

Machine Learning-driven Digital Cognitive Assessment For Early Detection Of Mild Cognitive Impairment And Neurodegenerative Diseases

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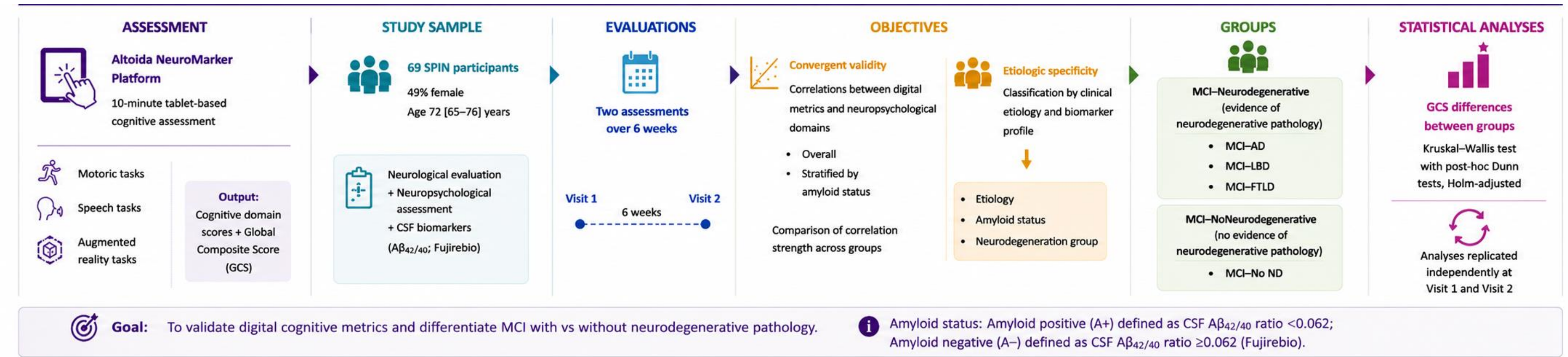
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INTRODUCTION

Traditional cognitive assessments fall short in scalability and differentiating early cognitive impairment associated with Alzheimer’s disease (AD). Novel machine-learning (ML)-based digital cognitive assessments use objective tasks to generate biomarkers that may enable earlier, precise, and accessible diagnoses.

Distinguishing neurodegenerative from non-neurodegenerative etiologies is critical for clinical decision-making.

METHODOLOGY



RESULTS

Global sample consisted of 19 cognitively unimpaired (CU) and 50 individuals with MCI classified by underlying etiology, including AD (MCI-AD; n=25), Lewy body disease (MCI-LBD; n=8), frontotemporal lobar degeneration (MCI-FTLD; n=6), and 11 MCI-NoNeurodegenerative. Digital metrics derived from the Altoida platform showed significant correlations with neuropsychological domain scores (p<0.05), supporting convergent validity, with no significant differences in correlation strength between amyloid-negative and amyloid-positive groups. MCI-AD group exhibited a significantly lower GCS compared with CU (p<0.001) and other non-neurodegenerative participants (p=0.03). Consistently, amyloid-positive individuals showed worse GCS performance than amyloid-negative participants (p<0.001), and MCI-neurodegenerative group performed worse than the CU group (p<0.001). Results were consistent across visit 1 and visit 2.

Table 1. Sample demographics

	Overall N = 69 ¹	CU N = 19 ¹	MCI-AD N = 25 ¹	MCI-LBD N = 8 ¹	MCI-FTLD N = 6 ¹	MCI-No ND N = 11 ¹	p-value ²
Age	72 (65, 76)	65 (58, 71)	76 (71, 78)	74 (72, 79)	75 (71, 78)	68 (61, 73)	<0.001
Sex							0.13
Female	34 (49%)	10 (53%)	13 (52%)	1 (13%)	5 (83%)	5 (45%)	
Male	35 (51%)	9 (47%)	12 (48%)	7 (88%)	1 (17%)	6 (55%)	
Education (years)	13.5 (10.5, 17.5)	16.0 (15.0, 20.0)	11.0 (8.0, 17.0)	12.5 (12.0, 14.0)	9.0 (8.0, 14.0)	13.0 (12.0, 18.0)	0.002
Mini-Mental State Examination (MMSE; z-score)	-0.05 (-0.80, 3.00)	3.00 (0.10, 3.00)	-0.45 (-1.15, 0.15)	0.60 (-1.40, 3.00)	0.15 (-0.50, 0.70)	-0.40 (-1.60, 0.10)	0.004
Number of Visits							0.4
1 Visit	31 (45%)	6 (32%)	11 (44%)	5 (63%)	2 (33%)	7 (64%)	
2 Visits	38 (55%)	13 (68%)	14 (56%)	3 (38%)	4 (67%)	4 (36%)	
Amyloid Status (CSF Determined)							
Arneg	32 (47%)	14 (78%)	2 (8.0%)	5 (63%)	4 (67%)	7 (64%)	
Apos	24 (35%)	3 (17%)	19 (76%)	0 (0%)	2 (33%)	0 (0%)	

¹ Median (Q1, Q3); n (%)

