EEG/EOG electrodes) were assessed by comparing model outputs to the automatic intracranial results. We obtained with random forest classifier: precision=77% and recall=2%, and with lightGBM: precision=67% and recall=3%.
Conclusion: The presence of a small (<5%) subset of IEDs in the MTL can be automatically detected with acceptable (>75%) precision non-invasively. We are now exploring the extent to which our models can generalize across individuals.
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MORNING PERCEPTION OF SLEEP, STRESS AND MOOD, AND ITS RELATIONSHIP WITH OVERNIGHT PHYSIOLOGICAL SLEEP PROCESSES IN ADOLESCENTS

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Introduction: Adolescence is characterized by profound biopsychosocial maturation, including changes in sleep physiology and behavior. Insomnia frequently emerges in adolescence, toward a greater prevalence in older girls. Although the objective-subjective sleep discrepancy is among the principal factors considered in insomnia diagnosis, the extent to which the profound developmental sleep changes occurring in adolescence are reflected in changes in subjective sleep perception is still unknown. In this study we aimed to investigate age- and sex-dependent differences in morning sleep perception, mood (e.g., sadness, stress, irritability), and readiness (e.g., concentration, fatigue, readiness), and explore the physiological correlates (polysomnographic (PSG) and electroencephalographic (EEG) sleep measures, and indices of sleep cardiac autonomic function) of morning perception of sleep, mood and readiness, in adolescents.
Materials and Methods: The sample consisted of 137 healthy adolescents (Age Range: 12-21 years; Mean Age: 15.5±2.3 y; 61 girls; Body Mass Index: 21.9 ±4.8 $kg \times m^{-2}$; 105 Caucasian), who were participating in the baseline sleep study of the National Consortium on Alcohol and Neurodevelopment in Adolescence (NCANDA) at SRI International (N = 109) and the University of Pittsburgh (N = 28). Participants underwent a laboratory-based PSG evaluation and rated their sleep quality, mood, and readiness the following morning. PSG, EEG, and autonomic indices were included in models to determine predictors of morning sleep perception, mood and state of readiness. Analyses were performed using Lasso predictor selection and linear regression with robust variance estimates.
Results: There was a significant effect of age for perceptions of sleep, with older adolescents reporting a deeper and less restless sleep than younger adolescents ($p<0.05$), however, they also reported more awakenings than younger adolescents ($p<0.05$). There were no sex differences in perceptions of sleep, however, older boys had greater discrepancy between the subjective and objective assessments of time spent awake at night (i.e., underestimation of PSG wakefulness), compared to younger boys and younger and older girls ($p<0.05$). Overall, PSG, EEG, and autonomic (heart rate and vagal-associated heart rate variability) measures explained between 3% and 29% of variance in morning sleep perception, mood, and readiness indices. Equally for both sexes, PSG measures (sleep timing, duration, and continuity) were the strongest predictors of morning self-reported measures, however, quantitative sleep EEG delta activity and autonomic measures also contributed to predicting sleep depth and restlessness, alertness, fatigue, sensation of being exhausted, and irritability ($p<0.05$).
Conclusions: For both boys and girls, the subjective experience of sleep is a complex and multi-component phenomenon, in which distinct physiological sleep processes only partially contributing to the morning perception of sleep and related measures of mood and readiness.
Acknowledgements:

NEURONS IN PREFRONTAL CORTEX RESPOND TO SLEEP DEPRIVATION BY INITIATING SLEEP PREPARATORY BEHAVIOUR AND NREM SLEEP

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Introduction: Animals undertake specific behaviours before sleep, yet little is known about whether these innate behaviours, such as nest building, are actually an intrinsic part of the sleep-inducing circuitry. The prefrontal cortex (PFC) contributes to executive functions and planning and is particularly sensitive to sleep deprivation. We examined the role of a subset of mouse PFC somatostatin/GABAergic (SOM/GABA) neurons which we found become activated during sleep deprivation.
Materials and Methods: We used cfos-based activity tagging to selectively capture SOM/GABA neurons in the mouse PFC cells that became active with sleep deprivation. To dissect the behavioural functions of these SOM/GABA cells, tagged mice were then challenged both chemogenetically and optogenetically. Projection specificities of the cells were tested by immunochemistry and electrophysiology.
Results: We found that mouse PFC SOM/GABA neurons, which become activated during sleep deprivation, induce sleep preparatory behaviour (nest building) when directly re-activated. Furthermore, if their activation is prolonged, these tagged neurons induce sustained global NREM sleep. We also found that these sleep-deprivation tagged PFC SOM/GABA neurons have long-range projections to the lateral preoptic (LPO) and lateral hypothalamus (LH) and these projections govern induction of nesting and NREM sleep respectively.
Conclusions: Our findings provide a circuit link for how the PFC responds to sleep deprivation by coordinating sleep preparatory behaviour and subsequent sleep. In the case of the PFC, with its role in executive function and planning, a direct connection to hypothalamic centres to initiate sleep preparation, and to help reinforce global sleep, could be a survival advantage to ensure the animal is in a safe place prior to sleeping.
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OBESITY-HYPOVENTILATION SYNDROME PREVALENCE IN PATIENTS WITH METABOLIC SYNDROME: INTERMEDIATE ANALYSIS ESTIMATES OBESITY-RELATED SLEEP HYPOVENTILATION PREVALENCE AT 6%

