

Age-related changes in the modulation of attentional brain responses to sleep pressure at night

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Objectives: There is evidence that performance of older adults is less impaired by sleep deprivation (SD) compared to young adults. Here, we explored age-related changes in the cerebral correlates underlying vigilant attention under high and low sleep pressure during night-time.

Methods: 12 healthy young (18-30 years) and older (55-75 years) adults underwent a 40-h SD and multiple nap protocol (NP). Blood-oxygen-level-dependent (BOLD) activity was assessed with fMRI during a 10-min Psychomotor Vigilance Task at the end of the biological night (3 hours prior habitual wake time).

Results: Night-time SE was higher in older, compared to young adults ($p < 0.05$). PVT performance at the end of the biological night was similarly modulated by sleep pressure across age groups such that SD led to longer reaction times (RT) than NP ($p < 0.05$). Brain imaging data on events associated to intermediate RTs (between Percentile 25 and 75) indicated that age modulates BOLD activity in an attention-related inferior parietal region according to the sleep pressure condition (interaction condition*age; $p_{\text{corr}} < 0.05$). Under SD, aged participants presented higher BOLD activity than the young, while activity profiles in this region did not differ under NP. Finally, time-on-task-dependent thalamic activity was modulated by sleep pressure, depending on the age group ($p_{\text{corr}} < 0.05$). Older adults presented stronger thalamic time-on-task effects under NP compared to SD.

Conclusions: Attention-related parietal over-recruitment might contribute to overall lower neurobehavioral performance decline in response to sleep loss in aged individuals. Our results also suggest that state instability across the task is modulated by both sleep pressure and age.