Neuroanatomy of Religiosity and Spirituality

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Background

Religion and spirituality have held important roles throughout history and remain prominent in modern times, with as many as 9 out of 10 people worldwide engaging in regular religious practices. Until the rise of modernity in Western culture, religion and mental health care were closely aligned, and in many places still are. There has been a historic bias against religion in psychiatry, and indeed some religious beliefs and practices are related to psychopathology. However, the field has seen a shift in recent years, with a growing body of epidemiological literature showing the benefits of religion and spirituality in many psychiatric conditions. With this renewed interest and the explosion of experimental methods available in neuroscience, studies have been conducted exploring the intersection of neurobiology and religion and spirituality.

Methods

To investigate the known neurobiological correlates of religion and spirituality, a literature search was conducted of online databases

Results

35 pertinent primary research studies were discovered, which used a multiplicity of measures and examined various religious/spiritual states and behaviors. Neuroanatomical targets were found utilizing various structural (i.e., magnetic resonance imaging and diffusion tensor imaging) and functional (i.e., functional magnetic resonance imaging, positron emission tomography, and single photon emission computed tomography) imaging modalities as well as electroencephalography and molecular methods. Religious affiliations mostly included Christianity/Catholicism, Islam, and Buddhism. Various religious aspects have been consistently associated with differential activity in numerous higher-order brain regions including the medial frontal cortex/orbitofrontal cortex, cingulate cortex, temporal insular and limbic structures, parietal foci including the precuneus, the caudate and ventral striatum of the basal ganglia, as well as other interconnected neuroanatomic and molecular targets.

Discussion

Multiple brain regions and molecular targets were identified, and some may have relevance to psychopathology. The general function of these foci and their corresponding religious/spiritual correlates are described. Overall validity and synthesis are currently limited due to small sample sizes and varying measures between studies. Future research should use the same or similar standardized measures to allow for synthesis of study data.

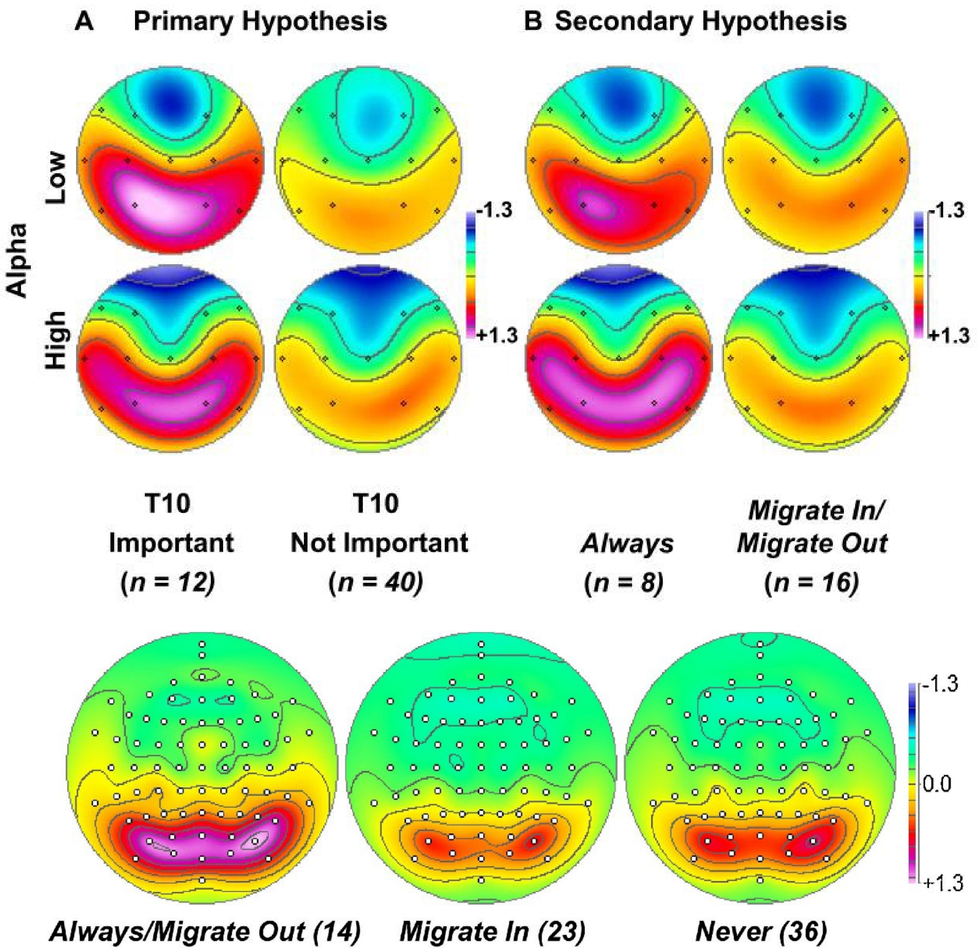
Due to space limitations, results from only several papers utilizing EEG will be explicitly shared as part of a dataset from a much larger multi-generational study of individuals at risk for depression based on family history. In the early 1980s, probands with depression and matched non-depressed controls were recruited. Subsequent assessments that included their offspring were obtained over the following 35 years spanning three generations. As this longitudinal study progressed, the researchers sought to incorporate various neuroanatomic and religious measures.

Study 1 *(top figure)*

In 2013, the first attempt to investigate the relationship between personal religious importance and resting posterior alpha was published. 52 participants responded to a single question survey of religious importance at study initiation and again at 10 year follow up. Then, also at year 10, a resting EEG was obtained. Results revealed that religious importance was associated with greater posterior alpha, especially if maintained throughout study duration. This finding can be seen in the figure below, noting that those who changed their valuation ("Migrate In/Migrate Out") and those who never rated religion as important demonstrated lower amplitude than those who consistently maintained their religious importance. The authors felt that greater posterior alpha may help one recover from a depressive episode as a form of stress reduction, and that religious practice may help to increase this signal over time.

Study 2 *(bottom figure)*

To further characterize the relationship between religious importance and resting posterior alpha over time, a follow up study was conducted and published in 2017. 73 participants responded to measures of religiosity including personal importance and denominational affiliation over a 20-year period. Then at years 10 and 20, resting EEGs were obtained. Corroborating the first study, those who maintained their importance over time had greater posterior alpha than those who never rated religion as personally important. However, this study revealed that there was no difference in posterior alpha between those who maintained their importance over time and those who decreased their valuation over time. This is demonstrated in the figure below. This suggests that posterior alpha is a stable trait that happens to also be associated with religious importance.



Study 3 *(no figure)*

In 2019, a subsequent analysis of the data was published to investigate if posterior alpha and religious importance are predictors of depressive episode severity. Data was retroactively analyzed from the same 73 participants as the previous study. Results revealed that greater religious importance correlated with lesser depressive severity and so did greater posterior alpha. However, in those with both religious importance and greater posterior alpha, as opposed to only one or the other, this was associated with greater depression severity. The authors suggest only a speculative interpretation for this conflicting result and clearly more study is needed to elucidate the possible relationship between religious importance, posterior alpha, and depression severity.