Since the time of Berger, EEG alpha has been identified as an idling rhythm characteristic of relaxed wakefulness that is blocked (desynchronized) when visual processes are engaged by opening the eyes (1). This conceptualization has been exploited in a series of studies using and the personal practice of meditation and/or prayer. We therefore hypothesized that the greater EEG alpha seen in experienced meditators compared to controls has been attributed both to state-related changes and trait (i.e., persistent) differences (4).

EEG alpha has been associated with risk for depression and response to treatment with antidepressants. EEG alpha power was elevated in euthymic adults who have recovered from depression (5), prompting the suggestion that alpha power might be able to identify a subgroup of depressed individuals at risk for a depression due to family history of affective disorders (6). We observed that offspring of two parents with MDD showed greater posterior condition-dependent alpha (eyes-closed minus eyes-open) compared to those with neither or only one depressed parent (7), thereby supporting the transmission of a trait across generations. Prominent posterior alpha is also predictive of a good response to treatment with serotoninergic antidepressants (8), but may not change following treatment (9). However, it is not yet known whether individuals who have positive outcomes following other treatments, or who have spontaneous remissions, might also show differences in posterior alpha.

An independent line of evidence links depression risk with personal spirituality and religion (10, 11). Self-reports of the importance of religion or spirituality are also consistent with a protective effect against depression, particularly in adults with a history of parental depression (12). Religious beliefs and practices also tend to be transgenerational, with children’s adherence to material and offspring religiosity is itself associated with risk for, and recovery from, depression (13). This protective role undoubtedly acts through neurobiological mechanisms because it is known that spirituality is associated with better studied indices of depression risk and outcome. For example, religious affiliations and practices provide access to multiple mechanisms known to be protective against depression, including social support networks, information and group counseling, an environment intended to foster purposes and hope, and the personal practice of meditation and prayer. Therefore we hypothesized that posterior EEG alpha (associated with depression response) would differ in subgroups classified according to self-reports of attitudes about personal spirituality and religion.

**Introduction**

**Methods**

**EEG methods**

Recording EEG was measured while subjects sat quietly during four 2-min periods (eyes open or closed, counterbalanced) and avoided blinking and head, eye and body movements (fixation for eyes open). Scalp EEG (13 sites, plus right ear, right ear reference, digitally re-referenced to linked-ears; bipolar tripmagnet and horizontal eye movements) was measured using an electrode cap (Electro Cap International). The EEG was recorded using a Bioamplifier system (James Long Company) at a gain of 10 K and a band pass of 0.01–30 Hz. EEG data were continuously acquired at 200 samples/s and segmented of 200 milliseconds and time-successive 25-sec epochs, 64 sec (50% overlap). Epochs contaminated by blinks, eye movements, or movement-related artifacts were excluded using a rejection criterion of ±100µV on any channel, followed by interactive rejection of remaining artifacts (7).

**CSD-fPCA feasibility with 13-channel montage**

Using 67-channel EEG, CSD-fPCA factors (A) characterized posterior (i.e., n = 12) alpha factors with topographies and condition criteria (eyes-closed maximum) (8, 17). Alpha was identified and quantified from well-defined spectral, topographic, and condition (eyes-closed maximum) criteria (8).

**Results**

**Alpha Differences by Importance Groupings**

The 12 participants who rated religion as important at the initial assessment showed significantly greater medial-posterior CSD alpha across conditions when compared to 40 rated as not important (t = 3.9, df = 50, p < .001). In contrast, alpha did not differ between 20 rated as not important (Fig 1B) and those who remained important (n = 12) at Time 20, both for condition-dependent alpha (left and overall alpha) right). The relationship between the changing importance and alpha is evident in Fig 1B by comparing the 12 who regarded religion important at the initial assessment and whose migrated in later.

**TABLE 1**

<table>
<thead>
<tr>
<th>Importance</th>
<th>Time</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Important</td>
<td>Time 10</td>
<td>20</td>
</tr>
<tr>
<td>Important</td>
<td>Time 20</td>
<td>60</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>120</td>
</tr>
</tbody>
</table>

**Fig. 1C.** CSD-fPCA solution distinguished Low and High alpha factors with topographies and condition dependency expected for posterior alpha (B). The contrast to previous studies, median spectral Theta was represented as a distinct factor. Although of theoretical importance, topographic and condition characteristics allow it to be described as a measure of posterior alpha. Exploratory analyses of theta, occipital, and frontal beta suggested no effects of interest.

**Fig. 2.** When classified by median posterior alpha for Not Important, those who migrated in showed significantly less alpha than those classified as important at the initial assessment.

**Conclusions**

- Individuals who differ in personal importance of religion do not systematically differ in posterior alpha. However, those who consider religion important differed depending on the timing of their assertion: Early reports (important) were associated with prominent alpha, and later reports (migrators into religion) with low alpha.
- The differences are clearest for individuals with a history of depression.
- The differences are not likely to be due to volatility related to this question, because the few initial important responders who changed their reports (migrated out) did not differ in alpha from others in this group.
- More data are needed to distinguish the contributions of trait and adjustment strategies to these differences.

**References**

4. Varma rotations (18). Alpha was identified and quantified from well-defined spectral, topographic, and condition criteria (eyes-closed maximum) criteria (8).
5. Chisq(2)=10.81; p=.004 Chisq(2)=7.504; p=.023