Associations between NREM sleep delta sub-bands activities and multimodal neuroimaging in cognitively unimpaired older adults

*P. Champetier[1,2], C. André[1], S. Rehel[1,2], V. Ourry[1], B. Landeau[1], F. Mézenge[1], D. Roquet[1], D. Vivien[1,3], V. de la Sayette[4], G. Chételat[1], G. Rauchs[1], Medit-Ageing Research Group*

[1]Normandie Univ, UNICAEN, INSERM, U1237, PhIND "Physiopathology and Imaging of Neurological Disorders", NeuroPresage team, Institut Blood and Brain @ Caen-Normandie, GIP Cyceron, Caen, France, [2]Normandie Univ, UNICAEN, PSL Université, EPHE, INSERM, U1077, CHU de Caen, GIP Cyceron, NIMH, Caen, France, [3]Département de Recherche Clinique, CHU Caen-Normandie, Caen, France, [4]Service de Neurologie, CHU Caen-Normandie, Caen, France

---

**Background**: NREM sleep delta activity (0.5-4 Hz) declines with age and has been associated with grey matter (GM) atrophy and hypometabolism within frontal regions. Few studies have also reported correlations between amyloid burden measured using Positron Emission Tomography (PET) and specific sub-bands of delta activity during NREM sleep. Interestingly, the direction of the associations with amyloid burden appears to differ depending on the sub-band considered. However, structural and functional correlates of delta power sub-bands have not been investigated so far. Our aim was to better understand the relationships between NREM sleep delta activity and brain integrity, assessing the correlates of delta power and of its sub-bands using multimodal neuroimaging.

**Methods**: We monitored sleep in 127 cognitively unimpaired older adults (mean age ± SD: 69.0 ± 3.8 years, 63 % of women) using in-home polysomnography. NREM sleep EEG power was quantified in whole delta (0.5-4 Hz), slow delta (0.5-1 Hz) and fast delta (1-4 Hz) frequency bands. GM volume, brain perfusion and amyloid burden were assessed using MRI and $^{18}$F-Florbetapir-PET (early and late acquisitions) scans respectively. Amyloid accumulation over 21 months was also quantified by calculating amyloid percent annual changes maps.

**Results**: Voxel-wise analyses revealed that lower whole delta (0.5-4 Hz) activity was associated with GM atrophy in various areas including fronto-cingular regions after controlling for age, sex, educational level, ApoE4 status and apnea-hypopnea index. Lower slow delta power (0.5-1 Hz) correlated with GM atrophy and hypoperfusion in the medial orbitofrontal and anterior cingulate cortices while lower fast delta (1-4 Hz) power was associated with higher GM volume within the same regions. NREM sleep delta power was neither associated with amyloid burden at baseline, nor its accumulation over time, whatever the frequency band considered.

**Conclusions**: Overall, our results reinforce current knowledge on the structural (GM volume) and functional (perfusion) correlates of NREM sleep delta power in older adults and suggest more complex relationships, with opposite associations when considering the different frequency sub-bands. This highlights the importance of analysing delta power sub-bands to better understand the impact of sleep quality on brain integrity. Further investigations are needed to disentangle the associations between sleep and amyloid pathology.