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Introduction: Obesity-hypoventilation syndrome (OHS) is defined by the combination of obesity (Body-Mass Index (BMI) $\geq 30 kg.m^{-2}$), sleep-disordered breathing , and awake daytime hypercapnia (awake resting PaCO2 > 45 mm Hg at sea level), after excluding other causes for hypoventilation. Worldwide OHS prevalence is estimated to be 10-20% in obese patients with obstructive sleep apnea (OSA) and 0.4% in the general adult population but is still unknown in France. Although frequently associated with OSA, it is a distinct clinical entity. The European Pneumology Society stages OHS severity from 0 (no OHS), 1-2 (obesity-related sleep hypoventilationmeasured by nocturnal capnography) to 3-4 (daytime hypercapnia). Under-diagnosed, OHS is most often discovered during an acute respiratory failure, which increases health-related costs and risk of hospitalization and death. It is thus critical to determine the prevalence of

early stages OHS (1-2) thanks to the use of capnography, and the clinical and environmental predictive factors within this obese population.
Materials and Methods: In this prospective multi-centric observational study, inclusion criteria were adults patients with obesity without past or current non-invasive ventilation or continuous positive pressure treatment and no recent hospitalization. In this intermediate analysis, OHS prevalence and staging, BMI and associated factors (gender, age, mean peripheral saturation, night-time desaturation < 90% (min and % of total sleep time), arterial blood gases values, SF-36 quality of life measurement, Ricci & Gagnon physical activity assessment, Epworth) were examined from the first 100 patients (67% women).
Results: In these patients, the prevalence of early stage OHS was 6% that is not routinely assessed. Stage 0 were 68% and stage 3-4 17%. Early stage OHS was associated with elevated level and duration of night-time hypercapnia (PtCO2 = 51.62mmHg ±6.88, $P<0.001$; Time PtCO2 > 50 mmHg = 144min ±166, $P<0.001$), hypoxemia (PaO2 = 82.55mmHg ± 14.32, $P=0.015$), lower pH (7.4 ± 0.03, $P=0.0086$) and elevated bicarbonate (HCO3- = 26.05mmol/L ± 0.92, $P<0.001$). No difference on BMI, apnea-hypopnea index, physical activity or Epworth score was found among groups.
Conclusions: These results suggest that the use of capnography recording allowed to determine the existence of early stage OHS which may be of clinical relevance and independent from BMI.
Acknowledgements:

ONE-NIGHT TOTAL SLEEP DEPRIVATION DID NOT ALTER THE EFFECTS OF PAVLOVIAN CUES ON INSTRUMENTAL RESPONSES FOR HIGHLY PALATABLE FOOD REWARDS

