fMRI analysis of functional connectivity involved in evidence integration and delusional ideation

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Introduction

The ability to integrate evidence or alter one’s beliefs is a critical cognitive process in response to changing information. A bias against disconfirmatory evidence (BADE) is associated with delusions and delusional ideation and may be linked to delusion maintenance [1-3]. Past studies have suggested that poor evidence integration such as BADE may be considered a cognitive marker for disorders on the psychosis continuum [3]. The current study builds on previously published functional magnetic resonance imaging (fMRI) research of healthy individuals [4].

Methods

The Schizotypal Personality Questionnaire (SPQ) [5] was administered to assess subclinical schizotypal traits.

Evidence Integration Task

The components were categorized into task-based brain network exemplars through voxel-based classification. Increase-to-peak (ITP) and return-to-baseline (RTB) variables were then computed and analyzed using canonical correlation analysis (CCA).

Results

Traditional Default Mode Network (TDMN)

Deactivation of brain areas corresponding to the TDMN was seen in component 1. An ANOVA revealed a significant interaction between time x condition (F(27,1080)=1.55, p<0.05), such that the disconfirm conditions showed more deactivation of the TDMN than confirm conditions.

Cognitive Evaluation/External Attention Network (CEN/EXT)

Component 2 consisted of a combination of the CEN and EXT networks. A significant main effect of condition (F(3,120)=14.50, p<0.001) and an interaction between time x condition (F(27,1080)=6.60, p<0.001) were found such that the disconfirm conditions showed more activation than the confirm conditions.

External Attention/One-Handed Response Network (EXT/1RESP)

Component 3 included patterns from both the EXT and 1RESP networks. No significant effects or interactions were observed. Note that EXT patterns were displayed in both component 2 and 3.

CCA Results

- A correlation was found between ITP and RTB values within the TDMN (r=0.61, p<0.05).
- A negative relationship was revealed between the TDMN and CEN/EXT canonical variates, as well as between TDMN and EXT/1RESP.
- No correlation was found between components and SPQ scores

Conclusion

- While there was no correlation found between components and SPQ scores, the estimated HDR plot for CEN/EXT showed a higher activation for disconfirm conditions (YN, NY) as compared to confirm conditions (YY, NN). This suggests that there may be a greater dependence on this network during the integration of information that contradicts one’s beliefs.
- As previous correlation analyses found a negative relationship between CEN/EXT and SPQ scores [4], decreased activity in this network may be associated with increased delusional ideation in healthy individuals.
- More research is needed to confirm the networks involved in evidence integration and could include alternate measures of delusional ideation.

References


41 healthy subjects were presented an initial partial image with a word displayed below and prompted to respond (Yes/No) with whether they believed the word would accurately describe the completed picture (4000 ms). Next, a second partial image showing more of the full picture was presented and subjects could change their previous response if desired (4000 ms). The full picture was then displayed for 1000 ms.

Traditional Default Mode Network (TDMN)

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References