APOE ε4 and ERP Intraindividual Variability: Emerging Diagnostic Targets for Alzheimer's Disease

Gabriella M. Marino[1], Tristan A. Gregg[1], Elizabeth R. Paitel[1] & Kristy A. Nielson[1,2]
Marquette University, Department of Psychology

Introduction

Purpose

- **There has been considerable interest in the ability to diagnose cognitive decline at the earliest possible stage of onset, thus discriminating healthy aging from early-stage deterioration**
- **Further examine trial-to-trial N200 amplitude intraindividual variability (IIV) in ε4+ individuals**
  - **We expect greater IIV activation in the Remote and Recent brand conditions**

IIV

- IIV is defined as the trial-to-trial participant differences collected in event-related potential (ERP) data sets
- Previous studies demonstrate that IIV increases with advancing age
  - Variability in processing speed increases as a compensatory function of normal aging
- Patients with dementia, specifically Alzheimer's disease, exhibit more variability in performance than normal elderly
- **N200 amplitude:** reflects the cognitive process in which the subject evaluates the stimulus
- Research on ERP IIV is minimal, despite ability to provide direct insight into neural processing

Gene Status

- APOE ε4 carriers are at increased risk for dementia disorders, including Alzheimer's (AD)
  - The mechanism by which APOE contributes to disease expression remains unknown
  - Neurological changes identified with AD begin decades before symptom onset, making biomarkers of early risk especially important
- Evidence that variability is significantly greater in APOE ε4+ individuals when compared to a control group
- APOE ε 4 allele displayed greater activation in response to famous names relative to unfamiliar names at baseline than non-carriers

Methods

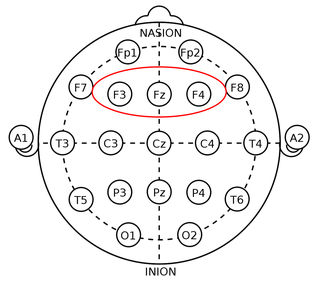
Participants:

- **45; healthy, cognitively intact**

	e4+ (N = 20)	e4- (N = 25)
Age in Years	78.82	80.19
Sex	85% female	68% female

Measures:

- **Event-related potentials (ERPs)**
  - 64-channel EEG system
  - F3, Fz, and F4 fronto-central electrodes
  - N200: peak 100-350ms, selective attention
  - ERP amplitude IIV = *SD* of single-trial peak amplitude
- **Brand Names Task**
  - The experimental materials comprised 60 real and 60 fake brands
  - **Real Names**: 20 Remote, 20 Recent, and 20 Enduring brands
  - Participants responded by pressing any button on the keyboard



Contacts: gabriella.marino@marquette.edu or kristy.nielson@marquette.edu

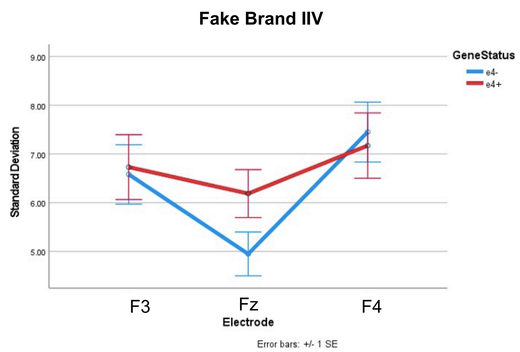
Results

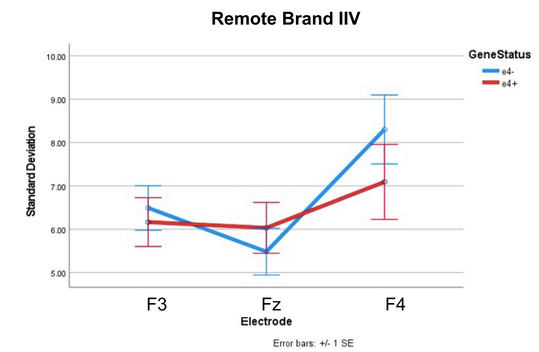
- **A 2 (gene status) x 3 (electrode) x 4 (stimulus type) ANOVA** revealed a possible interaction (p = 0.070) in Gene Status * StimType * Electrode in the Fake brand condition at the Fz electrode
- Possible Gene Status * StimType * Electrode interaction (p = 0.090) in the Recent Condition at the Fz electrode
- Task performance measures were comparable between groups

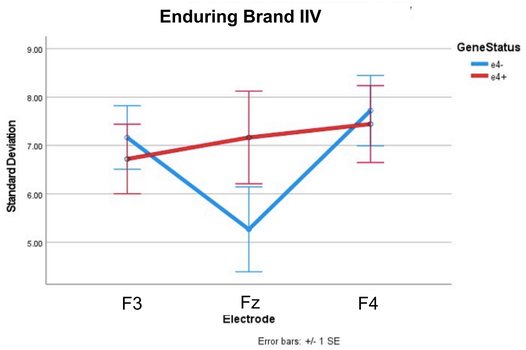
Fig 1. Task Performance

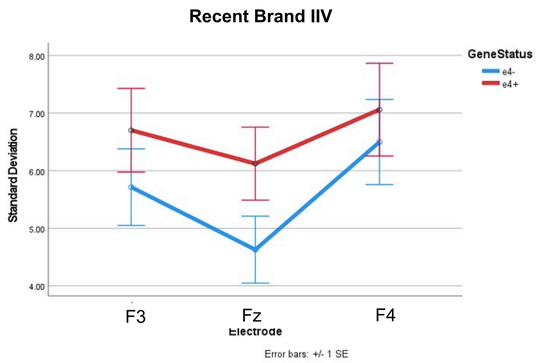
	e4+ (N = 20)	e4- (N = 25)
Performance Accuracy	0.8275	0.8658
Reaction Time (ms)	1475.9	1370.4

Fig 2. IIV in each Brand Condition









Discussion

- The current study supports the utility of examining intraindividual variability as a precursor to cognitive deterioration, especially in relation to APOE ε4+ gene status.
- Numerous mechanisms may contribute to increased IIV, including the speed of neural transmission, functioning of neurotransmitter systems, synchronicity of neutral activity, fatigue, stress, and practice/learning
- Future research implications include examining the Enduring brand condition further and using a larger ε4+ sample. It also would be worthwhile to consider other waves beyond N200, including P300.