



Assessing Motor and Cognitive Processes Using a Novel Performance-Based Test of Daily Functioning: Evidence from Ultra-Low-Field Magnetic Resonance Imaging



Alexandra M. Reed^{1,2}, **Chung-Fu Sun**^{1,2}, Matthew J. Huentelman^{2,5}, Michael Malek-Ahmadi^{1,2}, Scott C. Beeman^{1,2}, Megan Johnson⁵, Matthew D. De Both⁵, Saurabh Sharma⁵, Darian Chambers⁵, Sydney Y. Schaefer^{1,2}

¹School of Biological and Health Systems Engineering, Arizona State University; ²Arizona Alzheimer's Consortium; ³Department of Physical Therapy, Chapman University; ⁴Alzheimer's Disease and Dementia Research Center, Utah State University; ⁵Department of Physical Therapy, Chapman University

Introduction

Problem Performance-based tests of daily functioning may help screen for early signs of dementia while reducing reliance on informant or clinician-rated measures. However, because task scores may reflect both motor and cognitive deficits, their clinical interpretation can be limited when these contributions are not separated.

Prior Work Motor task variability has been linked to MRI-derived gray matter volume and neuropsychological performance in older adults (Malek-Ahmadi et al., 2023).

Purpose We used ultra-low-field MRI-derived cortical gray matter volumes and regression tree models to identify predictors of average trial time and intrasubject standard deviation (ISD) in trial time in diagnostically unlabeled older adults.

