Title

The translational potential of sleep and circadian rhythm disturbances as a biomarker of Alzheimer's disease

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ABSTRACTS

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O001 | Preserved neuron reactivity dynamics during prolonged wakefulness is linked to cognitive fitness in aging, independently of tau and amyloid beta burden

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Objectives/Introduction: Aging is associated with important modifications in sleep homeostasis and circadian rhythmicity. Whether these changes influence cognition beyond the age-related decline in brain integrity remains unclear, however. Here, we investigated whether the dynamics of neuron reactivity, a basic aspect of brain function influenced by sleep homeostasis and circadian processes, is related to performance across different cognitive domains in healthy aging. We further asked whether the link between neuron reactivity and cognition was independent from abnormal brain protein accumulations central to the pathophysiology of Alzheimer's disease (AD).

Methods: We used transcranial magnetic stimulation combined with electroencephalography (TMS-EEG) to assess the temporal dynamics of frontal cortical neuron reactivity in 47 healthy older individuals (aged 51–69 years, mean = 59.3 ± 5.2; 30 females) during 20 hr of wake extension in strictly-controlled constant routine conditions. A comprehensive battery of neuropsychological tasks measuring memory, attentional, and executive functions was administered to all participants while well-rested. Performance was Z-scored to create composite scores for memory, attentional, and executive abilities. Participants also underwent two Positron Emission Tomography (PET) scans to quantify tau and amyloid beta protein burden using, respectively, 18F-THK5351 and 18F-flutemetamol radioligands.

Results: Generalized linear mixed models analyses reveal that frontal neuron reactivity dynamics during prolonged wakefulness is strongly associated with the executive performance (p = 0.004), but not with memory (p = 0.9) or attentional (p = 0.16) functions (controlling for age, sex, and education). Importantly, those individuals retaining young-like dynamics in brain reactivity showed better executive performance. Critically, this domain-specific association remains significant after controlling for tau and amyloid beta burden in brain regions underlying executive functions (p = 0.01).

Conclusions: Our data show that older individuals exhibiting preserved sleep-wake regulation of frontal cortical neuron reactivity have better executive performance. Furthermore, this association appears independent of tau and amyloid beta protein accumulations which take place during normal aging and decades before the onset of AD cognitive symptoms. These original results provide strong support for a key role of sleep homeostasis and circadian rhythmicity in determining age-related cognitive decline apart from the age-related deterioration in brain structures.

Disclosure: Support: FNRS, ULiège, ARC17/21-09, FEDER, WBI, Clerdent Foundation.

O002 | Discovering the role of miR-709 in the sleep homeostatic process

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Objectives/Instruction: MicroRNAs are small non-coding RNAs occupying a key role in various biological processes, including sleep. We previously performed a microRNA-array analysis to determine which microRNAs are affected by sleep loss in the mouse brain and found the expression of miR-709, an activity-dependent microRNA, to be increased in the forebrain after 6 hr of sleep deprivation (SD). The current study aims to decipher the functional involvement of miR-709 in sleep homeostasis.

Methods: *In vivo* knockdown of miR-709 was performed using locked nucleic acid (LNA) inhibitors (Exiqon, Denmark). Cannulated mice, equipped with electroencephalography (EEG) and electromyography (EMG) electrodes, were injected intracerebroventricularly (ICV) with either (a) specific miRNA-709 inhibitors (imiR-709, n = 7), (b) non-functional "scrambled" inhibitors (scr, n = 6), or (c) artificial cerebrospinal fluid (aCSF, n = 5) as vehicle control. The response to a

6 hr SD relative to baseline was compared among the three groups. To identify pathways affected by miR-709 inhibition, we used primary cortical cultures from mouse embryos, treated with either (a) imiR-709, (b) scr, or (c) vehicle (n = 6/condition), and performed mRNA sequencing (RNA-seq) on the extracted RNA. Affected pathways were identified by enrichment analysis using the PANTHER Overrepresentation Test (released 2017-12-05) and the Gene Ontology (GO) database (released 2018-02-02).

Results: *In vivo* inhibition of miR-709 in murine brains resulted in a higher increase in the spectral composition of the EEG during NREM sleep after periods of prolonged wakefulness, as compared to the controls. This higher increase was specific to the slow delta frequency band (0.75–2.25 Hz). *In vitro* inhibition of miR-709 resulted in an up- or downregulation in the expression levels of 111 genes with known contributions in ion-channel activity (i.e. *Cacna1i*, *Kcnip4*), synaptic remodelling (i.e. *Nlgn1*, *Akap12*), and glutamatergic signalling (i.e. *Grip1*, *Grin1*), as compared to the control groups.

Conclusions: Our findings delineate miR-709 as a fine tuner of neuronal activity and synaptic plasticity in the mouse brain. In previous studies, miR-709 has been found to be upregulated after activation of metabotropic glutamate receptors, which are directly implicated in sleep homeostasis. miR-709 might therefore functionally link neuronal excitation during extended wakefulness to the recovery process occurring during sleep.

Disclosure: Nothing to disclose.

O003 | Symptom-based clinical subtypes of obstructive sleep apnoea show differences in spectral power and immediate post-arousal dynamics

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Objectives/Introduction: There is an emerging concept that distinct symptom subtypes exist in obstructive sleep apnoea (OSA), which relate to treatment responses and outcomes. However, the physiology of these subtypes has not been comprehensively characterized. Spectral analysis and recent electroencephalographic (EEG) markers of sleep, including the odds-ratio product (ORP), have successfully quantified sleep depth and response to arousal. This study identifies OSA symptom subtypes in a cohort from the U.S. and examines whether specific EEG physiological markers characterize these subtypes.

Methods: We used polysomnographic and symptom questionnaire data from 654 individuals with moderate-severe OSA [apnoea-hypopnoea index (AHI) ≥15; 65.4 ± 10.5 years-old; 32% female] in the Sleep Heart Health Study, a multi-centre, population-based longitudinal study. Symptom subtypes were identified using latent class analysis. We compared several EEG markers of sleep and conventional polysomnographic sleep parameters (e.g. AHI, sleep stage percentages, arousals and stage shifts) among identified subtypes using linear regression with and without adjusting for age, gender and body mass index.

Results: Analyses identified 4 subtypes as the optimal solution: 'moderate sleepiness only' (38.1%), 'minimally symptomatic' (32.7%), 'excessively sleepy' (16.5%) and 'disturbed sleep' (12.7%). There were statistically significant (p = 0.003), but clinically small differences in AHI; average AHI ranged from 27.2 to 34.2 events/hr. While no other conventional polysomnographic measures differed, symptom subtypes were associated ($p < 0.05$; 5% false discovery rate adjusted) with overall normalized EEG power, delta, sigma, beta-1 and gamma power, average wake ORP, and number of arousals with max-baseline ORP difference >0.5. After covariate adjustment, the 'moderate sleepiness only' group had lower delta [β (95% CI) = −7.3 (−12.0, −2.7); p = 0.002] and gamma power [−0.12 (−0.21, −0.04) μV^2/Hz; p = 0.002] and the 'excessively sleepy' group had a higher number of arousals with max-baseline ORP difference >0.5 [23.2 (6.6, 39.9); p = 0.006] compared to the 'disturbed sleep' group.

Conclusions: We show for the first time that EEG markers of sleep can explain differences in OSA symptom subtypes. The higher delta and gamma power in the 'disturbed sleep' group might indicate physiological responses to the insomnia-related symptoms in these patients. Similarly, the higher number of arousals with large ORP differences in the 'excessively sleepy' group might reflect more fragmented sleep, explaining their daytime symptoms.

Disclosure: Nothing to disclose.

O004 | The impact of treating insomnia upon functional health, psychological wellbeing and sleep-related quality of life: a randomised controlled trial with mediation analysis

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Objectives/Instruction: Digital Cognitive Behavioural Therapy (dCBT) is a scalable and effective intervention for treating the ubiquitous problem of insomnia. However, the majority of people with insomnia seek help because of the daytime consequences of

insomnia, and not the night-time effects per se. We investigated the impact of dCBT for insomnia upon functional health, psychological well-being and sleep-related quality of life (QoL), and whether a reduction in insomnia was a mediating factor.

Methods: This online, two-arm parallel group randomised trial with waitlist control included 1711 adults with complaints of insomnia (ISRCTN 60530898). Participants were randomized to dCBT (*Sleepio*™) or sleep hygiene education (SHE). Online assessments took place at 0 (baseline), 4 (mid-treatment), 8 (post-treatment), and 24 (follow-up) weeks. At week 25 participants allocated to SHE were offered dCBT. Primary outcomes were functional health (Patient Reported Outcome Measurement Information System: Global Health scale), psychological well-being (Warwick-Edinburgh Mental Wellbeing Scale) and sleep-related QoL (Glasgow Sleep Impact Index). Secondary outcomes comprised mood, fatigue, sleepiness, cognitive failures, work productivity and relationship satisfaction. Insomnia was assessed with the Sleep Condition Indicator. All analyses were intention-to-treat.

Results: In the dCBT group 681 participants (81%) logged on for at least one dCBT session and 491 participants (57.6%) completed at least 4 sessions. At weeks 4, 8 and 24, dCBT was associated with a small improvement in functional health (Cohen's d: 0.16, 0.31, 0.31 respectively) and psychological well-being (Cohen's d: 0.13, 0.35, 0.38), and a large improvement in sleep-related QoL (Cohen's d: −0.69, −1.38, −1.46) compared with SHE (all $p < 0.01$). Improvement in insomnia mediated these outcomes (range percent mediated 45.5–84.0%). Symptoms of depression, anxiety, sleepiness, fatigue, cognitive failures and work productivity all demonstrated significant differences in favour of dCBT.

Conclusions: dCBT is effective in improving insomnia, functional health, psychological well-being and sleep-related QoL in people screening positive for insomnia disorder. Targeting insomnia complaints could therefore be a therapeutic pathway for addressing self-reported health, well-being and quality of life. In addition, these results confirm that dCBT improves both daytime and night-time aspects of insomnia strengthening existing recommendations of CBT as the treatment-of-choice for insomnia.

Disclosure: AIL held a position at the University of Oxford during the conduct of the study that was funded by Big Health Ltd, the company which developed the dCBT for insomnia program (Sleepio). CAE is co-founder and Chief Medical Officer of Big Health Ltd.

UNRAVELING THE NEUROBIOLOGY OF SLEEP IN NORMAL AGEING AND IN NEURODEGENERATION

5 | Sleep oscillations and the pathogenesis of Alzheimer's disease

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With 10% of adults over the age of 65 suffering from dementia and this number projected to double by 2050, understanding the factors responsible for cognitive impairment is of critical importance. Amyloid beta (Aβ) plaques and neurofibrillary tangles (NFT) are two key pathological processes that lead to cognitive deterioration in Alzheimer's disease (AD). Cerebrospinal fluid (CSF) Aβ and tau concentrations have been used extensively as biomarkers of AD pathology and found to correlate with amyloid plaques and NFT at post-mortem. Emerging evidence suggests that the sleep-wake cycle directly influences their levels. Specifically, low NREM stage 3 (NREM3) slow wave activity (SWA) is associated, in normal elderly, with high cerebrospinal fluid (CSF) Aβ, while active disruption of slow wave sleep (SWS) results in increases in CSF Aβ peptides within-subjects. Unlike Aβ, associations between poor SWS and tau have not been observed suggesting that disruption in other sleep oscillations could be linked to tau pathology. In a cross-sectional study with one-night in-lab nocturnal polysomnography (NPSG) and morning-to early afternoon CSF collection that was conducted on 50 community-dwelling, cognitively normal healthy subjects, with normal or mild obstructive sleep apnea (OSA) defined as an apnea-hypopnea index with 4% desaturation (AHI4%) <15, we found that spindles during NREM stage 2 (NREM2) sleep were negatively correlated with CSF T-tau levels and to a lesser degree to CSF P-tau. Spindle-duration count and fast spindle density were also negatively correlated with T-tau levels. Sleep duration and other measures of sleep quality were not correlated with spindle characteristics and did not modify the associations when included in the models. While reductions in NREM sleep oscillations, including SWS and sleep spindles, or the more recently reported reductions in REM sleep percentage from the Sleep Heart Health Study, may reflect a preclinical AD state, it remains unclear just how these attenuated oscillations are mechanistically linked to cellular processes regulating Aβ and tau. Candidate mechanisms would include patterned activity-driven synthesis or degradation of such molecules or the coupling of such oscillations to neuroimmune function. Longitudinal and interventional studies to assess changes in sleep oscillations as well as AD biomarkers are needed.

Disclosure: Consulting with Eisai.

6 | Orexin and Alzheimer's disease

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In the recent years, orexinergic system dysregulation has been described in Alzheimer's Disease (AD) neurodegenerative process. In human studies, it has been demonstrated that both patients affected by moderate-severe AD and patients affected by mild cognitive impairment (MCI) due to AD pathology show increased CSF orexin levels compared to controls. These findings suggested that the orexinergic neurotransmitter system may be dysregulated in the early as well as in the advanced stages of the AD neurodegenerative processes. It is well known that the role of the orexinergic system is not limited to the control of diurnal wake, but also influences nocturnal sleep. In physiologic condition, higher orexin brain levels seems to reduce primarily REM and slow wave sleep and increase wakefulness during nocturnal sleep; whereas during the day the higher orexinergic tone promotes daytime wakefulness. The finding that CSF orexin levels are higher in AD and MCI patients and correlate with sleep dysregulation proposed that orexinergic signaling dysregulation coupled with nocturnal sleep alteration can be responsible for circadian rhythm disruption in AD patients. Animal model studies supported this finding by demonstrating that modulation of orexin and its effects on sleep appear to induce β-amyloid pathology in the brain. Taking into account that Alzheimer's pathology interferes with sleep physiology, orexinergic system dysregulation may play a significant role in altering sleep in AD patients and promoting AD pathology by inducing β-amyloid neurodegeneration. Hence, we will show the recent evidence about the relationship among orexinergic signaling overexpression, the disruption of the sleep-wake cycle and AD pathology.

