Identification of mild cognitive impairment (MCI) with digital biomarkers in individuals presenting with cognitive complaints

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BACKGROUND

- A major challenge in Alzheimer's disease (AD) is the identification of individuals at the earliest stages, who might benefit from disease-modifying therapies.

- People presenting with subjective cognitive decline (SCD), or mild cognitive impairment (MCI) face a high risk of cognitive worsening over time.

- Digital biomarkers could enable early diagnoses, and thus, streamline the patient journey to specialized care.

OBJECTIVE

- To compare scores of a digital cognitive assessment (Altoida Digital Neuro Signature; DNS) in SCD vs. MCI.

- To explore correlations between Altoida DNS scores and core AD biomarkers assessed in CSF.

DIGITAL BIOMARKER ASSESSMENT

- Altoida DNS is a research device based on machine learning (ML) that simulates conducting activities of daily living, providing an objective measure of cognition.

- DNS-MCI is an ML model that can identify MCI/AD with 84% accuracy (Pipeline Version v1.56.0; 13Jun2023).
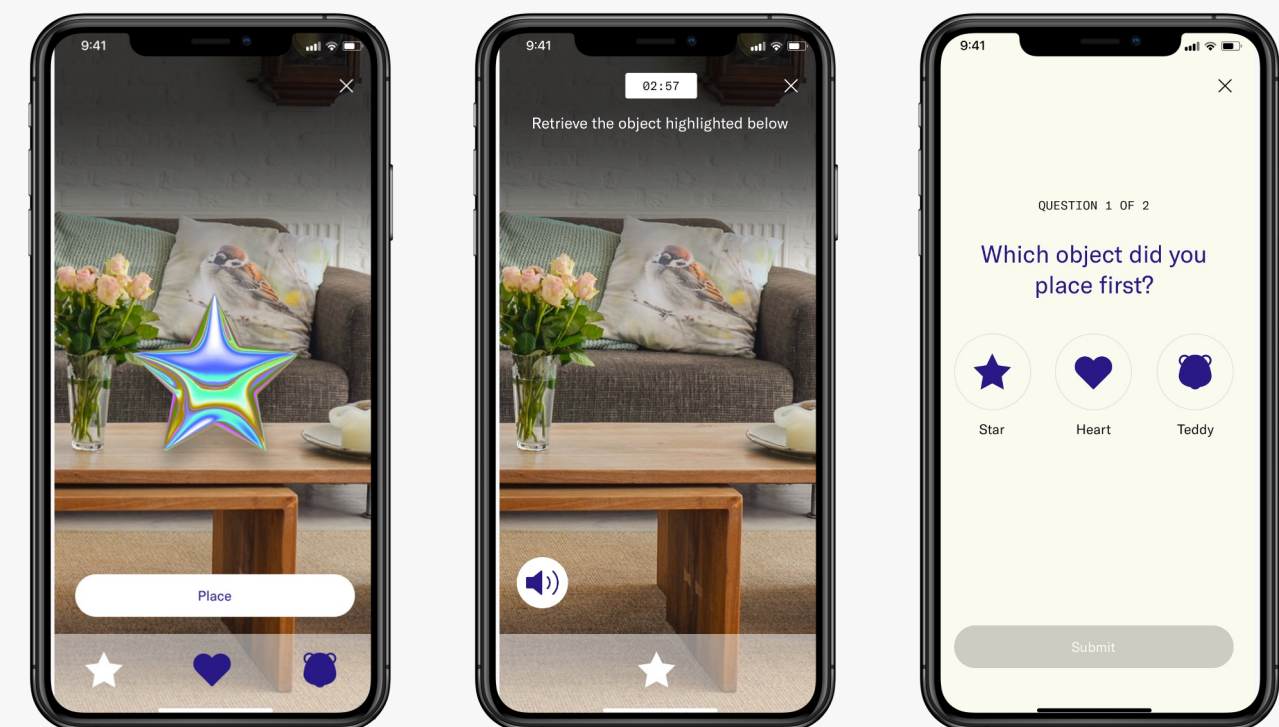
Figure 1. The Altoida DNS assessment evaluates cognitive and functional impairment based on a series of motoric and augmented reality tasks that simulate activities of daily living.

The tasks in the Altoida assessment evaluate multi-modal features, including micro-movements, micro-errors, speed, reaction times, or navigation trajectories, which are used to train specific machine learning models.

The test can be conducted on a smart device (iOS) and lasts approximately 10 minutes.