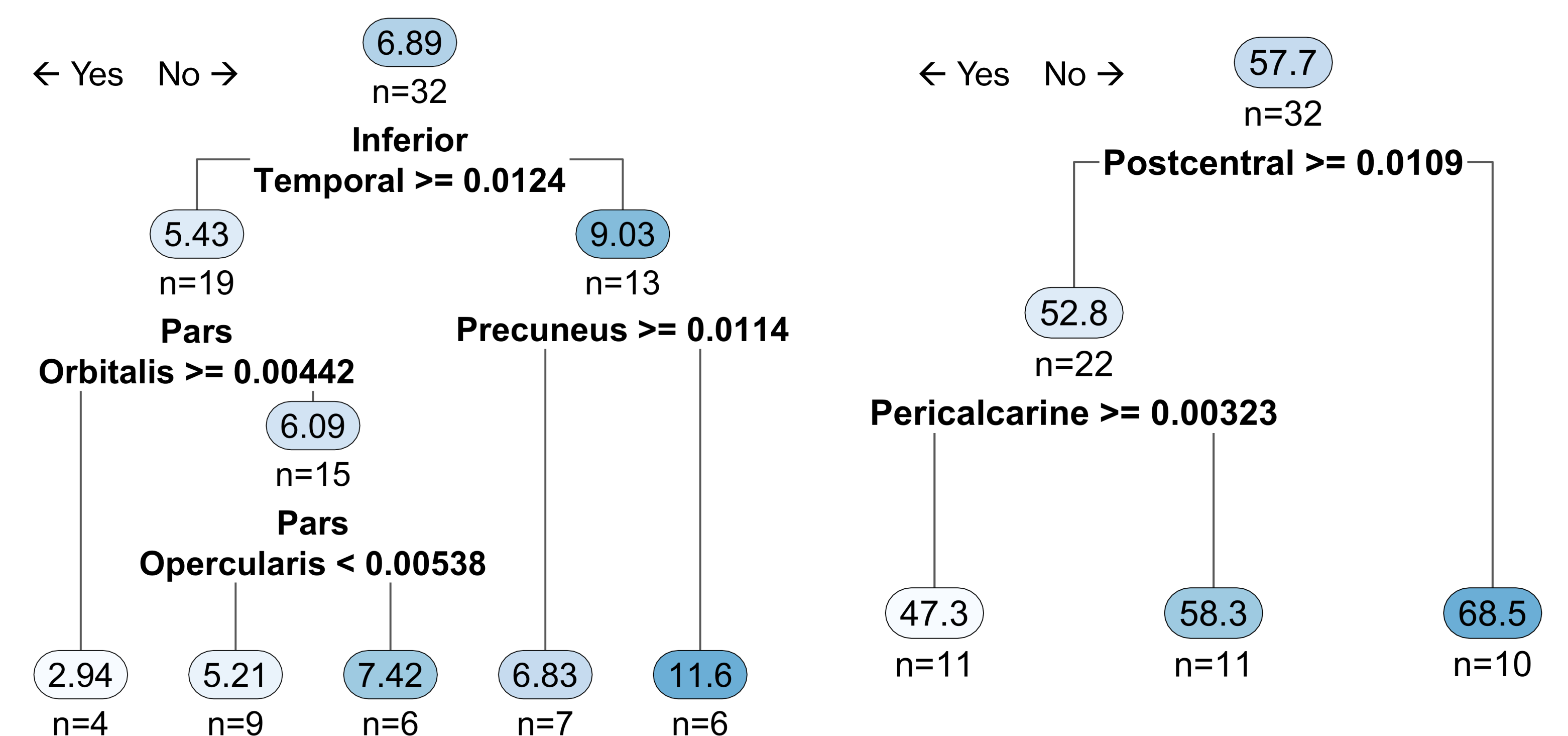


Results

CART identified cortical-volume subgroups for novel performance-based test

(A) ISD in trial time

(B) Average trial time



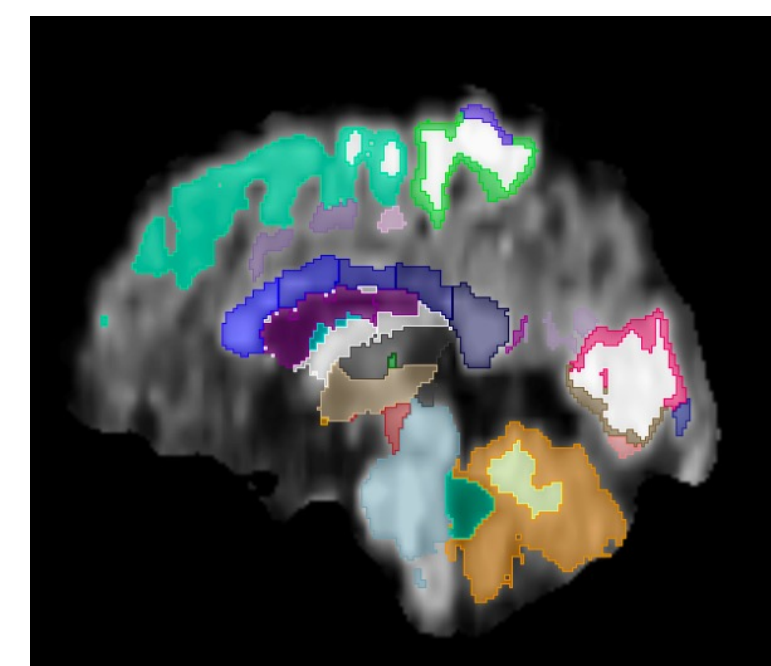
*Cortical volumes were summed across hemispheres and normalized by estimated total intracranial volume (eTIV)

Methods

Participants Data from 47 adults were collected through the ongoing MindCrowd Cohort (mean $\pm$ SD age 60.66 $\pm$ 11.64 yrs; 72% female; 80% report no memory problems).

Novel Performance-Based Test Involves 4 timed trials of transporting beans with a spoon with their nondominant hand to target cups in a repeating sequence.

Ultra-Low-Field MRI Participants underwent ultra-low-field (0.064 T) T1-weighted MRI. Structural images were processed in FreeSurfer.



Ultra-low-field MRI image from this study

CART Classification and regression tree analysis were used to empirically identify cortical-volume predictors of test performance. Separate models were fit for average trial time and ISD in trial time with a minimum terminal node size of 4.

Discussion

Motor-cognitive dissociation Novel performance-based test average performance and standard deviation may reflect partially distinct motor and cognitive contributions to functional task performance in older adults.

Distinct cortical-volume predictors CART models identified distinct cortical-volume predictors across scoring methods, supporting the potential use of this performance-based task for dementia screening and monitoring, pending validation in larger diagnostically labeled samples.



See QR code for key studies on the PBT

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