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Introduction: Inadequate sleep is a risk factor for obesity. Prior studies suggest that sleep-deprived individuals may consume more calorie-dense food. The mechanisms underlying such change is unclear. The present study aimed to evaluate if sleep deprivation altered the effects of cues on one's instrumental responses for highly palatable food rewards using the Pavlovian-Instrumental Transfer (PIT) paradigm. The PIT paradigm allowed for the evaluation of specific transfer effects, i.e., increased instrumental responding for a food reward in the presence of a conditioned cue associated with that specific food reward, and general transfer effects, i.e., increased instrumental responding for a food reward in the presence of a conditioned cue associated with other food rewards. It was hypothesized that one-night total sleep deprivation would elevate specific and general transfer effects.
Materials and Methods: A within-individual randomized crossover design was used. A sample of 96 healthy adults (mean age = 25.41 years, SD = 8.01, range = 18-51; BMI = 21.41, SD = 3.52, range = 16.61-40.16) were randomized to undergo either one-night total sleep deprivation (TSD) or the normal sleep control (NSD) condition first, followed by a 3-day washout period and the other condition. The PIT paradigm consisted of an instrumental training phase, a Pavlovian conditioning phase, and a testing phase. In the instrumental training phase, participants acquired the associations between pressing two keys on the keyboard (M and N) and two respective food rewards (i.e., instrumental conditioning). Then, in the Pavlovian conditioning phase, they were presented with five neutral graphical pattern cues pairing with the two food rewards used in instrumental conditioning, two other food rewards not previously presented, and a "no food reward" control respectively. In the PIT testing phase, they were told to press either M or N as many times as they can to get the food they wanted, in the presence and in the absence of the five Pavlovian cues. Participants completed the PIT training phases between 20:00 and 22:00 prior to sleep manipulation and the PIT testing phase between 0800 and 10:00 in the following day for both TSD and NSD conditions to control for circadian influences.
Results: Repeated-measure ANOVA showed that there was a main effect of satiation, indicating that instrumental responses decreased after satiation. Significant specific transfer effects were observed regardless of sleep conditions or satiation but not for the general transfer effect, indicating that the presence of cues associated with the key increased instrumental responses on that key. However, there was not a main effect of sleep on the specific transfer effects nor general transfer effects.
Conclusions: This finding did not support the hypothesis. Sleep deprivation did not alter the effect of Pavlovian cues on instrumental responses for highly palatable food rewards. It is possible that one-night TSD might not be sufficient to induce changes in habitual control of behavior. Future research directions will be discussed.
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PERSONALIZED EEG/FNIRS: A PROMISING TOOL TO STUDY WHOLE-NIGHT SLEEP IN HEALTHY AND PATHOLOGICAL CONDITIONS

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Introduction: Sleep is a crucial period during which neuronal and hemodynamic activities interact to support healthy brain functions. Simultaneous Electro-Encephalography and functional Magnetic Resonance Imaging (EEG-fMRI) remain the reference to study the hemodynamic responses associated with neuronal activity (Dang-Vu et al., 2010; Gotman et al., 2011). However, fMRI, only sensitive to fluctuations in deoxygenated hemoglobin, is limited by the difficulty to perform long-duration recordings. To overcome this issue, functional Near-Infrared Spectroscopy (fNIRS), a wearable technique sensitive to both cortical hemodynamic fluctuations of oxyhemoglobin (HbO) and deoxyhemoglobin (HbR), has been considered as an emerging technique for sleep monitoring (Ren et al.,2020). However, most fNIRS sleep studies relied only on a few optical sensors on the forehead, therefore not allowing accurate localization of the sleep-specific hemodynamic fluctuations. Although, it is well known that there are strong interactions between sleep and epilepsy with an increase of epileptic activity during non-rapid eye movement sleep (Frauscher et al., 2019, Lambert et al., 2018), the influence of sleep stage on the hemodynamic response to epileptic discharges remain unknown. In this preliminary work, we are proposing personalized EEG/fNIRS whole night monitoring as a promising tool to study sleep, where personalized fNIRS maximizes signal sensitivity to targeted cortical regions and allows an accurate localization of the hemodynamic responses (Cai et al., 2021).
Materials and Method: We performed whole-night personalized EEG-fNIRS monitoring on 4 healthy (20-35 years old) subjects and 3 focal epilepsy patients (21-42 years old). EEG electrodes were glued in the 10-20 layout using clinical adhesive (collodion) along with EOGs, EMG, and ECG. For the healthy subjects, we installed 54 fNIRS channels covering bilateral auditory cortices. For the epileptic patients, we installed 52 fNIRS channels targeting the epileptogenic focus and its homologous contralateral region (Pellegrino et al., 2016, Machado et al., 2018). The focus was estimated using EEG and Magnetoencephalography source localization of epileptic discharges. Using EEG, sleep stages and epileptiform discharges (bursts of spikes, spike, and waves and seizures) were marked and scored by sleep and epilepsy experts. We used a multi-taper approach to estimate HbO/HbR oscillatory characteristics during each sleep stage (Scheeringa et al., 2011).
Results: Average total bedtime was 7hours 11minutes (SD: 55minutes). Sleep efficiency was above 90% for all healthy subjects and was ranging from 70 to 80% in epilepsy patients. We found a gradual decrease of HbO oscillations power from awake to N3 followed by an increase in REM within endothelial (0.005-0.02Hz), neurogenic (0.02- 0.04Hz), and myogenic (0.04-0.15Hz) frequency bands in both healthy and epileptic subjects, in agreement with the existing literature (Näsi *et al.*,2011). In the epilepsy patients, we observed an HbO decrease and a HbR increase at the time of interictal epileptiform discharges (IEDs) and seizures. In one patient, fNIRS response to the IEDs differed between N2 and N3, suggesting a