STUDY POPULATION

Included 102 individuals with cognitive complaints seeking medical advice participating in the β-AARC study (Alzheimer's At Risk Cohort) at BBRC

	SCD (N=94)	MCI (N=8)	Total (N=102)	P-value
Sex				
female	52 (55.3%)	3 (37.5%)	55 (53.9%)	0.548
male	42 (44.7%)	5 (62.5%)	47 (46.1%)	
Age (years)				
Mean (SD)	66.4 (6.19)	70.1 (4.63)	66.7 (6.14)	0.0645
Median [Min, Max]	66.5 [55.6, 80.6]	70.4 [64.4, 76.1]	66.5 [55.6, 80.6]	
Education years				
Mean (SD)	14.8 (3.47)	12.0 (3.66)	14.6 (3.54)	0.0714
Median [Min, Max]	15.0 [8.00, 20.0]	11.0 [8.00, 18.0]	15.0 [8.00, 20.0]	
DNS-MCI				
Mean (SD)	73.9 (17.7)	46.3 (27.7)	71.8 (19.9)	0.0257
Median [Min, Max]	78.7 [22.3, 95.8]	37.0 [19.9, 92.7]	78.0 [19.9, 95.8]	
MMSE				
Mean (SD)	28.5 (1.33)	26.3 (2.76)	28.3 (1.58)	0.058
Median [Min, Max]	29.0 [24.0, 30.0]	27.0 [21.0, 29.0]	29.0 [21.0, 30.0]	
Amyloid status				
Aβ-	77 (81.9%)	5 (62.5%)	82 (80.4%)	0.388
Aβ+	17 (18.1%)	3 (37.5%)	20 (19.6%)	

Table 1. Aβ+ = amyloid-β positive (based on the Aβ42/40 ratio cut-off of ≤0.062); Aβ- = amyloid-β negative; MCI: single or multidomain cognitive deficits with preservation of activities of daily living); MMSE = Mini-Mental State Examination; SCD: subjective perception of cognitive decline in the absence of cognitive impairment determined by a formal neuropsychological assessment*) SD = standard deviation.

GROUP DIFFERENCES IN DNS ASSESSMENT
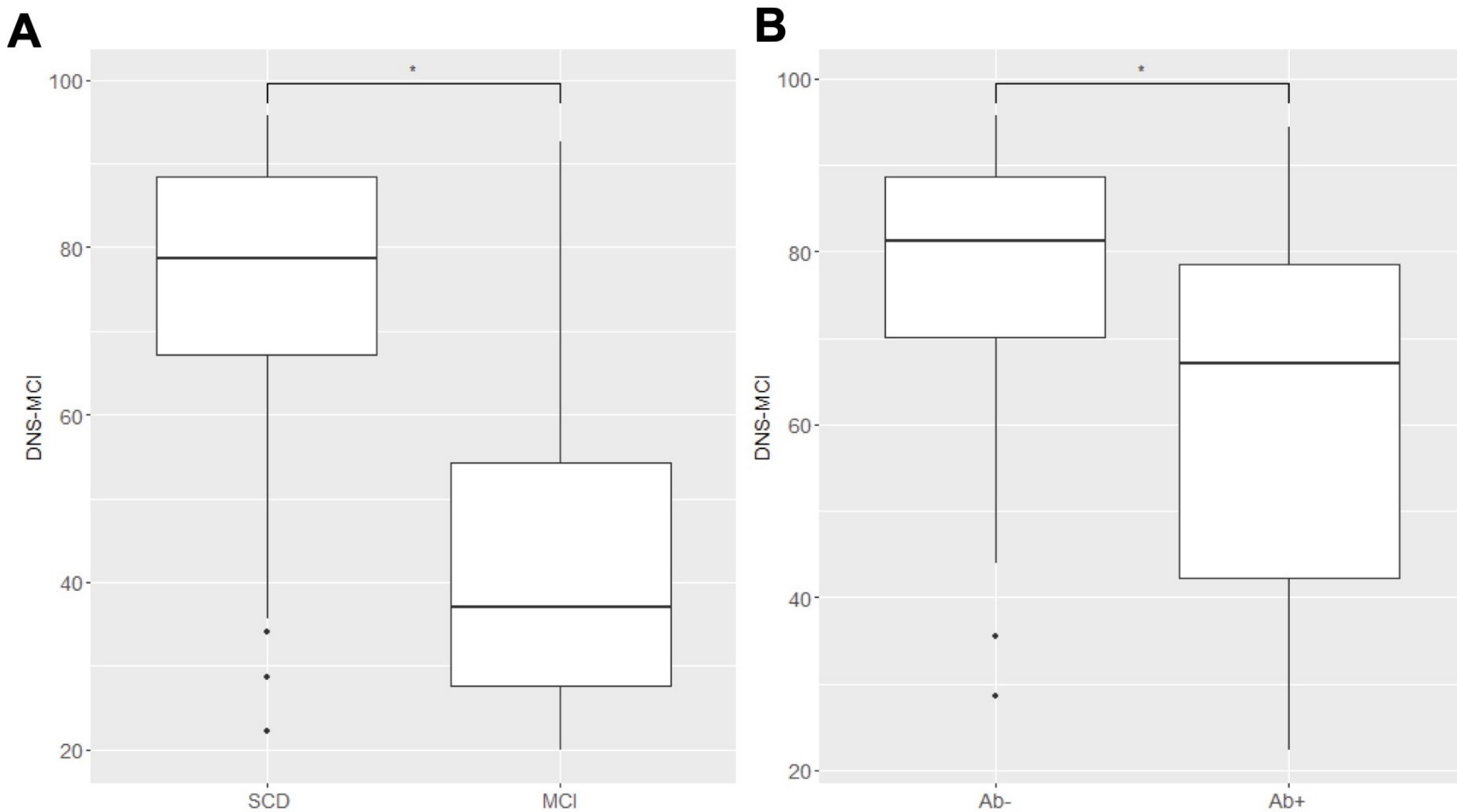
Figure 2. (A) Comparison of DNS-MCI scores between individuals presenting with SCD (n=94) and MCI (n=8) and (B) between those identified as Aβ+ (n=17) versus Aβ- (n=77) based on the Aβ42/40 ratio in the SCD subgroup only; *p<0.05; ***p<0.001, unpaired t-test.