Disclosure: Nothing to disclose.

7 | Isolated RBD, an early stage of α-synucleinopathy

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The isolated form of REM sleep behaviour disorder (RBD) has been recognized during the last years as the prodromal stage of an α-synucleinopathy. Several long-term follow-up studies of patients with isolated RBD from different centers demonstrated independently a very high risk (>90%) of developing α-synucleinopathies, such as Parkinson disease, dementia with Lewy bodies or multiple system atrophy.

Biomarkers of α-synucleinopathies have been extensively investigated in iRBD. Some biomarkers, like DAT-SCAN, olfactory function and subtle motor signs, are indicative of proximity to conversion to overt α-synucleinopathy. DAT-SCAN can be useful also in monitoring disease progression. Other biomarkers including different imaging techniques, tests of autonomic function, neuropsychological and EEG finding, tissue analysis, genetic, speech analysis and color vision need to be further investigated to clarify their potential usefulness in identifying patients at risk of short-term conversion or in monitoring disease progression. A long-term (>10 years) follow-up study by the Sleep Innsbruck Barcelona (SINBAR) group showed that biomarkers of prodromal PD are ubiquitous in patients with isolated RBD, providing evidence that even these patients are affected by an underlying neurodegenerative process.

The term 'prodromal RBD' (in analogy to prodromal Parkinson disease) has been proposed to define recognizable precursory disease states before the full diagnostic criteria for isolated RBD are met. In fact, evidence is accumulating that a prodromal stage of RBD exists. Patients with isolated REM sleep without atonia (RWA) or REM-sleep-related behavioural events (RBE) who do not fulfil the diagnostic criteria for RBD show a gradual increase in EMG activity or jerks captured on video during REM sleep over time. These observations suggest that RBD has an insidious onset until clinically manifest RBD develops. Thus, early screening using video-polysomnography could identify patients at risk of neurodegeneration even before isolated RBD becomes manifest.

Giving the outstandingly high specificity and very long interval between the onset of idiopathic RBD and the clinical manifestations of α-synucleinopathies, the prodromal phase of this disorder represents a unique opportunity for potentially disease-modifying intervention, allowing an even earlier detection of individuals at risk of neurodegeneration.

Disclosure: Honoraria for speaking and/or advisory board or consulting from Otsuka, Mundipharma, UCB, Janssen Cilag, Lündbeck, AbbVie, Lilly, Axovant, Benevolent Bio.

8 | Is OSA associated with pathological aging? A neuropsychological and neuroimaging perspective

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There is accumulating evidence that obstructive sleep apnea (OSA) may impact brain structure and function. Recent cohort studies suggest that OSA is a risk factor for stroke, mild cognitive impairment and Alzheimer's disease. Because prevention through treatment of risk factors is currently the main intervention for reducing the incidence of dementia, how OSA affects brain health and whether its treatment can slow neurodegeneration are relevant questions. This presentation will addressthe most recent findings on the neurocognitive consequences of OSAin the elderly. We will discuss neuropsychological results obtained in large cohort studies and the specific cognitive profile observed in older OSA adults. Regarding neuroimaging, most studies on OSA have been performed in young and middle-aged adults. Whether these findings can be generalized to an aged brain is unclear, as neuroimaging studies with older adults have

only just emerged. We will therefore review the most recent results from structural (e.g. voxel-based morphometry, cortical thickness and diffusion tensor imaging) and functional neuroimaging (e.g. cerebral blood flow, metabolism). Given the complexity of changes that can occur in response to OSA (e.g. cellular death, edema, increase in brain water content, neuroinflammation, changes in cerebral perfusion, increase in Aβ deposition), heterogeneous results can be obtained depending on participants' age, severity of intermittent hypoxia and sleep fragmentation, clinical stages of dementia, etc. It is therefore important to investigate the effect of OSA by combining multiple neuroimaging techniques. We will present how findings from neuropsychology and neuroimaging could impact future OSA management in older individuals. Finally, we will discuss the effect of OSA treatment, which may slow, stop or reverse neurodegenerative processes accentuated by OSA, even in individuals already affected by a neurodegenerative disease.

Disclosure: Nothing to disclose.

THE BIG SLEEP: UNRAVELING INSOMNIA USING BIG DATA

9 | Epidemiology, genetic models and epigenetics of insomnia

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Clinically significant, persistent insomnia is a common problem in health, associated to increasing age and female gender. According to twin and family studies, the heritability estimates for self-reported symptoms of insomnia are modest but tend to be higher for women than for men. Despite challenges in revealing specific genetic factors for sleep traits – most likely reflecting the multifactorial nature of these traits - such factors are emerging, thanks to combined efforts of basic sleep research, studies on experimental settings and on samples enriched for extreme phenotypes, and, recently, by making use of the very large genetic screenings. The strong positive correlation between the polygenic risk for insomnia symptoms and anxiety disorder is in line with previous analysis on twins showing completely shared additive genetic influences on insomnia and generalized anxiety disorders. The slightly lower genetic correlation between insomnia and depression symptoms is likely to be etiologically more complicated, as evidenced by twin studies showing only modest shared genetic influences between symptoms for insomnia and depression in cross-sectional and longitudinal settings.

Sleep is highly adaptive to the environment so that the propensity of sleep to react to external influences is built within its basic physiology. There are a few concrete examples revealing a modifying effect of a genetic variation for liability to disturbed sleep under a specific environmental influence, such as caffeine or shift work. At level of chromatin activity, the environment is considered to exert its effect via epigenetic mechanisms, including DNA methylation. Understanding the mechanisms involved in gene-environment interactions for disturbed sleep will be, by no doubt, of primary interest in order to fully understanding the risk at level of an individual and, eventually, bring important insight into risk prediction and development of therapeutic strategies.

Disclosure: Nothing to disclose.

10 | Trait and life history profiles reveal stable insomnia subtypes

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Objectives: Insomnia Disorder (ID) is the second-most prevalent disorder and a primary risk factor for depression. Despite its heritability, and recently identified risk-genes, it has proven difficult to pinpoint consistent biomarkers of ID. These inconsistencies have stalled progress in our understanding of mechanisms and flag possible heterogeneity. Previously proposed subtypes were predominantly defined by sleep-related characteristics. This method of subtyping unfortunately has limited reliability and validity. The present large-scale study investigated whether traits and life history profiles could reveal previously unrecognized subtypes with better reliability and relevance for treatment response and biomarkers.

Methods: N = 4322 volunteers of the Netherlands Sleep Registry completed up to 34 questionnaires on traits relevant to insomnia (Benjamins et al. Sleep Med Rev 2017:36:71-81). Latent class analysis on N = 2224 participants who fulfilled diagnostic criteria for ID allowed for data-driven identification of subtypes. Classification accuracy was evaluated in N = 1046 who completed at least 10 questionnaires. The subtypes were validated in an independent sample and using longitudinal follow-up. Clinical relevance of ID subtypes was assessed with respect to risk of comorbid depression, and using preliminary data on subtype development, biomarker, and treatment response differences.

Results: Five ID subtypes were identified that were distinguished by their multivariate profile of life history, affect and personality rather than their specific sleep complaints. The five-class solution performed equally well in an independent sample, and follow-up 4.8 ± 1.6 years later demonstrated high subtype stability. Lifetime

and comorbid depression differed significantly across subtypes. Moreover, preliminary analyses revealed differences between subtypes in the developmental trajectories of sleep complaints, brain function as indicated by an EEG biomarker, and treatment effect.

Conclusions: This large-scale study identified robust and clinically relevant ID subtypes, defined by traits and life history rather than sleep complaints. The demonstrated stability of the ID subtypes paves the way for studies to target homogeneous subtype samples, resolve inconsistencies, personalize treatments and select those with the highest risk of depression for preventive interventions. Feasibility of this approach was confirmed using preliminary data. A derived concise questionnaire for subtyping is freely available upon request.

Disclosure: Nothing to disclose.

11 | Genome-wide analysis of insomnia in UK Biobank and 23andMe identifies novel loci and functional pathways

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Insomnia is the second-most prevalent mental disorder, with no sufficient treatment available. Despite a substantial role of genetic factors, only a handful of genes have been implicated and insight into the associated neurobiological pathways remains limited. Here, we perform large-scale genome-wide analysis (GWAS) in UK Biobank and combine results in a meta-analysis with a GWAS in 23andMe to allow detection of a substantial number of genetic variants and gain insight into biological functions, cell types and tissues involved in insomnia. Moreover, we investigate six additional sleep-related phenotypes through GWAS in UK Biobank.

We perform genome-wide analysis (GWAS) of insomnia in UK Biobank (N = 386,533), and subsequent meta-analysis with GWAS results from 23andMe (N = 944,477) to increase statistical power (total N = 1,331,010). Next, we perform extensive follow-up analysis, including functional annotation using the online FUMA platform developed by our group, and analysis of gene-sets and tissue and single neuron gene-expression. The results are compared with GWAS of six-sleep related traits in UK Biobank.

We identify 202 genome-wide significant loci implicating 956 genes through positional, eQTL and chromatin interaction mapping. We show involvement of the axonal part of neurons, of specific cortical and subcortical tissues, and several specific cell-types in insomnia: striatal medium spiny neurons, pyramidal neurons in the claustrum and hypothalamic neurons. These cell-types have been implicated previously in the regulation of reward processing, sleep and arousal in animal studies, but have never been genetically linked to insomnia in humans. We found weak genetic correlations with other sleep-related traits, but strong genetic correlations with psychiatric and metabolic traits. Mendelian randomization identified causal effects of insomnia on specific psychiatric and metabolic traits. In addition, we observe many new genomic loci for sleep-related traits, including being a morning person and sleep duration.

Our findings reveal key brain areas and cells implicated in the neurobiology of insomnia and its related disorders, and provide novel targets for treatment. These results illustrate how big data approaches using large-scale datasets such as UK Biobank are accelerating novel breakthroughs and transform the field of human genetics.

Disclosure: Nothing to disclose.

12 | Modelling sleep disorders in mice

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The combination of large-scale approaches to both human and mouse genetics offers tremendous opportunities into the investigation of the biological mechanisms of sleep defects. Moreover, the development of precise preclinical models allow the development of novel intervention that can eventually be transferred to clinics. Over last decade in our lab we developed a series of novel preclinical mouse models that describes the modulations of important sleep phenotypes. In particular, we concentrated out attention towards: (i) the interaction between circadian clock and sleep homeostasis; (ii) the epigenetic control of sleep; (iii) the interplay between thermoregulation and sleep defects. Here I will describe an advanced platform for phenotyping sleep in mice that offers the possibility to cover large-scale datasets and to decipher the heterogeneous nature of sleep. In addition, focusing on the sleep defects associated with Prader-Willi syndrome (PWS), I will present our understanding of the genetic and epigenetic elements of the sleep abnormalities in PWS. Moreover, by using a preclinical mouse model of PWS we tested pharmacological interventions that ameliorates the REM sleep deficits and the alteration of temperature.

Disclosure: Nothing to disclose.

CIRCADIAN MODULATION OF EEG BRAIN ACTIVITY AND COGNITION, AND THE IMPACT OF LIGHT ON SLEEP

13 | The role of light in regulating alertness and performance in mice

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Light exerts a profound effects on physiology and behaviour. As well as circadian entrainment, light modulates autonomic and neuroendocrine responses as well as regulating cognitive processes such as attention, arousal and performance. The retinal photoreceptors mediating these non-image forming responses to light include the rods and cones as well as a subset of melanopsin-expressing photosensitive retinal ganglion cells (pRGCs). Despite major advances in this field, our understanding of the mechanisms by which light influences alertness and performance are limited, including both the photoreceptors and the central neural pathways underlying these responses. In humans, the effects of light on alertness have been primarily investigated via four different approaches:

(1) measures of subjective sleepiness;
(2) measures of cognitive performance;
(3) electroencephalography (EEG) and
(4) brain imaging.

These studies have provided a wealth of data on the effects of light stimuli on different aspects of alertness and cognitive performance, providing a critical basis for improved lighting design. By contrast, surprisingly few studies have been conducted on rodent models, which has limited our understanding of the fundamental mechanisms underlying these responses. Studies in mice have shown that melanopsin regulates alerting/arousing responses, associated with increased plasma corticosterone levels. As in humans, these responses are wavelength-dependent. Furthermore, recognition memory performance is acutely regulated by light. For the first time, we demonstrate that light exerts dose-dependent effects on recognition performance, and that these changes are paralleled by changes in EEG power in the theta and gamma range. Our preliminary data show that these effects on performance and EEG power also appear to be wavelength-dependent. Together, these data demonstrate that paralleling the approaches used in human studies, mice show a light-dependent regulation of alertness and performance, providing the basis for future studies on the role of specific photoreceptors and neural pathways in these responses.

Disclosure: Nothing to disclose.

