

## **REM-sleep, the regulation of self-conscious emotion and hyperarousal in psychophysiological insomnia**

### **ABSTRACT:**

#### **Background**

The mechanisms of hyperarousal, the key symptom of insomnia, have remained elusive. Recently, restless REM sleep emerged as a robust signature of insomnia. Given the role of REM sleep in emotion regulation, we hypothesized that restless REM sleep could interfere with the overnight resolution of emotional distress, thus contributing to accumulation of arousal.

#### **Aims**

We aimed to investigate whether restless REM sleep impedes overnight distress resolution, and accumulates as hyperarousal.

#### **Method**

Observational and experimental studies employed psychometrics, EEG and fMRI. We first validated a proxy measure for restless REM sleep, and assessed it in a large sample along with measures of distress dissolving and hyperarousal. We then implemented an internet-protocol to induce self-conscious distress and assessed distress dissipation across 5 consecutive days. The same distress-inducing protocol was used in a MRI scanner while conditioning it to a simultaneously provided odor. The odor was again given during part of the subsequent sleep period, to induce targeted memory reactivation. A second MRI scan of distress induction evaluated how neural correlates of its impact changed overnight.

#### **Results**

Of the association between restless REM sleep and hyperarousal, 62.4% was mediated specifically by reduced overnight resolution of emotional distress in insomnia. In people with insomnia, a night's sleep could even increase distress, rather than resolve it. MRI findings indicated activation of the salience network during the induction self-conscious emotions, that ameliorated with sleep but not with a similar interval of being awake.

#### **Conclusion**

Restless REM sleep interferes with overnight maintenance of balanced salience network activation.

#### **Keywords**

REM-sleep, Psychophysiological insomnia, Hyperarousal, Self-conscious emotion

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