CORRELATION BETWEEN DNS & AD BIOMARKERS
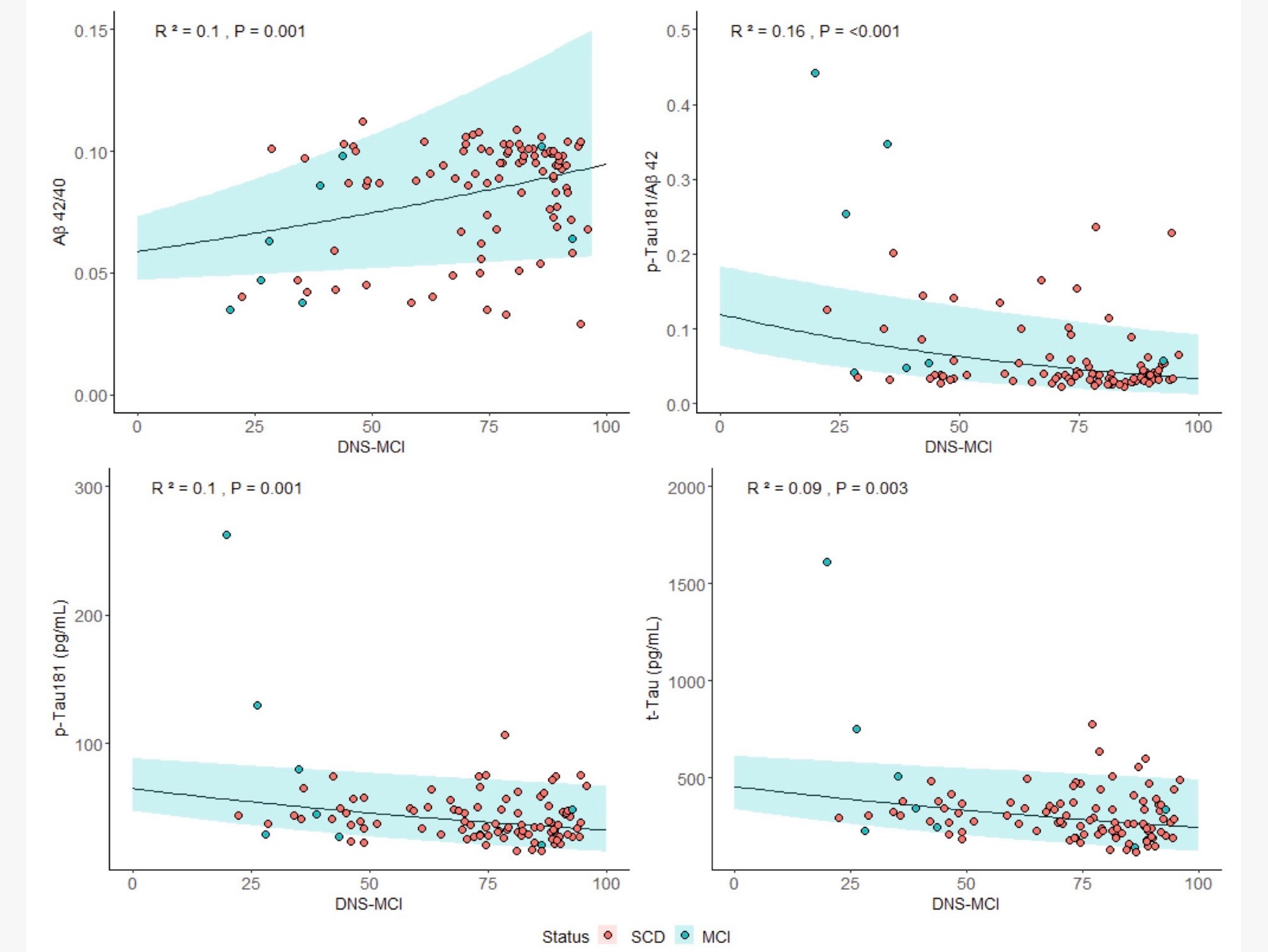
Figure 3. Correlations between DNS-MCI scores and core CSF AD biomarkers. Beta regression with two-tailed Wald's test on the coefficients was used for the Aβ42/40 ratio and linear regression on the log-transformed values was used for the p-tau181 and t-tau biomarkers.

CONCLUSIONS

- Altoida DNS-MCI identified differences in cognitive performance between MCI/SCD and Aβ+/Aβ- in a cohort with cognitive complaints seeking medical advice.

- DNS-MCI scores correlated with core AD biomarkers.

CONTACT INFORMATION

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