14 | Effects of the circadian system and circadian misalignment on cognition in non-shift workers and chronic shift workers

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Shift work increases the risk for human errors with extraordinary socio-economical costs. Overnight operations pose a challenge because our endogenous circadian system inhibits cognitive performance at night. Importantly, as task-specific cognitive brain regions have different 24-hr circadian dynamics, circadian misalignment, which corresponds to the misalignment between the circadian pacemaker and behavioral/environmental cycles, may impact cognition task-dependently. Furthermore, how the circadian system modulates cognition over multiple days, and its relevance for chronic shift workers remain to be established. Using a randomized, cross-over design mimicking night shift work, we show that circadian misalignment increases cognitive vulnerability on sustained attention, cognitive throughput, information processing and visual-motor performance *over multiple days*, as compared to circadian alignment (day shifts). Circadian misalignment effects are task-dependent: while they acutely impair sustained attention with recovery after 3-days, they progressively hinder daily learning. Individuals felt sleepier during circadian misalignment, but they did not rate their performance as worse. Furthermore, circadian misalignment effects on sustained attention depended on prior sleep history (sleep efficiency). Shift workers frequently undergo circadian misalignment, which has been proposed as a biological mechanism that may explain why they experience decrements in their perceived levels of alertness and cognitive efficiency. However, it remains uncertain whether chronic shift workers may, to some extent, adapt to circadian misalignment and thus show no adverse effects on cognitive function. Therefore, we investigated whether the task-dependent cognitive effects of circadian misalignment can be translated to chronic shift workers. Chronic shift workers had more cognitive vulnerability on sustained attention, information processing and visual-motor performance under circadian misalignment as compared to when the same individuals were under circadian alignment, particularly after more than 10 hr of wakefulness. Furthermore, their subjective perception of sleepiness and their prior sleep history significantly predicted performance variability on sustained attention and visual-motor performance. These data suggest that when chronic shift workers are under circadian misalignment their performance may dramatically deteriorate if exposed to longer durations of wakefulness, while their performance across the wake episode remains fairly stable under circadian alignment. Collectively, circadian misalignment may provide an important biological framework for developing countermeasures against adverse cognitive effects in shift workers.

Disclosure: Nothing to disclose.

15 | Relationship between daytime light exposure and EEG sleep architecture, slow-wave activity, and sleep quality in young healthy office workers

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Introduction: Light is the primary signal for the circadian organization of the sleep-wake cycle. A possible role of daytime light on sleep characteristics and sleep quality, other than timing alone, has become more likely since the discovery of direct projections of photosensitive retinal ganglion cells to brain areas involved in sleep regulation. In addition, studies in mice have shown the involvement of melanopsin in homeostatic sleep regulation. Recently, two studies were carried out that supported the effect of daytime light on nighttime sleep quality in humans.

Study 1: In a field study with ambulatory polysomnography and a light sensor at the wrist (n = 20), we found a clear correlation between the amount of daytime light and sleep architecture during the subsequent night; high daytime light exposure significantly correlated with a lower percentage of REM sleep ($p < 0.001$) and a larger and faster accumulation of slow-wave sleep ($p < 0.05$).

Study 2: A laboratory experiment supported the idea of high daytime light levels improving sleep. In a within study design, 12 participants completed two conditions: 1900 lux of bright white light (BL) or 130 lux of low light (LL) from 9 a.m. to 5 p.m. Sleep-EEG analysis of the subsequent night showed a significant ($p < 0.05$) increase in percentage of REM sleep (LL: 19.7%; BL: 23.3%), decrease in percentage wake after sleep onset (LL: 5.8%; BL: 2.5%) and increased sleep efficiency (LL: 92.1%; BL: 95.8%). The accumulation of slow-wave-activity (1–4 Hz) during non-REM sleep was significantly faster in the BL condition compared to the LL condition ($p < 0.001$). Subjective ratings of sleepiness the next morning supported the improved sleep quality: early morning sleepiness as measured with the Karolinska Sleepiness Scale was significantly lower after a night in the BL condition compared to the day before ($p < 0.001$), while this was not found in the LL condition ($p = 0.12$).

Conclusion: In general, these findings support the idea that higher daytime light levels improve sleep quality during the night. Whether this is explained by an alerting effect of light during the day, or reflects a direct effect on sleep homeostasis at night will be discussed.

Disclosure: Marijke Gordijn works as a consultant for Philips Healthy Sleep Solutions.

16 | Impact of different light exposures in the evening on EEG slow-wave activity and REM sleep

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Objectives: Quality and quantity of evening light exposure has been shown to impact on sleep architecture, slow-wave activity and REM sleep. We aimed at testing the effects of three different light conditions in the evening on EEG sleep spectra during NREM and REM sleep.

Methods: A total of 18 young participants (mean age 23.2 ± 3.3 years; 12f and 6 m) were exposed to different light conditions on three subsequent evenings (for 30 min): blue-enriched polychromatic light, bright orange light, or dim light. In the mornings they received either blue-enriched polychromatic or control light (=incandescent bulb) for 3 consecutive days, in a balanced cross-over design. EEG recordings from all nights were visually scored according to standard criteria and subjected to spectral analysis (Fast Fourier Transformation). NREM/REM sleep cycles were expressed as percentiles. Artifact free REM sleep cycles were also subjected to semi-automated microstate analysis (Siesta Group, Vienna, Austria). Statistical analyses were performed with mixed linear regression models.

Results: EEG slow-wave/theta activity in the frequency range between 1.5–5.25 Hz (from a central derivation) was significantly higher after orange light in sleep cycle 2 when compared to blue-enriched light (sleep cycle x evening light; $p < 0.05$). The REM sleep atonia index was larger after orange lighting in the evening than after dim light (main effect of evening light; $p < 0.05$). For morning light conditions, EEG activity in the sigma range (14–16.25 Hz) and beta range (17.25–23 Hz) was significantly lower after the blue-enriched morning light compared to control light exposure (main effect of morning light; $p < 0.05$), without statistically significant interactions with evening light conditions.

Conclusions: Our results confirm and expand previous findings such that orange light in the evening increases SWA during NREM sleep compared to blue-enriched light and led to lower EMG amplitudes during REM sleep. Blue-enriched morning light seems to lower EEG beta activity the following night. It remains to be tested whether orange light exposure in the evening may have beneficial effects in patients with different sleep disorders.

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Disclosure: G. Gruber is working for the Siesta Group and D. Kunz is the shareholder of Intellux GmbH, Germany.

SLEEP AND DRIVING

O017 | Maintenance of Wakefulness Test, real and simulated driving in narcolepsy/hypersomnia patients

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Objectives/Introduction: Sleepiness at the wheel is a major risk factor for highway traffic accidents. Narcolepsy and idiopathic hypersomnia (IH) are rare central disorders that induce severe daytime sleepiness. The objective of this study is to assess the relationship between real and simulated driving performance and the objective level of alertness as measured by the Maintenance of Wakefulness Test (MWT) in patients suffering from narcolepsy or idiopathic hypersomnia.

Methods: 27 patients (10 patients with narcolepsy, type 1 (n = 7) and type 2 (n = 3), and 17 patients with idiopathic hypersomnia, mean age = 33.8 ± 11.1 years, range = 18–65 years; 4 males) were recruited in a randomized, crossover, double-blind placebo-controlled trial and compared to 27 matched healthy controls.

Patients were randomly assigned to receive modafinil (400 mg) or placebo before the driving test (2 hr of real and 2 hr of simulated highway driving for each patient). Standard Deviation of Lateral Position (SDLP) of the vehicle in real and simulated driving and mean sleep latency in a 4 × 40 min MWT were assessed.

Results: Untreated patients presented shorter sleep latencies on the MWT (20.8 (IQ range 16.1–32.9) vs. 34.9 min (IQ range 28.1–40.0)) and worse simulated driving performance ($p < 0.001$) than treated patients. Nevertheless, treated patients still exhibited shorter mean sleep latencies on the MWT than controls (34.9 (IQ range 28.1–40.0) vs. 40 min (IQ range 37.1–40.0), $p < 0.05$) but driving performance was identical in both groups. The SDLP of the vehicle in real driving conditions and the MWT score correlated with the SDLP in simulated driving (respectively, $r = 0.34$, $p < 0.05$ and $r = -0.56$, $p < 0.001$).

Conclusions: In patients with narcolepsy/idiopathic hypersomnia, simulated driving and MWT explore different dimensions of fitness-to-drive and could be used complementarily to better evaluate sleep-related driving impairment. The use of validated simulators among the sleep community would be a reasonable goal to harmonize evaluation of the ability to drive in patients suffering from central hypersomnia.

Disclosure: Nothing to disclose.

O018 | To predict sleep related accidental risk of patients with obstructive sleep apnea syndrome: self reported sleepiness at the wheel versus Apnea Hypopnea Index

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Objectives/Introduction: Sleep related accidents are a major concern for patients suffering from obstructive sleep apnea syndrome (OSAS) and recommendation about fitness to drive are a key issue for both patients and physicians. Up to now articles in the literature do not always discriminate patients suffering from nocturnal breathing disorders (AHI < 10) from patients complaining of sleepiness at the wheel with an AHI > 10. We conducted a new study to identify factors associated to sleep related accidents (SRA) among patients suspected of OSAS.

Methods: We analyzed through the French Sleep Observatory of the federation of pneumology 58,815 sleep recordings and questionnaires collected on patients suspected of suffering from OSAS. All patients had to complete questionnaires on their level of daytime sleepiness (i.e. Epworth Sleepiness Scale), self reported sleepiness at the wheel, symptoms of OSAS and socio demographic variables. Multivariate logistic regression was performed to identify associated factors.

Results: 2.4% of patients presented an AHI ≥10 (n = 42,617). 35% of these patients reported suffering in the last year of episodes of sleepiness at the wheel. 2% of the patients included in the databasis (1,316) reported a sleep related accident in the past year, Patients suffering from an AHI ≥ 10 without sleepiness at the wheel in the past year (n = 27,634) did not have an increased risk of SRA compared to subjects having an AHI < 10 and without sleepiness at the wheel (n = 10,829). Patient reporting sleepiness at the wheel independently of the AHI value presented a significant higher risk of SRA (adjusted p value <0.01) compared to patients not reporting sleepiness at the wheel.

Conclusions: Fitness to drive should be evaluated on self reported sleepiness at the wheel and AHI alone should not be a single criteria used to evaluate driving risk in patients suffering from OSAS.

Disclosure: Nothing to disclose.

O019 | Diagnostic patterns of sleep- and vigilance tests in distinct causes of excessive daytime sleepiness

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Objectives/Introduction: After excluding the most frequent causes of excessive daytime sleepiness, (EDS) such as internistic and neurological disorders as well as sleep apnoea syndrome, a few ambiguous diagnoses remain, presenting a challenging differential diagnosis. Sleep and vigilance tests (SVT) are often used as supportive tools in the further diagnostic process. The aim of this study was to evaluate in EDS patients the extent to which SVTs, namely the Epworth Sleepiness Scale (ESS), polysomnography based sleep efficiency (PSG), Multiple Sleep Latency Test (MSLT), Maintenance of Wakefulness Test (MWT), actigraphy based inactivity index (ACTI), Psychomotor Vigilance Task (PVT), Steer Clear Test (SCT) and pupillography (PUI) can help to differentiate between fatigue syndromes (FS), insufficient sleep syndrome (ISS), narcolepsy with cataplexy (NC), narcolepsy without cataplexy (N), idiopathic hypersomnia (IH) and non-organic hypersomnia (NOH).

Methods: The Bern sleep database (1997–2016) contains >17,000 SVTs. We retrospectively analysed those 167 FS, 106 ISS, 102 NC, 63°N, 86 IH and 155 NOH patients who underwent ≥1 MSLT and ≥1 additional SVT. Comparisons (Kruskal-Wallis, Dunn-Bonferroni; $p < 0.05$) between patient groups (=15 pairs) were performed for each SVT and sensitivity and specificity of each SVT for each diagnosis was analysed by comparing the area under the curve of Receiver Operating Characteristic (ROC) curves (CI 95%, $p < 0.05$).

Results: Mean values differed significantly in most diagnoses-pairs (11/15) for both the MWT and MSLT, in many pairs for ESS (10/15), SCT (9/15) and PVT (7/15), but less frequent for PUI (5/15), ACTI (2/15) and PSG (2/15). We found a "fair" to "good" diagnostic power in the MSLT for NC (0.834), N (0.747) and FS (0.897), and also in the MWT for NC (0.834), N (0.801) and FS (0.754), while all other power values ranged from "poor" to invalid".

Conclusions: MWT and MSLT are the most valuable diagnostic tests to differentiate between ambiguous disorders of EDS. Over all diagnoses, single SVTs have a rather poor differentiating power and combining multiple tests together with a careful clinical judgement is mandatory to accurately diagnose patients suffering from EDS.

Disclosure: Nothing to disclose.

O020 | Moderate and severe OSA in males impair psychomotor reaction times assessed by CRD-series testing

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Objectives/Introduction: Obstructive sleep apnoea (OSA) is characterized by repetitive transient obstructions of the upper airway, which result in cessations of the airflow and consequently lead to hypoxemia and hypercapnia. Most obstructive events in apnoeic patients are accompanied by (micro) arousals from sleep, resulting in chronic sleep fragmentation, sleep deprivation and consequent excessive daytime sleepiness (EDS). All those factors may be mechanisms underlying psychomotor impairment in OSA patients, mostly in areas of general psychomotor functioning, memory, attention and vigilance, perception and alertness. We hypothesize that moderate and severe OSA have adverse effects on reaction times to visual stimuli, simple arithmetic tasks, and complex psychomotor limbs coordination assessed by the computer-based psychomotor CRD-series tests.

Methods: The study was conducted on 206 male subjects; 103 of them had moderate or severe OSA (Apnea Hypopnea Index, AHI > 15) diagnosed by whole-night polysomnography/polygraphy. Control subjects ($N = 103$), matched with OSA patients by age and BMI, had no recorded OSA in their medical history, no increased risks for OSA measured by STOP and STOP-BANG questionnaires and EDS measured by Epworth Sleepiness Scale (ESS) score. All subjects solved three multiple task tests, which measured speed of visual perception (CRD311), convergent thinking during solving simple arithmetic operations (CRD11), and operative thinking during tasks that required complex psychomotor limbs coordination (CRD411). In each test, total test solving time (TTST), minimum (best) single task solving time (MinT), and median time for task solving (MedT) were recorded.

