BACKGROUND: Three electrophysiological measurements have been prospectively associated with antidepressant treatment responses: the amplitude of loudness dependent auditory evoked potentials (LDAEP), EEG power in the alpha band, and theta current density localized to the rostral anterior cingulate cortex (rACC). However, the reliability of these measurements has not been established. The current analyses evaluated the test-retest reliability of these EEG measures in healthy adults enrolled in the multi-site Establishing Moderators and BioSignatures of Antidepressant Response for Clinical Care (EMBARC) project.

METHODS: Resting EEG (four min each eyes open and closed) and auditory event-related potentials (1000 Hz tones, five intensities from 60 to 100 dB) were collected from 40 healthy adults with a test-retest interval of about one week; 10 participants were assessed at each of the four EMBARC sites. EEG alpha and LDAEP measures of N1 dipole were calculated using principal components analysis of current source density (CSD) estimates. Low-resolution electromagnetic tomography (LORETA) was used for EEG source localization, and resting theta current density was extracted from a predefined rACC region-of-interest.

RESULTS: For the LDAEP, N1 dipole amplitudes increased monotonically along with tone intensity (p < 0.001), with no differences across sessions or centers. The overall reliability of N1 was high (r = 0.87; range: 0.70 to 0.98 across centers). For EEG alpha, there was a significant difference in posterior CSD alpha across centers (p < 0.001), with one center (MGH) showing lower alpha than the other three centers, and a center by session interaction (p = 0.05), with one center (Columbia) showing greater alpha in the second session. There was, however, no overall session effect and test-retest reliability was high (r = 0.89; range: 0.72 to 0.99 across centers). LORETA measures of activity localized to rACC required spatial smoothing to minimize differences across sites. Nevertheless, there was a significant center effect (p < 0.001), with one center (MGH) having higher current density than the others. There was, however, no significant difference between the two sessions with respect to rACC current density for each level of spatial smoothing, and test-retest reliability ranged from r = 0.70 to r = 0.93 for different levels of spatial smoothing.

DISCUSSION: These findings demonstrate that CSD measures of N1 dipole loudness modulation, EEG alpha, and source-localized rACC theta activity can be obtained with good to excellent reliability in a multi-site study. These findings lay the foundation for investigating the predictive validity of these EEG markers with respect to treatment outcome in major depression.

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