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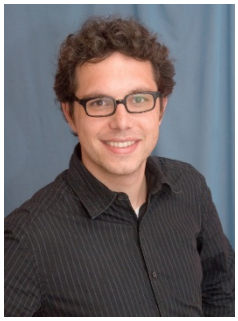
EEG-Informed fMRI Reveals a Disturbed Gamma-Band-Specific Network in Subjects at High Risk for Psychosis
Leicht G, Vauth S, Polomac N, Andreou C, Rauh J, Mußmann M, Karow A, Mulert C

ABSTRACT:
OBJECTIVES. Abnormalities of oscillatory gamma activity are supposed to reflect a core pathophysiological mechanism underlying cognitive disturbances in schizophrenia. The auditory evoked gamma-band response (aeGBR) is known to be reduced across all stages of the disease. The pre-sent study aimed to elucidate alterations of an aeGBR-specific network mediated by gamma oscillations in the high-risk state of psychosis (HRP) by means of functional magnetic resonance imaging (fMRI) informed by electroencephalography (EEG). METHODS. EEG and fMRI were simultaneously recorded from 27 HRP individuals and 26 healthy controls (HC) during performance of a cognitively demanding auditory reaction task. We used single trial coupling of the aeGBR with the corresponding blood oxygen level depending response (EEG-informed fMRI). RESULTS. A gam-ma-band–specific network was significantly lower active in HRP subjects compared with HC (random effects analysis, $P < .01$, Bonferroni-corrected for multiple comparisons) accompanied by a worse task performance. This network involved the bilateral auditory cortices, the thalamus and frontal brain regions including the anterior cingulate cortex, as well as the bilateral dorsolateral pre-frontal cortex. CONCLUSION. For the first time we report a reduced activation of an aeGBR-specific network in HRP subjects brought forward by EEG-informed fMRI. Because the HRP reflects the clinical risk for conversion to psychotic disorders including schizophrenia and the aeGBR has repeatedly been shown to be altered in patients with schizophrenia the results of our study point towards a potential applicability of aeGBR disturbances as a marker for the prediction of transition of HRP subjects to schizophrenia.

STATEMENT:
In this work, in which 8 UKE researchers from the Department of Psychiatry and Psychotherapy were involved, we aimed to identify alterations of a gamma-band specific network in subjects showing high risk criteria for the development of a psychosis by means of simultaneously recorded EEG and fMRI. Abnormalities of oscillatory gamma activity are known to reflect a core pathophysiological mechanism underlying cognitive disturbances and other symptoms of schizophrenia. For the first time we report a reduced activation of a gamma-band specific network in the high-risk state of psychosis. Since the high risk-state for psychosis reflects the clinical risk for conversion to psychotic disorders including schizophrenia we were able to describe a candidate biomarker for the prediction of transition of sub-jects at high risk for psychosis to schizophrenia.



BACKGROUND:
This work was performed at the Department of Psychiatry and Psychotherapy in the group of author Christoph Mulert who holds a professorship at UKE since 2009. Funding was provided by the German Research Foundation (DFG SFB 936, Multi-Site Communication in the Brain, Project C6 to Christoph Mulert). The work was part of the PhD thesis of author Sebastian Vauth within the research training group of the SFB 936. The authors have strong research interests in the field of neuroimaging in psychiatry with a special focus on disturbed brain networks and multi-site communication deficits in schizophrenia investigated by means of simultaneous recordings of EEG and fMRI.