ABSTRACT
REINFORCEMENT LEARNING, ERROR-RELATED NEGATIVITY, AND GENETIC RISK FOR ALZHEIMER’S DISEASE

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Reinforcement learning (RL) has been widely used as a model for understanding animal and human learning and decision making. The neural processes required for adaptive RL are the same as those greatly affected by disease pathology such as hippocampal atrophy in Alzheimer’s disease (AD). Yet, RL, and non-invasive methods of assessing related neural processes, have been underutilized in the literature as a framework for understanding disease pathology or its pre-clinical states. This study aimed to provide a novel approach for assessing very early changes in asymptomatic individuals at genetic risk for AD.

Electroencephalography (EEG) recordings were collected from forty apolipoprotein-E (APOE) genotyped older adults (Male n = 11; Mage = 79.30; Meducation = 14.88 years) while they performed an RL task comprised of three distinct phases (RL, implicit, and explicit). Group comparisons were made based on low risk (APOE ε4--; n = 20) vs. high risk (APOE ε4++; n = 20) for AD as well as based on RL related the event-related potentials (ERPs) associated with the error detection system: the response-ERN and the feedback-ERN.

Behavioral analyses indicated that risk groups did not differ on their performance on the RL task. A series of mixed ANOVAs of ERP peak amplitude indicated that RL processes in the high risk group deviated from typical, adaptive RL when compared to the low risk group in both phases of the task.

The pattern of results in the present study was largely consistent with prediction in that risk groups did not differ on performance indices of RL, but did differ in related neural components. Results are consistent with the current literature, but expand on previous findings as little investigation has applied an RL model to AD or it’s preclinical states. RL paradigms may offer high sensitivity for assessing preclinical decline among individuals at genetic risk for the disease.