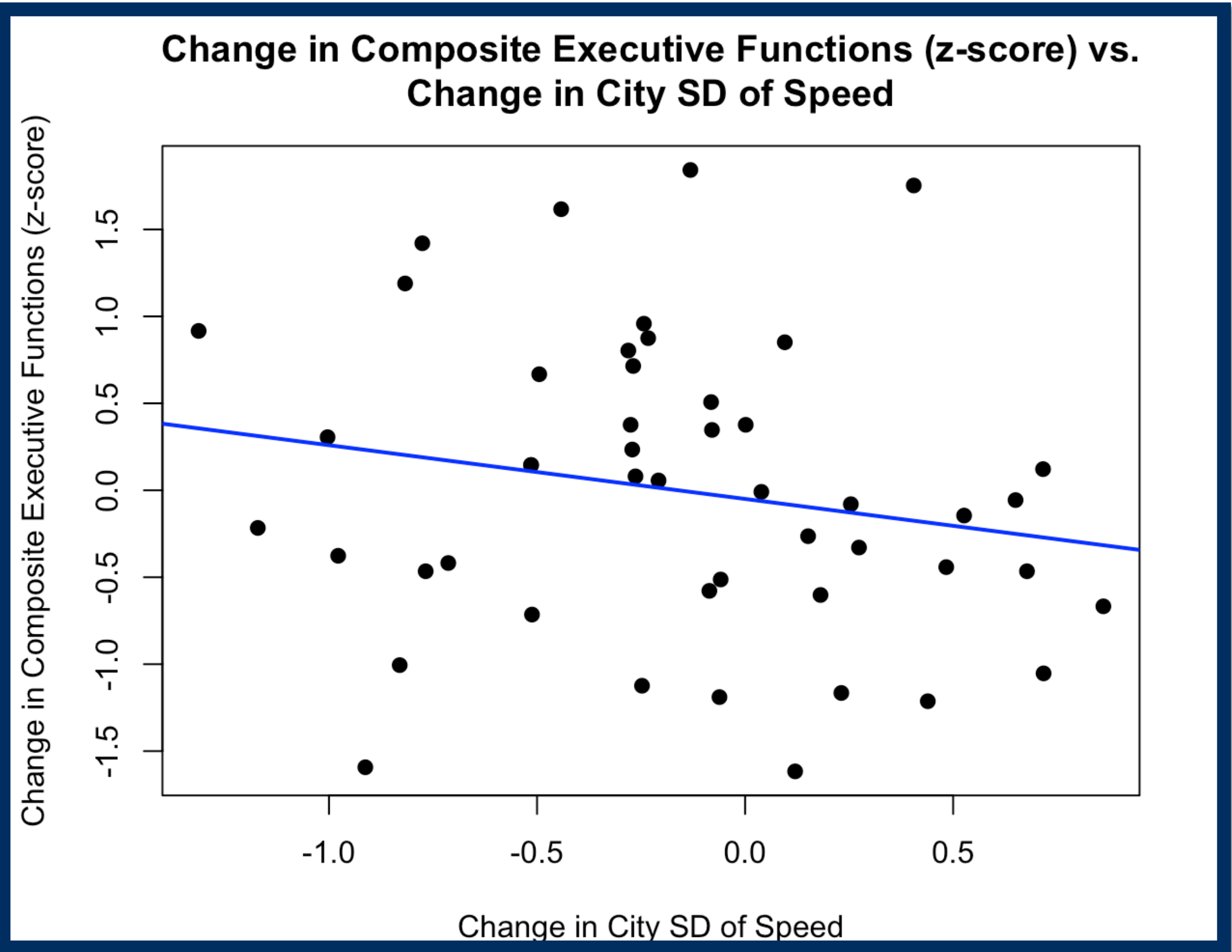


**Figure 2.** Trend-level negative main effect of change in variability in city driving speed over two years on change in executive functions over the same interval, after controlling for age, education, and amyloid status.  $\Delta R^2 = .059$ ;  $p = .066$ . \*higher values = MORE variability in speed over time

## Conclusions

### Takeaway:

- An increase in the variability of simulated city driving speed over two years had a trend-level association with decline in executive functioning over the same two-year interval.
- As such, increases in driving speed variability - which may reflect less consistent and/or reactive driving behavior (for instance, slower responding to oncoming cars resulting in abrupt speed changes; stopping rather than slowing when cars approach) - may serve as a predictor of executive function decline regardless of AD pathology.

### Future Directions:

- Explore other domains of cognitive change, such as memory, which is also susceptible to ADRD-related cognitive decline
- Re-examine this early work with a larger dataset of returning participants to see if this trending effect persists

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