² Kruskal-Wallis rank sum test; Fisher's exact test

Figure 2. GCS between-groups comparisons; by Etiology

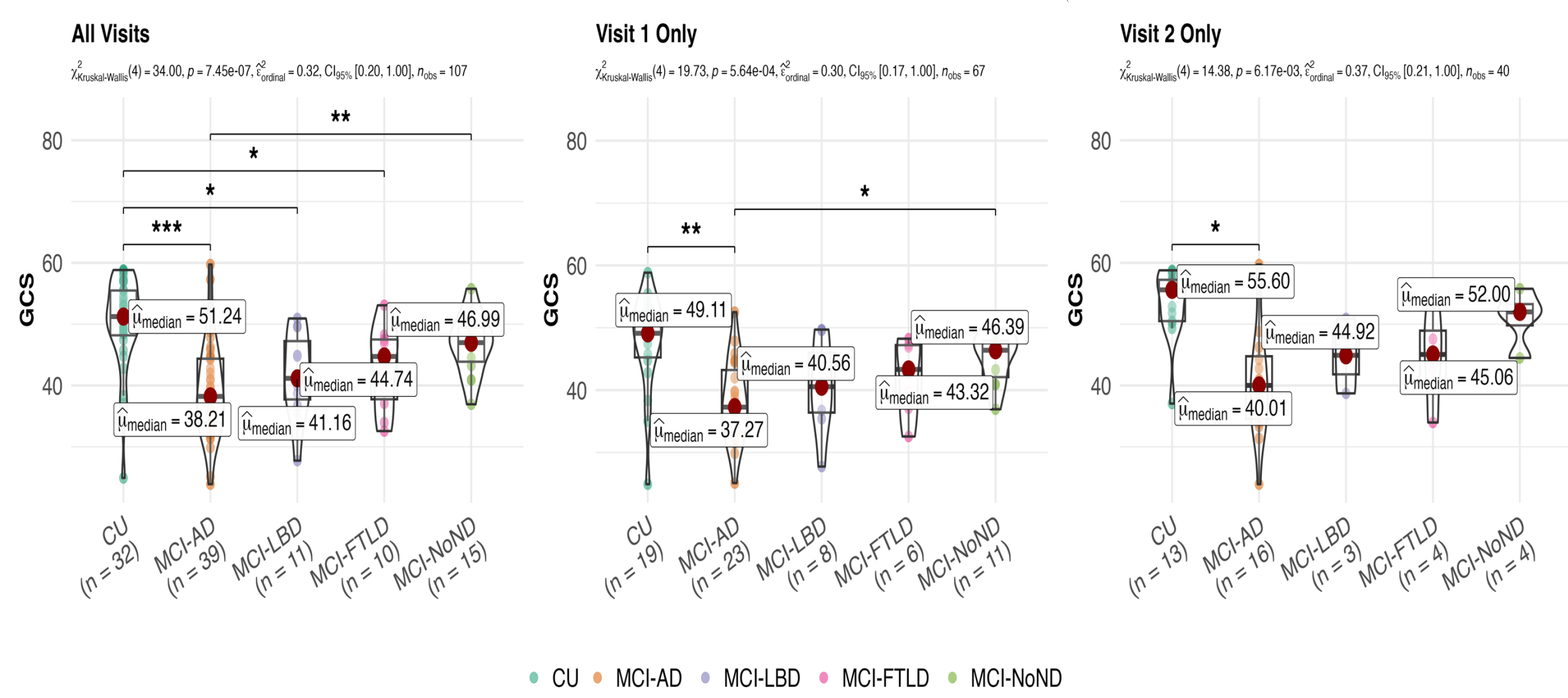


Figure 1. GCS between-groups comparisons; by Amyloid Positivity

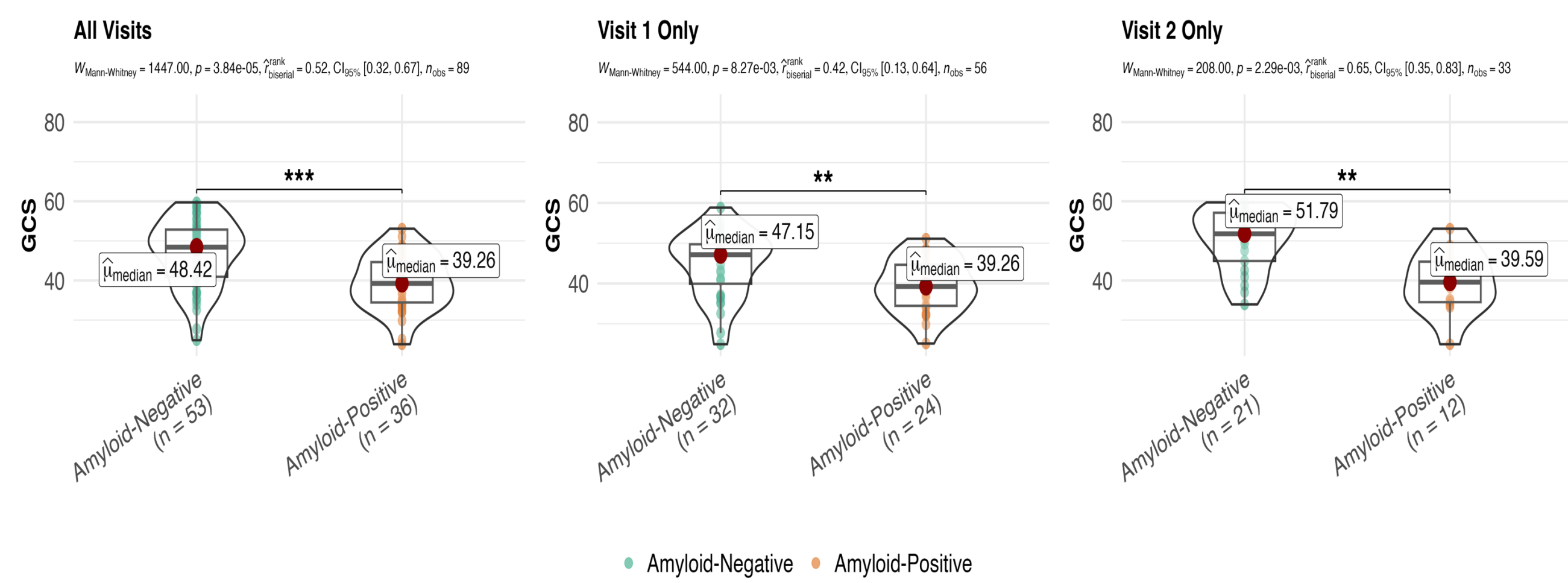
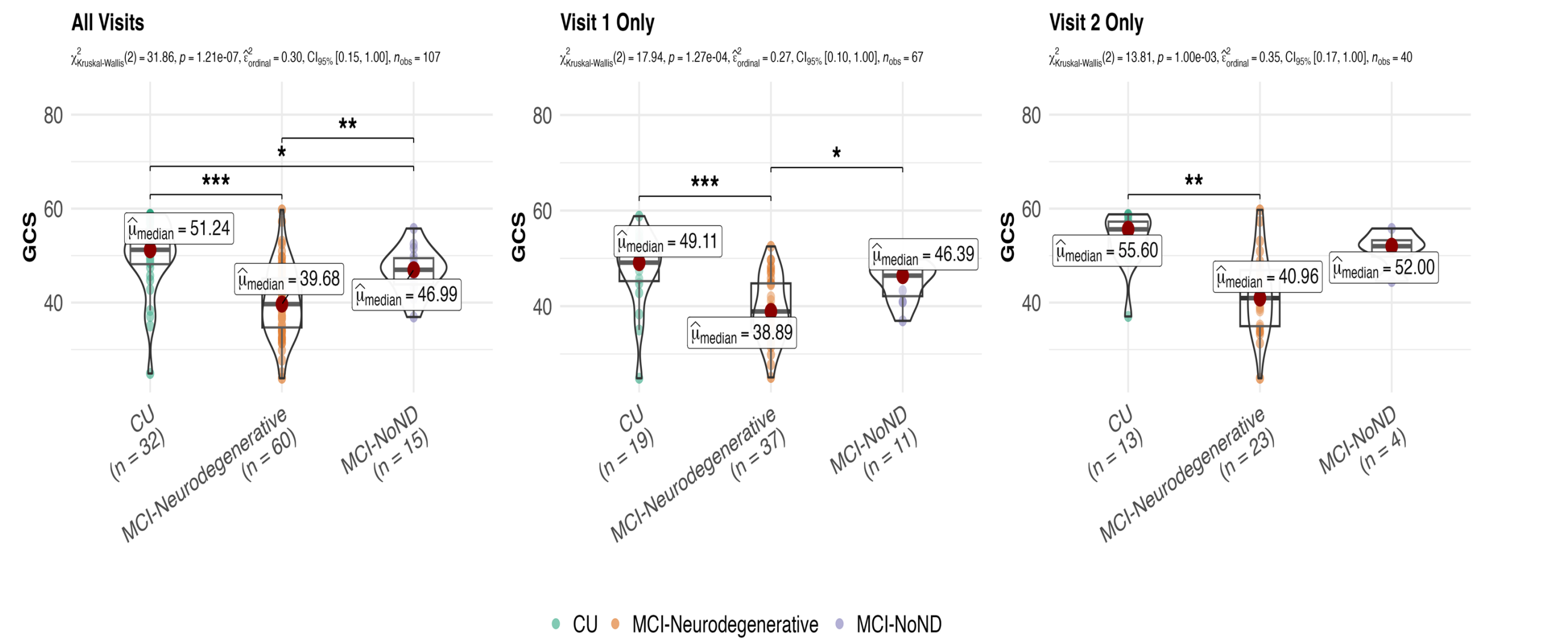


Figure 3. GCS between-groups comparisons; by Neurodegeneration group



CONCLUSIONS

Digital metrics derived from the Altoida NeuroMarker Platform show sensitivity to differentiate amyloid-positive and neurodegenerative MCI and align with neuropsychological measures at the group level.

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