Spontaneous back-pain alters randomness in functional connections in large scale brain networks

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We use randomness as a measure to assess the impact of evoked pain on brain networks. Randomness is defined here as the intrinsic correlations that exist between different brain regions when the brain is in a task-free state. We use fMRI data of three brain states in a set of patients monitored over a period of 6 months. We find that randomness in the task-free state closely follows the predictions of Gaussian orthogonal ensemble of random matrices. However, the randomness decreases when the brain is engaged in attending to painful inputs in patients suffering with early stages of back pain. A persistence of this pattern is observed in the patients that develop chronic back pain, while the patients who recover from pain after 6 months, the randomness reverts back to a normal level. Our results demonstrate the effectiveness of random matrix theory in measuring systematic changes occurring in functional connectivity and also provide insights in improving treatment evaluations for back-pain patients.