Results: OSA patients had worse results compared to control subjects on all CRD tests: MinT was 3.0 ± 0.9 s vs. 2.6 ± 0.6 s, $p < 0.001$ on CRD11; 0.49 ± 0.1 s vs. 0.46 ± 0.1 s, $p = 0.089$ on CRD311; and 0.69 ± 0.2 s vs. 0.61 ± 0.1 s, $p = 0.007$, respectively. No significant correlation was found between ESS score and CRD11 and CRD311 results, and negative correlation was found between ESS score and CRD411 results in OSA group ($r = -0.213$, $p = 0.03$ for MedT).

Conclusions: Moderate and severe OSA increased psychomotor reaction times in male patients, in which there was no positive correlation of EDS and poorer results on psychomotor testing. The results may suggest that working or driving performance in those patients could be impaired independent of excessive daytime somnolence.

Disclosure: Nothing to disclose.

O021 | A pre-drive ocular assessment predicts subsequent driving impairment: a naturalistic driving study in shift workers

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Objectives/Instruction: Sleep-related motor vehicle accidents account for approximately 20% of all crashes, with shift workers at higher risk than the general population. Predicting sleep-related driving impairment before a drive allows for timely intervention. We assessed whether pre-drive ocular variables predicted subsequent driving impairment, and objective alertness measured by ocular variables during the drive.

Methods: Shift workers (n = 20, Males = 7) were recruited from a metropolitan Melbourne hospital (nurses = 13, doctors = 7). Participants completed driving diaries and drove an instrumented vehicle over 2 weeks, while working day and/or evening shifts and a minimum of 2 night shifts, as determined by their work roster. The instrumented vehicle was fitted with the Seeing Machines Driver Monitoring System, comprising a driver-facing camera utilising real-time algorithms to detect driver features, including ocular parameters (mean blink duration (MBD), the Percentage of time with Eyes Closed (PERCLOS), and average long eye closures >300 ms). A road-facing camera (MobilEye) was used to detect lane departures as a measure of driver impairment. A 4-min assessment (N = 131) was completed immediately prior to each drive to measure ocular parameters. A 5-min Psychomotor Vigilance Task (PVT, N = 55) was completed at the end of 3 shifts, prior to driving home. We examined whether pre-drive ocular variables, mean RT and PVT lapses predicted driving impairment (ROC curve analyses) and whether pre-drive PVT parameters predicted objective measures of alertness during the drive (Linear regression).

Results: MBD during the pre-drive assessment significantly predicted the occurrence of lane departures (AUC = 0.68, p = 0.009). While PVT Lapses also approached significance (AUC = 0.72, p = 0.052), PERCLOS, long eye closures and mean RT did not significantly predict lane departures (p = 0.94, 0.65 and 0.29, respectively). Mean RT (R^2=0.13, p = 0.01), RT variability (R^2=0.14, p = 0.007), the slowest 10% of RT (R^2=0.22, p = 0.001) and PVT lapses (R^2=0.19, p = 0.001) significantly predicted PERCLOS during the drive. No significant predictors of MBD or long eye closures were found.

Conclusions: We demonstrated that pre-drive ocular parameters and PVT show promise for predicting subsequent driving impairment in a naturalistic setting. Further analysis will incorporate multiple factors into the prediction model and examine prediction of micro-sleeps.

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NEW METHODS IN BASIC AND CLINICAL SLEEP RESEARCH

O022 | Environmental influence on the behaviorally defined sleep (rest) in a wild nocturnal primate Nycticebus javanicus

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Objectives/Introduction: Growing evidence suggests that environmental variables, including temperature and light, have a major influence on sleep and activity patterns of animals and humans. While research on these influences in primates has increased over the last decade, only a few species have been systematically studied in the natural habitat, and the knowledge on sleep-wake patterns in wild nocturnal primates is essentially lacking.

Methods: We monitored a wild population of Javan slow lorises *Nycticebus javanicus* in West Java, Indonesia between 2014 and 2017, to test the influence of environmental factors on their daily activity patterns. We fitted 12 Javan slow lorises with accelerometer devices to record locomotor activity, which was stored at 1-min intervals. Each recording was performed on average over 34.8 ± 13.5 days. We used actigraphy and linear mixed-effect models to test the relationship between slow loris activity, climatic variation (ambient temperature, humidity, rainfall) and solar phases.

Results: We quantified the amount and distribution of activity and behavioural sleep (rest) across 24 hr. All animals displayed prolonged periods of consolidated rest during the light period patterns, entering a sleeping site shortly before sunrise and emerging soon after sunset. All individuals displayed a striking synchronization of onset and end of activity in relation to sunrise and sunset, spending 10:53:04 ± 02:46:08 (hh:mm:ss) immobile. Notably, all lorises displayed longest consolidated rest periods with least locomotor activity at the beginning of the light phase, with fragmentation increasing

during the second half of the day. We also observed a relationship between rest fragmentation and the levels of ambient temperatures, suggesting a strong influence of environmental variables on sleep.

Conclusions: In conclusion, here we for the first time characterized the daily activity patterns in a wild nocturnal primate *Nycticebus javanicus*. We observed a major influence of lighting conditions on rest and activity, suggesting that the levels of illumination are an important determinant of the circadian rhythm in behaviour in these animals. Increased consolidation of rest at the beginning of their habitual sleep period may reflect increased sleep 'intensity', although the environmental influence cannot be excluded.

Disclosure: Nothing to disclose.

O023 | Two million nights to characterize sleep heterogeneity: what objective and self report big data tell us

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Objectives/Introduction: Demographic, health, and lifestyle factors all affect sleep. However, little is known about how heterogeneity among such factors relates to sleep outcomes, and most studies use a single self-report sleep measure. We used big data – both objective and self-report – to identify distinct sleep profiles.

Methods: We analyzed 1,920,457 nights of objective sleep data collected between 7-13-14 and 1-8-18 via S+ by ResMed sleep tracking technology, complemented with self-report data. We performed Multiple Correspondence Analysis and hierarchical profiling on 20 self-report categorical variables reflecting demographic, health, and lifestyle factors (e.g., age, BMI, smoking, exercise, blood pressure, stress) to reveal distinct clusters of sleepers. We set the number of clusters to 8 based on the inertia gain criterion and visual inspection of the dendrogram. Each cluster was then profiled using objective sleep data, including TST, SOL, Number of Awakenings, and Sleep Stage durations (Wake, Light, Deep, and REM).

Results: Analysis of the self-report data revealed 8 clusters. Profiling those clusters with objective sleep data revealed between-cluster heterogeneity:

(1) Active and healthy (n = 2,679);
(2) Older, with healthy lifestyle (n = 1,857);
(3) Stressed, tired but active patients without sleep issues (n = 1,379);
(4) Active and healthy but with restless sleep and sleep breathing issues (n = 1,955);
(5) Otherwise healthy with sleep disorders (n = 1,420);
(6) Stressed smokers (n = 640);
(7) Overweight and older with health issues and restless sleep (n = 1,811); and
(8) Overweight older patients with health issues and sleep disorders (n = 1,120).

Interestingly, the two clusters with the poorest sleep included the most smokers and the most people whose BMI indicated obesity, showing an important association between sleep and lifestyle factors.

Conclusions: This study is the first to identify sleep profiles using both self-report and objective big data collected in the home environment. Uncovering heterogeneity among sleep profiles can help us better understand relations between sleep and demographic, health, and lifestyle factors. Findings can inform the development of behavior change guidelines that might aid in achieving better sleep and new interventions to improve sleep.

Disclosure: This study was conducted by SleepScore Labs. All authors are affiliated employees of SleepScore Labs. ResMed launched S+ by ResMed in 2014.

O024 | Studying the temporal dynamics of human sleep in real life and large numbers

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Objectives/Introduction: The temporal dynamics of sleep are complex. First of all, each sleep episode itself is highly structured in time, on a scale of seconds to hours (sleep architecture, cycles, fragmentation). These ultradian dynamics of sleep are then embedded and influenced by factors on a longer timescale, that is the circadian timing of the sleep episode as well as the timing and structure of prior sleep and wakefulness (sleep history). Studying these temporal dynamics and their clinical relevance has been difficult since the monitoring of ultradian sleep dynamics relies heavily on polysomnography, which is impractical for recordings over longer circadian and infradian timescales such as days and weeks.

Methods: To enable combined analyses of sleep from ultradian to infradian timescales, we developed a method to probe ultradian sleep dynamics from simple wrist activity recordings (actimetry/actigraphy): a non-linear transformation of locomotor activity to "**L**ocomotor **I**nactivity **D**uring **S**leep" (LIDS). To test its suitability for large scale field studies, LIDS was not only assessed in standard laboratory polysomnography (20 nights) but also in 16,441 sleep bouts from longitudinal recordings of 573 people in real life. Using mixed model regressions, we analyzed influences of age, sex, sleep duration, work schedules and mental health status on ultradian LIDS dynamics.

Results: Our analyses show that the ultradian structure of sleep is directly reflected in Locomotor Inactivity During Sleep - despite the expectedly lower resolution than polysomnography. LIDS oscillates in synchrony with sleep cycles, showing a median period of 110 min. LIDS also declines gradually during sleep in its levels, reminiscent of

sleep homeostatic markers. LIDS-derived sleep dynamics did not differ between women and men (despite differences in absolute levels), but were strongly altered with age and also shift work. Altered were particularly the decline rates and rhythm amplitudes, while period and phase were remarkably stable. Circadian and homeostatic influences are currently under investigation.

Conclusions: Our actimetry-based method makes sleep dynamics easily quantifiable in everyday contexts and in huge numbers of nights and people. This enables large-scale field studies bridging the time scales necessary to investigate the complex temporal dynamics of sleep.

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O025 | Scoring sleep with artificial intelligence enables quantification of sleep stage ambiguity

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Objectives/Instruction: In the last few years machine learning approaches have made significant advancements and offer now powerful tools for classification problems such as sleep scoring. The objectives of the study was to evaluate the performance of a bidirectional long short-term memory (LSTM) recurrent neural network (RNN) classifier based on sleep-wake related features and to explore the possible value of the sleep stage probability distribution ("hypnodensity") obtained at the RNN output.

Methods: Supervised deep learning for sleep scoring was trained with 472 and tested in 116 polysomnographies (PSGs), all scored independently by 2 experts and by a consensus scorer. In total, 556.797 soft targets were available to predict sleep stage probabilities. The trained RNN outputs hypnodensities, which are used to determine sleep stages and their ambiguities. The validation data consisted of 97 PSGs scored by 4 human experts, with 10 PSGs having been scored in addition by 8 experts. Epoch-by-epoch Cohen's kappa agreement was determined as compared to a consensus scoring without the assessed scorer included in the consensus.

Results: The kappa coefficients between manual and consensus scoring ranged between 0.61 and 0.77 (mean ± SD: 0.71 ± 0.04) for the 10 studies with 12 manual scorings and between 0.70 and 0.79 (mean ± SD: 0.74 ± 0.04) for the 97 studies with 4 manual scorings. The kappa coefficients between auto and consensus scoring were 0.79 for both the 10 and the 97 PSGs. By exploiting available options of the Somnolyzer system to vary sensitivity settings for NREM sub-classification, the kappa values for autoscoring increased to 0.86. The RNN-derived hypnodensities correlated significantly with the sleep stage distribution derived from the 12 human scorings (r = 0.92, 0.75, 0.89, 0.91 and 0.97 for W, N1, N2, N3 and R). Exploring the hypnodensities revealed ambiguities of sleep onset by 5 to 10 min in 21% and by more than 10 min in 40% of the studies. Ambiguous REM periods were identified in 21% of the 97 studies.

Conclusions: Autoscoring based on the RNN classifier was equal to the best human expert scorer and even outperformed all human expert scorers after adjusting the sensitivity settings accordingly. Moreover, the RNN-derived hypnodensity is a sensitive measure for sleep stage ambiguity.

Disclosure: All authors are employees of Philips Austria GmbH.

O026 | New spectral analysis method to identify trait-like features in NREM sleep power spectra

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Objectives/Introduction: Variability among individuals in sleep/wake biology and behaviour is pervasive. Sleep/wake-related variability involves individual trait-like features (ITLF). In order to study ITLF, we developed an advanced spectral analysis method (ASAM) to compare, in a systematic and reproducible way, 3 features of NREM power spectra (PS). As sleep spindles (SS) have been reported several times to be an important ITLF, we focused on a broad range of sigma activity (10–18 Hz).

Methods: The ASAM is composed of three main steps. First, EEG sleep recording is preprocessed and the NREM PS is computed for each channel of interest. Second, three characteristic features from the NREM PS related to sigma peak activity are extracted: magnitude, peak location and standard deviation. Third, the intra-individual stability and the inter-individual variability of these features, as well as the influence of sleep perturbations, are statistically tested using the Intra-Class Correlation (ICC) coefficient and the Wald Z-test. The performance of the ASAM was assessed using different polysomnography-derived sleep recordings from 16 healthy young male subjects (18–30 years). For each subject, these recordings were acquired in 5 different "sleep contexts": the acquisition was varied from 4 to 12 hr and was performed at different circadian phases.

Results: All three features of sigma activity (magnitude, peak location and its standard deviation) were recognized as important ITLFs (ICC = 0.74, 0.94 and 0.63 respectively). Furthermore, the inter-

individual variability of these three features was significant different from zero (Wald Z-test $p_s < 0.05$).

