

Hawaii Memory Disorders Center & Hawaii ANNE (Alzheimer's Neural Network EEG) Lab collaborates with **Advance Brain Monitoring** Research work on ERP Real World Data for Monitoring Cognitive Decline presented at 2025 CTAD San Diego 2025



ERP biomarkers of cognitive dysfunction in Alzheimer's disease: Real-world evidence for translation into clinical trial endpoints

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Key takeaway: ERP biomarkers in a real-world, point-of-care setting for assessment of cognitive dysfunction support their potential as clinical trial endpoints

INTRODUCTION

Recent anti-amyloid therapies for Alzheimer's disease (AD) have demonstrated modest cognitive benefit despite successful clearance of molecular pathology [1]. This underscores the need for neurophysiological biomarkers that can link molecular pathology to the higher-order cognitive function. Electroencephalography (EEG) and event related potential (ERP), have shown promise as a reliable and scalable biomarker, especially in early-stage Mild Cognitive Impairment (MCI) [2].

METHODS

We used a standardized EEG/ERP assessment platform (BEAM™) in a memory clinic setting (Hawaii Pacific Neuroscience) to collect data from patients diagnosed with MCI and AD. (Table 1). The protocol included an auditory oddball ERP task designed to assess neural and behavioral responses to auditory stimuli [3]. Patients were compared to older healthy controls (HC_{Old}).



Table 1. Participants

Group	n	age	sex
HC _{Young}	n=73	age: 18-49	57%F
HC _{Old}	n=66	age: 50-90	84%F
MCI	n=163	age: <1 89	53%F
AD	n=14	age: 57-85	36%F

RESULTS

Both N100 and P300 latencies were delayed in the MCI and AD groups. The N100 delay opposed, while the P300 delay aligned with the healthy aging effect. Latency effects were larger in the AD group, compared to MCI. MCI group exhibited more reduction in P300 amplitude.

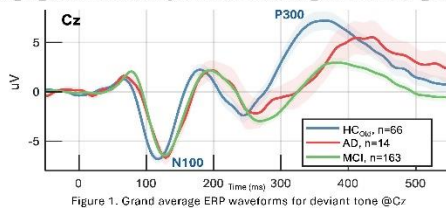


Figure 1. Grand average ERP waveforms for deviant tone @Cz

Table 2. Group comparisons for each ERP measure (deviant tones)

Comparison	ERP Measure	Effect Size	Norm. effect size	Statistical significance	Region
HC _{Old} vs. HC _{Young}	N100 Latency	-10 ms	-0.74	p<0.001, df=133	Global / Fz
	P300 Latency	+38 ms	+0.74	p<0.001, df=137	Posterior / O2
	P300 Amp.	+2.2 uV	+0.64	p<0.001, df=137	Frontal / F8
MCI vs. HC _{Old}	Reaction Time	-7 ms	-0.12	p=0.35, df=141	N/A
	N100 Latency	+10 ms	+0.91	p<0.001, df=226	Global / Cz
	P300 Latency	+28 ms	+0.47	p=0.001, df=227	Global / C4
AD vs. HC _{Old}	P300 Amp.	-2.41 uV	-0.86	p<0.001, df=227	Global / T6
	Reaction Time	-44 ms	0.57	p<0.001, df=233	N/A
	N100 Latency	+16 ms	+1.31	p<0.001, df=78	Global/IR-Central / C4
AD vs. HC _{Old}	P300 Latency	+56 ms	+1.06	p=0.001, df=76	Global / T6
	P300 Amp.	-2.3 uV	-0.42	p=0.15, df=78	Frontal / Fz
	Reaction Time	+58 ms	0.76	p=0.01, df=81	N/A

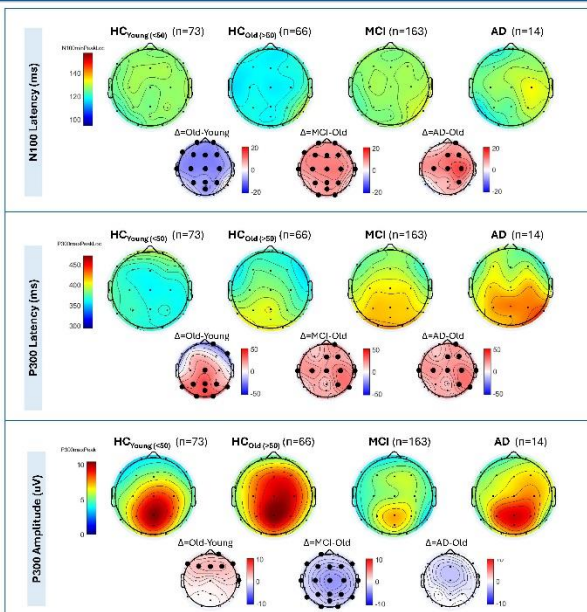


Figure 2. Topographical maps of the group averages and group differences

CONCLUSIONS

ERP paradigms can be deployed in real-world, point-of-care settings. Patients with MCI and AD exhibited measurable deficits in ERP components that were more prominent than behavioral performance deficits. These findings support the use of ERP biomarkers as potential endpoints for monitoring cognitive decline and treatment response in Alzheimer's disease.

REFERENCES

- [1] Van Dyck, Christopher H., et al. "Lecanomab in early Alzheimer's disease." *New England Journal of Medicine* 388.1 (2023): 9-21.
- [2] Meghdadi, Amir H., et al. "EEG and ERP biosignatures of mild cognitive impairment for longitudinal monitoring of early cognitive decline in Alzheimer's disease." *PLoS one* 19.8 (2024): e0308137.
- [3] Tarawneh, Hadeel Y., et al. "Investigating auditory electrophysiological measures of participants with mild cognitive impairment and Alzheimer's disease: A systematic review and meta-analysis of event-related potential studies." *Journal of Alzheimer's Disease* 84.1 (2021): 418-448.

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