Conclusions: Three aspects of NREM PS sigma activity are recognized as important ITLFs. It is also showed that even though these features changed according to sleep context, they remained specific to the individuals. Establishing the trait-specific nature of variability in sleep/wake parameters could elucidate genetic mechanisms.

Disclosure: The authors do not disclose a potential conflict of interest. Sources of funding: Belgian Fund for Scientific Research (FNRS), European Research Council (ERC-Starting Grant). Actions de Recherche Concertée of the Wallonia-Brussels Federation, University of Liège research funds, Fondation Médicale Reine Elisabeth, Fondation Simone et Pierre Clerdent.

O027 | Cognitive functioning following sleep deprivation is moderated by time-of-day: results from the Karolinska WakeApp

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Objectives/Introduction: Cognitive functioning is known to be impaired following sleep deprivation. Similarly, the effect of sleep deprivation has been shown to fluctuate depending on time-of-day. However, it is less understood the extent to which the effects of time-of-day and sleep loss interact. This study aims to investigate the interaction between sleep deprivation and changes in performance on five cognitive tasks over one day. This study also introduces the 'Karolinska WakeApp' – an extremely brief mobile application for cognitive testing.

Methods: 176 participants (101 female, ages 18–45) participated in a sleep-deprivation experiment. After two nights of normal sleep (7–9 hr), participants were randomised to either one night of sleep deprivation or a third night of normal sleep. Participants completed a battery of cognitive tests using the Karolinska WakeApp. Cognitive tests included psychomotor vigilance (PVT), working memory (WM), episodic memory (EM), mathematical ability (MA) and impulse inhibition (Stroop). Each test being 2 min. A baseline measurement was completed at 22:00, and three further measurements were taken the following day (post sleep-deprivation) at approximately 08:00, 12:30 and 16:30.

Results: Growth curve modelling revealed that sleep deprivation led to a linear decrease in performance over time in all tasks ($p < 0.05$), highlighting that brief 2-min tests are sensitive at detecting the impairments in both higher and lower cognitive functions after sleep loss. Additionally, PVT, EM and MA showed a significant interaction between sleep deprivation and orthogonal time polynomials (time^2 and time^3, $p < 0.001$). This suggests that sleep deprivation leads to a stronger influence of time-of-day compared to control participants, even after accounting for a general linear decrease in performance.

Conclusions: Sleep deprivation causes significant performance impairments in five cognitive tasks - and several cognitive domains including executive functions - as measured through the Karolinska WakeApp. This establishes the use of brief 2-min tasks to assess cognitive functioning following sleep loss. Additionally, we find that the cognitive performance following sleep deprivation is not only impacted by time-of-day, but also moderated by it. Therefore, this study highlights the importance of scheduling tasks following sleep deprivation in order to best preserve cognitive ability.

Disclosure: Nothing to disclose.

O028 | A computer algorithm to quantify REM sleep without atonia

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Objectives/Instruction: REM sleep behaviour disorder (RBD) is characterized by intermittent loss of muscle atonia during REM sleep, causing elaborated motor activities associated with dream mentation. Several methods have been proposed to visually quantify this REM sleep without atonia (RWA), using the electromyographic (EMG) channels of a polysomnography (PSG). Visual scoring however is time consuming and subjective to a human scorer's judgement. We developed a computer algorithm that follows the criteria of the visual RWA-scoring used in our clinic, using only the chin EMG, but that also can be used to consider additional EMG channels as e.g. with the SINBAR method.

Methods: Preassumption is that PSG recordings were scored on sleep stages and epochs with artefacts were excluded. Our algorithm then evaluates the chin EMG on a second to second base, without differentiating between phasic and tonic activity. It brings to zero EMG amplitudes exceeding 500 μV, dismisses REM episodes as artefacted if the EMG threshold value is higher than 5 μV and removes electrocardiographic (ECG) crosstalk. In addition, the algorithm returns a signal quality report, providing information about number of samples exceeding a 500 μV reference value, correlation of the EMG with the ECG signal and ECG-corrected epochs, and EMG threshold value of each REM episode. This indicates possible limitations of the computation due to technical problems.

With the algorithm we analyzed 60 PSGs (20 RBD patients, 20 healthy controls and 20 PLMS patients as controls with another type of nocturnal motor disability) and also visually scored on RWA.

Results: The automatically generated RWA scores showed highly significant correlations with the visual analysis for all subjects

($R = 0.95$, $p < 0.01$), as well as for the RBD subgroup ($R = 0.92$, $p < 0.01$).

Conclusions: Our algorithm reliably detects loss of atonia during REM.

Disclosure: Nothing to disclose.

O029 | Evaluation of night-to-night variability of sleep apnea in home polysomnography

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Objectives/Introduction: Clinical polysomnography (PSG, type 1) is the golden standard for investigating sleep disorders. An alternative for a complete polysomnography investigation is the home polysomnography (H-PSG, type 2). Sleep apnea is diagnosed and graded by conventional thresholds of apneas and hypopneas per hour of sleep, and treatment is usually initiated in the presence of symptoms. This study assessed the night-to-night variability of the apnea hypopnea index (AHI) during two consecutive nights of H-PSG.

Methods: In our tertiary sleep center we were accustomed to perform two consecutive 24 hr H-PSGs. A retrospective study was performed on the data of 262 patients of which 51 patients (72.5% male, 53.9 ± 12.1 years, BMI:2 9.4 ± 6.5 kg/m^2) were diagnosed as having a Sleep Related Breathing Disorder (SRBD) diagnosis based on history and the combined data of 1st and 2nd night. We compared the apnea hypopnea index (AHI) of the second night to the first night to assess if a second night of PSG affects diagnosis and classification of SRB severity. The sleep apnea was categorized according to conventional thresholds using the AHI (no sleep apnea: <5; mild: 5–14; moderate: 15–30; and severe: >30).

Results: Twenty-one percent of the 51 the SRBD patients had a nightly H-PSG AHI variability of greater than 10. Seventeen percent of all patients had a significantly higher AHI on the first night, and 7.8% had a significantly higher AHI on the second night. The sleep apnea severity category shifts in 35.3% of the patients. Only four patients (7.8%) have in the second night such a higher AHI that they shift to a more severe diagnostic group. One patient went from the group no diagnosis to a mild sleep apnea.

Conclusions: Only a slight percentage of the patients shift to a more severe diagnostic category. Therefore, a second H-PSG will not effect the treatment strategy of the majority of the SRBD patient. The Clinical Practice Guideline for Diagnostic Testing for Adult Obstructive Sleep Apnea of the AASM (Kapur et al. 2017) recommends to do a second PSG if the first one isn't conclusive. Our data suggest that doing a second night H-PSG hardly alters the treatment strategy.

Disclosure: Nothing to disclose.

O030 | Accuracy of detecting sleep apnea using machine-held submental ultrasonography

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Objectives/Introduction: We previously reported that manually-operated submental ultrasonography (US) could be used to identify patients with severe obstructive sleep apnea (OSA). The present study aimed to test the accuracy of machine-held submental US to identify patients with moderate-severe OSA.

Methods: 13 heathy volunteers [apnea-hypopnea index (AHI) < 5/hr] and 40 OSA patients (AHI > 5/hr) were enrolled. The pharynx was scanned for 4 s through hypoid bone to mandibular plane with 5-MHz convex transducers (Terason T3000, USA) while the participants were awake and at supine position. Total 84 frames of US image were obtained for each 4-s scan. The transverse diameter of pharyngeal aerospace was measured for three times at both of the tidal breathing and Müller′s Maneuver (MM) where the median coefficient of variance of measurement as 4.9% in the volunteers. The dynamic change was defined as percentage of pharyngeal diameters shortening from the diameters upon expiration during tidal breathing to that during MM. Multivariate logistic regression was applied to identify independent predictors for moderate-severe OSA (AHI ≥ 15). Thereafter, these independent predictors were used to estimate the probability of moderate-severe OSA, which was tested using the area under the receiver operating characteristic (AUROC) curve for diagnosing moderate-severe OSA.

Results: Among 53 participants, 69.8% male, the median age was 46 y/o [interquartile range (IQR), 18] and body mass index (BMI) was 27.2 Kg/m^2 (6.7). The AHI was 0.4/hr (0.5) and 22/hr (34.7) in volunteers and OSA patients, respectively. The age ($r = 0.45$, $p < 0.001$), BMI ($r = 0.65$, $p < 0.001$), median pharyngeal diameter at MM ($r = 0.4$, $p = 0.003$) and dynamic change ($r = 0.51$, $p < 0.001$) were correlated with AHI. The Stepwise logistic analysis identified the BMI [odds ratio (OR) 1.242, 95% CI 1.026–1.505, $p = 0.026$] and median dynamic change (OR 1.062, 95% CI 1.010–1.117, $p = 0.018$) as independent predictor for moderate-severe OSA. The AUROC of BMI and median diameters for identifying the moderate-severe OSA was 0.866 (95% CI 0.772–0.961, $p < 0.001$).

Conclusions: Using BMI and median dynamic change of pharyngeal diameter as the indicators, the machine-held submental US could be applied to identify patients with moderate-severe OSA with good accuracy.

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O031 | Cerebral free-water imaging with obstructive sleep apnea severity

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Objectives/Instruction: Obstructive sleep apnea (OSA) is increasingly recognized as a risk factor for dementia, and thus, characterizing its effect on the aging brain is key to understanding its role in neurodegeneration. A novel diffusion-weighted imaging technique quantifies *in vivo* the cerebral free-water fraction (extracellular) and restricted-water (intracellular). Pathological processes modify the extracellular/intracellular water: increased intracellular water is observed in cytotoxic oedema, inflammatory cellular recruitment and reactive gliosis, while increased extracellular water is observed in vasogenic oedema, neuroinflammation and cellular loss. Measuring the cerebral free-water fraction in OSA can clarify the nature of cerebral tissue alterations. The objective of this study was to investigate free-water fraction in untreated older individuals with different severity of OSA. We hypothesized that different OSA severity levels will feature different free-water patterns, suggesting a biphasic presentation of pathological processes similarly to preclinical neurodegeneration.

Methods: Sixty-three subjects (16F; age: 64.8; 55–82) were divided in three groups (no, mild and moderate-severe) according to various indices of OSA severity: apnea-hypopnea index (OSA; cut-off: 5 and 15 events/hr); sleep time with oxygen saturation <90% (hypoxemia; cut-off: 0 and 1.7 min); micro-arousal index (sleep fragmentation; cut-off: 10 and 18 events/hr). ANCOVA was used for cerebral free-water fraction between groups adjusted for cerebrospinal fluid volume.

Results: The mild OSA/hypoxemia groups had lower free-water fraction compared to the no OSA/hypoxemia and moderate-severe OSA/hypoxemia groups (p between 0.017 and 0.049). No group difference was observed between the sleep fragmentation groups.

Conclusions: Mild OSA and hypoxemia is associated with decreased free-water fraction representing increased intracellular water, which could be caused by cytotoxic oedema, inflammatory cellular recruitment and reactive gliosis. The U-shape relationship between OSA severity and free-water fraction suggest a biphasic pattern of pathological processes. More severe OSA and hypoxemia may be characterized by the reversal of pathological processes, or by an apparent normalization of the free-water fraction caused by competing processes that yield both increased intracellular and extracellular water.

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SLEEP, – OMICS AND NOVEL CELLULAR AND MOLECULAR MECHANICS

O032 | Predicted gene expression in the brain is associated with sleep macrostructure in healthy young individuals

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Objectives/Introduction: Uncovering the genetics of sleep is a very difficult challenge. Many genes have been associated with different sleep features in animal models and in humans. The brain is obviously implicated in sleep and several key brain regions have been identified. How the expression of "sleep genes" in different parts of the brain may be related to sleep regulation is unknown, however. Here, we took advantage of a novel genetic tool to predict gene expression in different tissues to assess the association between regional sleep genes brain expression and sleep in young adults.

Methods: Sleep electroencephalography was recorded during an 8 hr baseline sleep in 200 healthy young male volunteers devoid of any sleep disorders (aged 18–31 years, mean = 22.07 ± 2.71). Blood sample were collected in all participants to assess common Single Nucleotides Polymorphisms (SNPs) over the entire genome. PrediXcan (http://predictdb.org/) was employed to predict the expression of 101 sleep genes, selected based on the literature, in 9 different human brain tissues based on these common SNPs.

Results: Generalized linear mixed model revealed significant associations between sleep metrics and the predicted expression of sleep genes in 2 different brain regions: the cerebral cortex and the anterior cingulate cortex. Predicted sleep gene expression in the anterior cingulate cortex was associated with the sleep onset latency ($p < 0.001$). Moreover, predicted sleep gene expression in brain cortex was significantly linked to the percentage of the REM sleep ($p = 0.01$). These associations remain significant after adjusting for age.

Conclusions: These original preliminary results show that one can use whole genome information to assess the association between predicted gene expression in different parts of the brain and sleep. They further suggest that where in the brain genes are expressed matter for variability in sleep.

Disclosure: FNRS, ULiège, ARC, FEDER, Welbio, FMRE, Clerdent Foundation.

O033 | The cortical synaptic transcriptome is organized by clocks, but its proteome is driven by sleep

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Objectives/Introduction: Circadian oscillations occur at the level of transcription and post-transcription to modulate levels of RNAs, proteins and their activity. Complicating matters still further, rhythms in RNA levels can also be driven by temporally consolidated behaviors. As an example, in the cortex, sleep-wake cycles play a major role (Maret et al., 2005). Neurons present a special case. They have developed elaborated mechanisms to traffic RNA and proteins into distant synapses to facilitate changes in their composition and allow rapid synaptic responses. However, the control of these processes across the day remains unstudied.

Here we will use a multi-omic approach to provide novel mechanistic insights into the combined regulation of synaptic RNA and proteins by the clockwork and sleep.

Methods: Taking a biochemical approach to isolate synaptosomes from mouse forebrain, we analyzed the transcriptome and proteome of these neuronal compartments.

Results: We show that forebrain synaptic transcript accumulation is overwhelmingly circadian - with 70% of synaptic transcripts showing time-of-day-dependent abundance to anticipate dawn or dusk - but independent of oscillations in the soma. Transcripts preceding dawn relate to metabolism and translation, whereas those anticipating dusk, to synaptic transmission. Comprehensive characterization of the synaptic proteome around the clock demonstrates the functional relevance of temporal gating for synaptic processes and energy homeostasis. Surprisingly, however, simple sleep deprivation completely abolished proteomic but not transcriptomic oscillations. ($n = 3, p < 0.05$).

Conclusions: Altogether, the emerging picture is one of circadian anticipation of mRNA needs in the synapse only followed by translation as demanded by rest-activity cycles. (124 words)

Disclosure: Nothing to disclose.

O034 | mGluR5-dependent nuclear speckle assembly drives sleep-wake transcriptomics

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Objectives/Introduction: The nucleus has been shown to be heavily compartmentalized to regulate gene expression, but the extent of its plasticity during normal daily sleep-wake rhythms still remains elusive. Here we show the importance of structural rearrangement upon neuronal activity by the example of the RNA binding Drosophila Behavior Human Splicing (DBHS) protein family, consisting of NONO, PSPC1 and SFPQ.

Methods: C57Bl6 and DBHS knockout mice were analyzed for nuclear morphology, sleep phenotype and gene expression variations using immunofluorescence, omics techniques and cortical EEG recording.

Results: We show that DBHS proteins form a new type of heterogeneous clusters in neurons *in vivo* and *in vitro*, and expression levels are increased concurrent to neuronal firing (*in vivo*: $n = 4$, $p < 0.05$, *in vitro*: $n = 9–10$, $p < 0.01$). These clusters rearrange upon neuronal activity which is signaled via glutamatergic pathways, mainly via mGluR5 (*in vivo*: $n = 4–6$, $p < 0.05$, *in vitro*: $n = 30$, $p < 0.05$) and its downstream target PKC (*in vivo*: $n = 3–4$, $p < 0.05$, *in vitro*: $n = 8$, $p < 0.001$). We also show that DBHS proteins are important for sleep gene expression and homeostatic response to sleep deprivation ($n = 4–9$, $p < 0.01$).

Conclusions: Our results identify DBHS protein clusters as plastic, intra-nuclear structures important for regulation of synaptic transmission during sleep and wake and give an insight into possible downstream mechanisms of mGluR5.

Disclosure: Nothing to disclose.

O035 | RNA-Seq analysis of the impact of sleep deprivation in medial prefrontal cortex of young and old mice

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Objectives/Instruction: Sleep deprivation (SD) negatively affects cognitive functions, particularly learning and memory. Sleep and memory loss are both significant problems associated with aging. Behavioral studies on interactions of SD and aging show inconsistent results. Here, we aimed to understand the age-related differences in the molecular consequences of SD in medial prefrontal cortex (mPFC) of young and old mice using next generation RNA-sequencing.

Methods: Fifty-four young (3-month) and 54 old (18-month) male C57/B6 mice were separated into 9 groups ($n = 6$ per condition) corresponding to baseline (Z0; lights-on), sleep for 3, 6, 9, and 12 hr and SD for 3, 6, 9, and 12 hr. Libraries were made using TruSeq Stranded mRNA kit, and sequencing was done using Hi-Seq 4000. Differentially expressed genes (DEGs) between SD and sleep at any

of the four time-points were determined within young and old animals, separately, using the F-test in the LimmaVoom package. We also compared the SD-related changes between young and old at each time-point to evaluate which genes showed age-specific responses.

Results: Using a false-discovery rate of 5% (FDR < 0.05), we found 7,330 DEGs in young and 5,157 DEGs in old animals, representing 8,412 unique genes. Approximately 50% of DEGs were common between young and old mice, whereas 3,255 were unique in young and 1,078 unique in old. Using interaction tests, 35 genes met statistical criteria for differential responses based on age. *Reln*, a synapse gene affecting learning and memory, was down-regulated by SD in the young mice, but not in the old. *Slc22a3*, an organic cation transporter linked with brain function and cognition, and *Cacna1b*, an N-type Ca^{2+} channel protein affecting long-term memory and potentiation, showed similar effects. *Insulin growth factor 2* (*Igf2*) was down-regulated by SD in the old mice, but not the young.

Conclusions: Sleep deprivation affected more genes in the mPFC of young mice than in the old. Thirty-five genes showed significantly different sleep/wake responses between ages; many related to synapse and memory. Results help to understand potential molecular mechanisms of age differences in sleep/wake responses.

Disclosure: Nothing to disclose.

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O036 | The effects of insufficient sleep on microglial morphology and functional state

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Objectives/Introduction: Insufficient sleep activates the innate immune response and many of the molecular immune mediators are crucially involved in sleep regulation. However, less is known how microglia, the brain resident immune cell, is affected. The steady-state microglia maintain tissue homeostasis in highly branched morphology whereas upon challenge they transform into reactive from with distinct morphological and functional changes. We investigated how acute sleep deprivation (SD) or chronic sleep fragmentation (SF) affected microglial morphology and functional state in mice.

Methods: Acute 9 hr SD was performed with the gentle handling method while the 14d SF by housing the mice (B57) in the Sleep Fragmentation Chamber, in which sleep was automatically interrupted in 2 min intervals during the 12 hr lights-on period. *In vivo*, microglial morphology was investigated by repeated two-photon fluorescent imaging of cortical microglia in freely behaving microglia reporter mice throughout the experiments. Parallel brain samples from the somatosensory cortex (sCX), the hippocampus (HC) and the basal forebrain (BF) were collected, immunohistochemically stained for detection of microglia (IBa1) and analyzed for microglial morphology by confocal microscopy. Morphometric analyses of the fluorescent images were performed using Fiji's Simple Neurite Tracer. For analysis of microglial functional state, cell suspensions from brain samples were stained with flow cytometric markers of microglia ($CD11b^{+}$) as well as with markers for microglial activation (MHCII and/or CD206), and the number of reactive microglia were counted.

Results: *In vivo* the microglia soma size in the sCX consistently decreased during the acute SD as compared to baseline (BL) day while during the recovery day soma size was slightly increased (N_{cells} = 91, p = 0.003, N_{mice} = 4). When cortical microglial morphology was assessed from the brain sections, SF simultaneously decreased the number of processes while increasing their length (N_{cells} = 10, $p < 0.005$, N_{mice} = 4). Neither of the treatments significantly affected microglial functional state assessed by flow cytometry but the number of reactive microglia was in general consistently higher (N_{mice} = 46, $p < 0.005$) in the BF as in other brain areas.

Conclusions: Even relatively short periods of SD dynamically modify the microglial phenotype but the effect is not uniform across brain areas.

Disclosure: Nothing to disclose.

PRECLINICAL SYSTEMATIC REVIEWS AND META-ANALYSIS IN SLEEP RESEARCH

37 | Introduction to systematic review and meta-analysis of preclinical animal studies

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While systematic reviews and meta-analyses are frequent and well-established in clinical research, they are still uncommon in animal experimentation. However, recent publications have highlighted important features of systematic reviews of animal studies from experimental, translational and ethical perspectives. Animal systematic reviews are an effective methodological tool to gather all relevant data on a given animal experimentation topic, providing comprehensive analyses and conclusions and, last but not least, leading to a more reasonable usage of animal resources. In this introduction, the key features of systematic reviews will be explained and the aspects in which they differ from classical reviews highlighted. Moreover, the advantages of these reviews for preclinical research in general and for sleep research in particular will be illustrated.

Disclosure: Nothing to disclose.

38 | Meta-analysis on the relationship between sleep deprivation and anxiety in rodents

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Increased anxiety is a common behavioral comorbidity of sleep deprivation in humans. Due to the relevance of this relationship, several preclinical studies have tried to replicate this condition using animal models. However, despite the consistency in clinical data, animal studies (mainly rodents) have failed to replicate the increased state anxiety caused by lack of sleep in clinical settings. While some of these studies report anxiogenesis as a consequence of sleep deprivation, others presented anxiolysis as a final result. Taking these discrepancies into account, this work aimed to explore the effects of preclinical sleep deprivation the effect of sleep deprivation on anxiety-like behavior in preclinical research, by means of a systematic review and meta-analyses. Fifty articles were in accordance with our inclusion criteria, among which 30 were conducted in mice, 19 on rats and a single one used Zebrafish models. Our results demonstrate that lack of sleep leads to a decreased in anxiety-like behavior in animal models, which is conflicting with the increase anxiety observed in clinical studies. These findings were supported by stratified analysis having species, sleep deprivation method and anxiety measurement techniques as control variables. In conclusion, the use of preclinical models of lacks translational applicability when trying to access the relationship between sleep deprivation and anxiety. New experimental should be considered or developed, in order to provide more reliable methodological tools for the research on the field of sleep deprivation and anxiety in experimentation animals.

Disclosure: Nothing to disclose.

39 | Adenosine and sleep: a systematic review and meta-analyses of the preclinical literature

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The neuroregulator adenosine is, amongst others, involved in sleep-wake control. It can be measured with microdialysis, a diffusion-based method to study the extracellular space in vivo. Basal forebrain (BF) adenosine levels have long been known to increase during sleep deprivation. Only few studies addressed the effect of sleep deprivation on adenosine concentrations in other brain regions. Because cortical functioning appears to decrease after sleep deprivation, it would be interesting to know what happens to adenosine levels in various cortical regions.

A systematic literature review (SR) was performed, the protocol was posted to the SYRCLE website on 25 January 2016. A comprehensive search for studies measuring intracerebral adenosine in animals by means of Microdialysis in Embase, Pubmed and Web of Science retrieved 981 unique references; we included 133 in the final review. 124 of these described baseline adenosine levels, nine described one or more sleep deprivation experiments. Sleep deprivation data were available for the following brain regions: BF, brainstem, several cortical regions, hypothalamus, nucleus accumbens and thalamus. These studies mainly used the gentle handling technique, only one study used intermittent forced locomotion. Rats were studied in eight papers, cats in one.

Meta-analyses (MAs) were performed to analyse global effects of sleep deprivation on adenosine levels in the BF and the cortex. Adenosine concentrations in the brainstem, hypothalamus, nucleus accumbens and thalamus were only reported in one paper and not further analysed. Our MA reflects BF dialysate adenosine concentrations increasing during sleep deprivation, with on average 74.7% (95% CI: 54.1–95.3%) over baseline. Cortex dialysate adenosine concentrations during sleep deprivation were only reported by 2 publications. The evidence for cortical adenosine levels is still inconclusive (BF compared to cortex: on average 35.28% more increase; 95% CI: −16.03 to 86.60, MA for difference in change scores: $p = 0.18$).

The increase in adenosine during sleep deprivation may be specific to the BF. The evidence for adenosine levels in other brain regions is so far scarce, and insufficient for making generalised conclusions. At this stage, further primary studies are still warranted.

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40 | Systematic review on the relationship between monoamines and sleep

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Background: Sleep is a complex process involving a network of exogenous and endogenous regulators including monoamines. Monoamine disruption, *e.g.* by sleep deprivation (SD), seems to promote certain diseases. Assessment of monoamine levels during the light and dark phase, sleep stages and SD is instrumental to understand the molecular dynamics during and after SD and their consequences.

Methods: A comprehensive search was performed in PubMed and EMBASE. Two independent reviewers screened 2662 retrieved publications, resulting in 96 inclusions. Information on the used study

design, animal model, measurement characteristics and outcomes, was extracted and tabulated by experiment type and monoamine (*i.e.* dopamine, serotonin, noradrenalin, adrenaline, 5-hydroxyindoleacetic acid (5-HIAA) and 3,4-dihydroxyphenylacetic acid (DOPAC)). Results were described qualitatively. Network-meta analyses (NMAs) were performed to compare noradrenalin and serotonin concentrations between naturally occurring sleep-wake stages.

Results: Dopamine and DOPAC levels generally seemed to increase during the dark phase and decrease during the light phase. Serotonin and 5-HIAA levels generally peaked at or after dark phase onset. Noradrenalin and adrenaline levels did not show an overall consistent pattern. Monoamine levels were generally higher during wakefulness while lower during sleep; except for dopamine levels in amygdala and locus coeruleus, which were stable. These qualitative observations were supported by the NMAs: monoamine levels decreased from wakefulness to slow wave sleep (serotonin: standardized mean difference (SMD): −0.16, 95% Confidence interval (CI) [−0.21; −0.12]; Noradrenalin: SMD: −1.01, 95% CI [−1.55; −0.47]), and decreased further during Rapid Eye Movement sleep (serotonin: SMD: −0.24, 95% CI [−0.29; −0.19]; Noradrenalin: SMD: −2.30; 95% CI [−2.98; −1.63]). In contrast, monoamine levels generally increased during SD, and sometimes remained high even during subsequent recovery. Decreases during or after SD were only reported for serotonin levels.

Conclusion: This systematic literature review indicates that monoamine levels show systematic variation over the light-dark cycle and between sleep stages. Sleep deprivation modifies these naturally occurring patterns, with effects sometimes extending beyond the sleep deprivation duration.

Disclosure: Nothing to disclose.

LACK OF SLEEP: EFFECTS ON PERIPHERY AND THE BRAIN

O041 | Effects of sleep restriction on glucose tolerance in adolescents

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Objectives/Instruction: Many adolescents are exposed to chronic partial sleep deprivation. Short sleep duration has been hypothesized to contribute to elevated blood glucose and increased risk of type 2 diabetes. Here, we examined effects of sleep restriction on glucose tolerance in adolescents whose sleep was scheduled as a single bout during the night versus a split-sleep schedule with a shorter night segment and a mid-afternoon nap.

Methods: Adolescents aged 15–19 years underwent 2 cycles of sleep restriction (6.5 hr of time in bed) and recovery (9 hr of time in bed) that simulated sleep behaviour over 2 school weeks. During sleep restriction, participants were given 6.5 hr of time in bed (TIB) at night (n = 29), or 5 hr of TIB at night plus a 1.5-hr nap opportunity (n = 29). A 75-g oral glucose tolerance test was administered on mornings following baseline sleep, sleep restriction, recovery sleep, and re-exposure to sleep restriction. The finger-prick method was used to measure the change in capillary blood glucose from the fasting state to 2 hr after the glucose load.

Results: The split-sleep group with shorter night sleep (5.0 hr TIB plus 1.5-hr nap) exhibited significantly elevated blood glucose during both cycles of sleep restriction compared with their baseline glucose response after 9 hr of TIB ($p < 0.05$ for both comparisons). In contrast, glucose responses in the consolidated sleep group (6.5 hr TIB) did not differ between sleep restriction and baseline sleep.

Conclusions: In adolescents exposed to moderate sleep restriction (6.5 hr of TIB per day), the split-sleep schedule with shorter night sleep was associated with reduced glucose tolerance compared with consolidated night sleep. Our results indicate that the distribution of TIB in sleep-restricted adolescents has considerable impact on glucose responses. Adolescents who take naps to compensate for short night sleep may exhibit reduced morning insulin sensitivity.

Disclosure: This work was supported by the National Medical Research Council, Singapore (NMRC/STaR/015/2013), the National Research Foundation, Singapore (NRF2016_SOL002), and the Far East Organization.

O042 | The relationship between adolescents' sleep spindles and cognitive performance following experimental sleep restriction

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Objectives/Instruction: Sleep spindles have shown associations with cognitive performance in adults and increasingly in adolescents, however it is unclear whether sleep loss has an impact on this relationship. Adolescents typically restrict their sleep during weekdays and experience detriments to academic achievement. An analysis of sleep spindle activity and cognitive performance in the context of experimental sleep restriction may elucidate a mechanism through which this occurs.

Methods: 34 adolescents participated in a 10-day laboratory study where they firstly received one adaptation and one baseline night of 10 hr time in bed. Adolescents were allocated to one of three sleep 'doses': 5 hr (n = 12), 7.5 hr (n = 10) or 10 hr (control condition; n = 12) of time in bed. Two recovery nights of 10 hr time in bed followed. Cognitive variables examined were: working memory (operation span task), fluid intelligence (letter sets and number series tasks) and attention (psychomotor vigilance task).

Results: At baseline for the full sample, fluid intelligence was positively correlated with fast spindle density (r = 0.36, p = 0.04) and trended toward significance with fast spindle duration (r = 0.26, p = 0.13) and slow spindle amplitude (r = 0.28, p = 0.11). Working memory and attention did not show significant relationships with spindle characteristics at baseline. The change in spindle parameters across the experimental phase was associated with several changes in cognitive performance, however a clear dose-response effect was not evident. Although correlations did not reach significance ($p > 0.05$), there were consistent small relationships between working memory improvements and increased density of fast spindles in all conditions (5 hr: r = 0.29; 7.5 hr: r = 0.19; 10 hr: r = 0.40). During moderate sleep restriction (7.5 hr), increases in fast spindle duration were consistently associated with worse cognitive performance (working memory: r = –0.50, p = 0.15; fluid IQ: r = –0.69, p = 0.03 (letter sets), r = –0.45, p = 0.19 (number series); attention: r = –0.51, p = 0.14). Such consistent patterns were not seen for severe sleep restriction or the control condition.

Conclusions: Sleep spindles show both static and dynamic associations with some measures of cognitive performance in adolescents. Adolescents whose fast sleep spindles became longer across moderate sleep restriction experienced more deficits in cognitive performance.

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O043 | Association between individual impairments in glucose metabolism and cognitive performance in response to sleep restriction

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Objectives/Introduction: Short sleep durations have been associated with impaired glucose metabolism as well as with trait-like impairments in cognitive functions. We examined whether this trait vulnerability of cognitive performance to sleep loss extends also to glucose tolerance and insulin sensitivity.

Methods: Thirty-six healthy volunteers underwent a 12-day sleep lab study. In a sequential design, they completed one adaptation night and two baseline nights with 8 hr time in bed (TIB), 5 nights with 5 hr TIB (21 participants of the sleep restriction group, 9 female, mean ± SD, age 26 ± 4 years, BMI 23.1 ± 1.9) or 5 nights with 8 hr TIB (control group, data not shown here), followed by one 8 hr TIB recovery night, 38 hr of sleep deprivation, and a final night with 10 hr TIB. Oral glucose tolerance was tested in the morning immediately after lights on (>10 hr fasting) on the second baseline day, after 5 nights with 5 or 8 hr TIB, after the recovery night, and after 24 hr of sustained wakefulness. Fasting glucose and insulin levels, as well as those 30, 60, 90, and 120 min after glucose intake were analyzed in blood samples. Averaged daytime results of a 3-hourly performed psychomotor vigilance task (10-min PVT) were calculated. Pearson correlations between impairments (differences to baseline) in glucose metabolism and performance were calculated.

Results: Mixed ANOVAs showed that in comparison to baseline areas under the curve (AUC) of glucose, insulin, and the homeostasis model assessment (HOMA) were increased after sleep restriction (all p = 0.0003), stayed elevated after one night of recovery sleep (all $p < 0.02$), but returned to baseline levels after 24 hr of sleep deprivation (all $p > 0.6$). Impairments after 5 nights of sleep restriction showed significant correlations between mean speed/10th percentile of speed and glucose at 90 min (r = –0.51/r = –0.52), insulin at 30 min (r = –0.55/r = –0.59), 90 min (r = –0.61/–0.61), and at 120 min (r = –0.51/trend r = –0.49) after exposure.

Conclusions: Sleep restriction, but not acute sleep deprivation, impaired glucose tolerance and insulin sensitivity. Individuals under sleep restriction appeared to be likewise either vulnerable or resilient regarding both glucose metabolism and cognitive performance.

Disclosure: Nothing to disclose.

O044 | Investigation of the neural substrates underlying the homeostatic sleep response in the basal forebrain

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Objectives/Introduction: Optogenetic stimulation of Cholinergic (ChAT+), vesicular glutamate transporter2-expressing glutamatergic (vGluT2+) or parvalbumin-expressing GABAergic (PV+) neurons in the basal forebrain (BF) cause arousal responses. However, little is known about their role in the homeostatic sleep response (HSR). ChAT+ are thought to play a privileged role in this response since selective lesions of these neurons abolish the HSR. Here, we explore the interactive roles of the three neurotransmitter systems in BF.

Methods: C57BL/6 (WT) mice were sleep deprived (SD) 6 hr with and without microdialysis of cholinergic antagonists, α-amino-3-hydroxy-5-methyl-4-isoxazole-propionic acid (AMPA) or N-methyl-D-aspartate (NMDA) glutamate receptors antagonists into BF to examine the effect of pharmacological blockade of the cholinergic and

glutamatergic receptors on recovery sleep and delta activity (0.5–4.5 Hz), the markers of HSR. We transduced AAV-ChR2-EYFP in BF of ChAT-Cre, vGluT-Cre and PV-Cre mice and examined the effect of 6 hr laser illuminations (5 s/min, 10 ms pulses, 10 Hz for ChAT+, 20 Hz vGluT2+ and 40 Hz for PV+) on HSR, during the 2 hr post-stimulation period and compared it with time matched sham stimulation. In ChAT-Cre mice we performed optodialysis of cholinergic antagonists during 6 hr optical stimulation and examined the post stimulation HSR.

Results: In WT mice (n = 4) microdialysis of cholinergic antagonists did not prevent HSR as evaluated by an increase in time spent in sleep (+36.74%±5.65) and the delta power (+13.82%±3.62). Microdialysis of AMPA or NMDA receptor antagonists in another set of WT mice (n = 3) showed a tendency towards attenuated recovery sleep by −5.06%±7.35 and −11.72%±4.05, respectively. Optogenetic stimulation of ChAT+ (n = 3) led to increase in sleep-time (BL 52.6 ± 0.56 vs. Post-stim 57 ± 2.88) and delta by 24% during the 2 hr Post-stimulation. Acetylcholine antagonist administrations during ChAT+ stimulations failed to block HSR. Optogenetic stimulation of vGluT2+ (n = 3) led to HSR. GABAPV+ stimulation did not provoke HSR.

Conclusions: Our preliminary results suggest that ChAT+ and vGluT2+ but not PV+ neurons, are involved in HSR. Local effects of acetylcholine on nonChAT+ neurons are not required for HSR. Moreover, microdialysis of glutamate receptor antagonists attenuates vGluT2+ stimulation-induced HSR.

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O045 | 'Waking at a lower cost': running wheel access reduces sleep propensity

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Objectives/Introduction: Sleep need increases during waking and dissipates during subsequent sleep. The nature of the process that keeps track of the time spent awake is unknown. We hypothesize that waking behaviour affects the capacity to sustain continuous wakefulness and may affect accumulation of sleep pressure. We propose that stereotypical behaviour reduces build-up of sleep pressure compared to more demanding, goal-directed behaviour.

Methods: To test this hypothesis, continuous EEG/EMG recordings were performed in adult male C57BL/6 mice (n = 6–8/group), well habituated to wheel running, and subjected to 3-hr sleep deprivation (SD) by providing novel objects during the last 3 hr of the light phase. Subsequently, starting from dark onset the animals were kept awake for an additional 3 hr, either by novel objects to elicit predominantly exploratory behaviour (exploratory wakefulness, EW), or by providing access to the wheels, which the animals used extensively (RW). Subsequently, the animals were left undisturbed without wheel access.

Results: We found that the animals from the EW group had a significantly shorter sleep latency, defined as the time until the first consolidated sleep period >5 min (EW: 62.9 ± 30.0 min, RW: 116.0 ± 41.2 min, $p < 0.05$), and the total amount of waking during the first hour after the animals were left undisturbed was lower in the EW group compared to RW animals (EW: 38.8 ± 5.0 min, RW: 53.1 ± 3.1 min, $p < 0.05$). The total time spent awake from the beginning of SD procedure until sleep onset following the SD+EW/RW interval was ~50 min longer in the RW as compared to EW condition (p = 0.08). However, the total amount of sleep during the first 1-hr interval starting from sleep onset was strikingly similar between the groups (EW: 37.6 ± 3.8 min, RW: 37.4 ± 4.8 min, p = 0.95), and the levels of NREM EEG slow wave activity during this interval were nearly identical (EW: 166.9 ± 11.1%, RW: 166 ± 20.5% of mean before SD).

Conclusions: Our preliminary results suggest that waking behaviour affects the capacity to sustain consolidated wakefulness. The excess wakefulness dominated by stereotypical wheel running appears to have little effect on the level of sleep need. We conclude that certain types of wakefulness, which are associated with a low cognitive/attentional demand, correspond to a 'waking at a lower cost'.

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PULSE WAVE ANALYSIS DURING SLEEP – A MEANINGFUL TOOL FOR IMPROVED PHENOTYPING IN SLEEP DISORDERS?

46 | Pulse wave analysis during sleep - physiology and methodology

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Introduction: Many sleep disorders pose a stress on the cardiovascular system. According to the AASM rules for the recording of polysomnography for cardiac signals only ECG recording is mandatory. If available, the pulse wave can be recorded as well. However, there are no recommendations to record of monitor blood pressure. To assess blood pressure or ultimately the cardiovascular risk for a particular patient during sleep is desirable for many sleep disorders.

Method: The pulse wave signal is monitored as finger photoplethysmography by pulse oximetry at two wavelengths and may be stored with polysomnography if hardware and software settings allow this. Regularly only the final calculated oximetry signal is recorded and stored with the polysomnography data. Sometimes one photoplethysmographic signal is recorded as well. Some add-on devices provide pulse wave signals as raw signals, which can be recorded in parallel to polysomnography. Based on these it is possible to derive a surrogate for blood pressure from finger photoplethysmography under the assumption that other modifiers stay constant during sleep. The pulse wave reflects sympathetic tone and parasympathetic activity as vascular signals.

Results: This has been exploited by peripheral arterial tonometry recorded by external devices. Photoplethysmography allows to estimate blood pressure non-invasively up to some degree and allows to estimate cardiovascular risk by using additional algorithms for the processing of the signal. If the photoplethysmographic signal is stabilized and standardized, it can be used for diagnosing sleep stages and sleep disordered breathing. This had been exploited by peripheral arterial tonometry regularly recorded by external devices.

Discussion: The recording of pulse wave and an advanced analysis of the pulse wave allows assessment of sympathetic activity during sleep. Amplitude changes, pulse rate changes, and pulse wave characteristics are the three targets for analysis. Advanced signal processing and advanced classification rules allow to derive sleep stages, some sleep disorders, and finally provide a cardiovascular risk assessment.

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47 | Pulse wave analysis during sleep in insomnia

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Introduction: Cardiovascular (CV) diseases account for about 30% of all deaths worldwide making CV risk assessment highly important. Sleep disorders and especially short sleep duration may increase CV risk due to hyperarousal state. Photoplethysmography is a non-invasive method to measure pulse rate and blood circulation with a finger pulse oximeter. By conducting a pulse wave analysis, CV risk can be assessed.The aim of our study was to detect autonomic and cardiovascular differences in insomnia and non-insomnia participants with pulse wave analysis.

Method: We examined 52 participants (26 men, median age = 32.5 years, median BMI = 23.2 kg/m^2) with 26 insomnia patients and 26 non-insomnia participants. We additionally divided the insomnia patients into 12 with objectively measured high sleep efficiency (SE > 80%) and 14 with low sleep efficiency (SE ≤ 80%). All participants underwent laboratory-based overnight polysomnography including advanced analysis of the pulse wave signal derived from finger pulse oximetry.

Results: While the insomnia and non-insomnia group were comparable for gender distribution, age, BMI, alcohol consumption, smoking, and apnea-hypopnea index, both insomnia groups showed significantly lower subjective sleep quality than the non-insomnia group. Also, average heart rate and arousal index were increased in insomnia patients compared to non-insomnia participants. Pulse wave analysis revealed differences regarding single parameters (pulse rate, pulse propagation time (PPT)) and composite variables (cardiac risk index). Pulse rate was significant higher for both insomnia groups compared to the non-insomnia group ($p < 0.01$). Vascular stiffness was highest in insomniacs with low SE (median PPT = 169 ms) and differed significantly from both, the high SE insomnia (237 ms) and the non-insomnia group (244 ms; $p < 0.01$). Additionally, the composite cardiac risk index was higher in insomnia subjects with low SE ($p = 0.054$).

Discussion: The polysomnography and pulse wave analysis support the assumption of a physiological hyperarousal evidenced by cardiovascular and autonomous activity during sleep in subjects with insomnia. Especially pulse rate and vascular stiffness were increased indicating rigid and atherosclerotic vessels and a higher CV risk in insomnia patients with low SE. Overnight pulse wave analysis appeared to be a useful tool for continuous assessment of relevant cardiovascular parameters during sleep. To be more conclusive, we recommend further investigations including different insomnia phenotypes.

Disclosure: Nothing to disclose.

JOINT SYMPOSIUM ESRS - EAN - DISORDER OF AROUSALS (DOA): AN UPDATE

48 | Local aspect of sleep and wakefulness: implications for DOA

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Disorders of arousals (confusional arousals, sleepwalking, sleep terror) are a group of Non Rapid Eye Movement Sleep parasomnias, in which features of sleep and wakefulness are thought to be simultaneously present in different brain areas. In addition, the normally integrated aspects of consciousness and environmental connection can become selectively impaired in these conditions, providing a

valuable opportunity to study these features in isolation. Case reports and clinical observations suggest that affected patients can either be fully conscious and perceive their surroundings during parasomnia episodes (consciousness without sensory disconnection), be conscious but disconnected and only interact with imaginary people or objects (consciousness with sensory disconnection), or behave in an almost entirely automatic way without awareness (unconsciousness or minimal consciousness). In the present talk I will present a study in which we systematically assessed consciousness and environmental disconnection during episodes of disorders of arousal, with the aim of studying how these features relate to local patterns of sleep and wakefulness. Subjects with frequent parasomnia episodes underwent two high-density EEG sleep recordings (baseline and recovery sleep after sleep deprivation). In order to increase the frequency and complexity of episodes, serial awakenings were performed during recovery sleep. Subjects were systematically interviewed about their mental activity after each behavioral episode. I will present a detailed description of the conscious experiences reported by the patients and will show some preliminary high-density EEG findings.

Disclosure: Nothing to disclose.

49 | Clinical and PSG features distinguishing DOA from sleep related hypermotor epilepsy-SHE

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The differential diagnosis between Sleep Related Hypermotor Epilepsy (SHE) and Disorder of Arousal (DOA) can be challenging. A definitive diagnosis is paramount to establish a correct management of these disorders. Different anamnestic key features have been recognized as discriminant in the differential diagnosis between SHE and DOA and clinical scales have been developed, though limited by contradictory diagnostic accuracy. Therefore, Video-Polysomnography represents the "gold-standard" test for diagnosing paroxysmal sleep-related events. Considering that interictal and even ictal scalp EEG can be uninformative in many SHE patients, a careful semiological analysis of manifestations is considered the most useful tool to differentiate epileptic versus parasomnic events. However, some clinical characteristics do not allow to make a definite diagnosis and brief arousals of epileptic and non-epileptic origin are frequently indistinguishable. Moreover, the analysis of clinical patterns implies a part of subjectivity and depends on the clinician experience. The stage from which nocturnal events emerge and event timing relative to sleep onset are considered as discriminant features between epilepsy and DOA. Generally DOA, arise more frequently from deep NREM sleep, in the first third of the night while sleep-related seizures occur mostly during light NREM sleep anytime during the sleep period. However, systematic studies analyzing and comparing these aspects in parasomnic and epileptic patients are scanty and sometimes discordant. In a recent retrospective study we reviewed video-polysomnography recordings of 89 patients with a definite diagnosis of DOA or SHE analyzing the stage and the relative time of occurrence of every major or minor event. We found that episodes occurred mostly during N3 and N2 in DOA and SHE patients respectively. Indeed, the occurrence of at least one major event outside N3 was highly suggestive for SHE while the occurrence of at least one minor event during N3 was highly suggestive for DOA. Moreover, DOA episodes tended to occur more frequently during the first part of the night with respect to epileptic events. Thus, our work confirms that the stage and the relative time of occurrence of minor and major complex motor manifestation during sleep represent a useful tool to discriminate DOA from SHE episodes.

Disclosure: Nothing to disclose.

50 | Parasomnia overlap disorders

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Parasomnia overlap disorder (POD) is a condition with clinical features of both non-REM and REM parasomnias. POD is currently classified as a subtype of REM parasomnias.

However, increasing evidence suggests that POD is a distinct type of parasomnia. There is a number of reports on symptomatic and idiopathic cases of POD, however, incomplete understanding of the etiology, the pathological basis and the clinical spectrum of POD continue to impede the final classification and the correct diagnosis of the disorder.

Is POD just the result of co-occurring parasomnias or it might represent a dyscontrol of sleep-related motor behavior that progressively affects the different sleep stages? Are the REM- or the NREM-related behaviors more prominent in POD? Are there any distinctive features in POD compared to REM- and NREM-Parasomnias? How does POD evolve?

In this talk, we present an update on the clinical features and the spectrum of conditions associated with POD, and we discuss available data on electrophysiological characteristics and possible neurobiological mechanism of this disorder.

Disclosure: Nothing to disclose.

ASYMPTOMATIC SLEEP DISORDERED BREATHING: WHO SHOULD BE TREATED?

51 | Predictors and biomarkers of negative outcomes in obstructive sleep apnea

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Obstructive sleep apnea (OSA) is associated with incident cardiovascular, metabolic or psychiatric diseases. While some untreated OSA patients will develop these negative outcomes, many others will not. It is unfortunately unclear how to differentiate these two populations since they may show the same level of apnea hypopnea index (AHI).

Considering the high prevalence of OSA in the general population and the cost of OSA treatment, providing preventive treatment to all asymptomatic OSA patients would be irrealistic and ethically questionable. It is thus crucial to find predictors and biomarkers other than AHI to determine which OSA patients are at risk for developing negative outcomes and should be treated. These predictors could be demographic, genetic, inflammatory, clinical (sleepiness) or associated with specific physiological sleep parameters. Among these, autonomic nervous system activations following respiratory events has raised interest in the last years. The hypothesis is that OSA patients with strong sympathetic activations following respiratory events may be at higher risk of devolping cardiovascular, cerebrovascular and metabolic disorders than OSA patients with only mild sympathetic activations.

HypnoLaus is a population-based sleep cohort in which 2162 middle to older age participants underwent full polysomnography at home, answered questionnaires regarding their sleep habits and complaints, and had a full clinical assessment. Pulse wave amplitude variations, as a marker of sympathetic activation during sleep, was also analysed. At 5 years follow-up of this cohort, incident hypertension, diabetes, metabolic syndrome, and depression were assessed. Each cardiovascular or cerebrovascular events were also adjudicated by a pannel of experts. Preliminary analysis of the follow-up data of HypnoLaus cohort revealed that the duration of the pulse wave amplitude drops was independently associated with incident hypertension (OR: 2.08; CI: 1.06–4.11, $p = 0.034$) after adjustment for age, sex, BMI and baseline blood pressure, while AHI was not (OR: 1.00; CI 0.88–1.13; $p = 0.535$). This suggests that autonomic activations during sleep may be one of the biomarkers of incident cariovascular outcomes in OSA patients.

Disclosure: R. Heinzer is member of the medical advisor bords of nightbalance and rythm companies.

52 | Plasma miRNAs as predictor of CPAP response in resistant hypertension

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In patients with resistant hypertension (RH) and obstructive sleep apnea (OSA), the blood pressure response to continuous positive airway pressure (CPAP) treatment is highly variable even when adherent use of CPAP is documented, with some patients exhibiting major reductions in blood pressure (>10 mm Hg) and others showing either unchanged or even worsening of blood pressure levels. In fact, 25–30% of patients who use CPAP treatment for >4 hr/night do not experience a positive effect on blood pressure. The underlying causes of patient variability in response to continuous adherent use of CPAP are unknown. No clinical or anthropometrical variable has been identified to date that enables clinicians to identify those patients who will respond favorably to CPAP treatment (i.e. reduced blood pressure levels). It has been explored cardiovascular system-focused circulating miRNA expression in responders and nonresponders to CPAP treatment on blood pressure. So, a recent study reported a singular cluster of circulating miRNAs that predicts blood pressure responses to CPAP treatment in patients with resistant hypertension and OSA. This specific expression profile gives a quantitative score parameter (the HIPARCO score), which identifies those patients with resistant hypertension and OSA who will exhibit a favorable blood pressure response to CPAP. This approach represents the first validated precision medicine tool for resistant hypertension management in OSA patients. Interestingly, this study also reported that effective use of CPAP treatment in patients who respond to CPAP treatment by lowering their blood pressure is accompanied by concurrent changes in cardiovascular system-related miRNAs that may potentially influence the risk for cardiovascular disease among patients with OSA and resistant hypertension.

The features of OSA heterogeneity and their determinants have not yet been characterized, and this issue constitutes one of the main challenges for OSA management. Improved phenotyping of OSA patients should improve prognosis prediction and guide therapeutic strategies. Moreover, the application of technologies for the prediction of the clinical response to CPAP treatment, is urgently needed.

Disclosure: Nothing to disclose.

53 | Breath analysis in OSA patients, new biomarkers?

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Introduction: Obstructive sleep apnoea (OSA) is a highly prevalent disorder and is associated with metabolic changes. OSA is usually diagnosed by overnight polysomnography which is time-consuming

and provides few information on the patient's individual phenotype thus limiting a personalised treatment approach. Exhaled breath contains extensive information on metabolism that can be analysed by diverse techniques including mass spectrometry.

Objectives: The objective of the presented studies was to identify a breath profile in patients with OSA by the use of secondary-electrospray-ionization-mass spectrometry (SESI-MS).

Aims: Breath profiles specific for OSA characterise an individual's metabolic response and make a comprehensible phenotyping of OSA possible. This can be of use to diagnose OSA and monitor treatment effects.

Methods: Daytime, real-time exhaled breath analysis by untargeted SESI-MS was performed in patients with OSA.

Results: A panel of discriminating mass-spectral features was found and allowed differentiation between treated and untreated OSA.

Conclusions: Exhaled breath analysis by SESI-MS allows rapid and accurate detection of OSA. The technique makes it possible to characterise an individual's metabolic response to OSA and thus has the potential to become a comprehensible tool for phenotyping.

Disclosure: Malcolm Kohler received advisory fees from Bayer.

TEMPORAL CONSTRAINTS ON SLEEP AND COGNITION: IMPORTANCE FOR BRAIN HEALTH DURING AGEING

54 | The translational potential of sleep and circadian rhythm disturbances as a biomarker of Alzheimer's disease

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Introduction: Sleep disturbances have long been known to be associated with Alzheimer's disease (AD), and there is now growing interest in how these disturbances might impact AD pathophysiology. It is hypothesized that interventions modulating sleep may have therapeutic potential in AD, but the precise sleep disturbances to target are not well understood.

Objectives: To address this important gap in knowledge, we characterized daily sleep-wake rhythms and sleep architecture in 4 transgenic mouse models of AD and in patients diagnosed with AD.

Methods: In mice, we used continuous recording of locomotion using infrared motion sensors to assess sleep-wake rhythmicity and cranial implants of EEG electrodes to evaluate sleep architecture. In patients diagnosed with mild-moderate AD, we used actigraphy to assess sleep-wake rhythmicity and a portable EEG headband to assess sleep architecture in the home environment.

Results: The mouse models of AD exhibit spectral EEG shifts, such that there is a reduction in the slow-wave frequencies. Data collection in the human patients is ongoing, but preliminary validation of the portable EEG headbands against polysomnography suggests that high quality ambulatory assessment of deep sleep is feasible.

Conclusions: Our findings in preclinical AD models are consistent with EEG data from certain studies in patients with Mild Cognitive Impairment, suggesting an evolution of EEG abnormalities across the AD spectrum. Ongoing studies in human AD will attempt to validate these preclinical findings, and determine to what extent EEG power spectral signatures and sleep quality can be used for diagnostic purposes and outcome measures in clinical trials.

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Disclosure: Nothing to disclose.

55 | Brain molecular, histopathological and structural measures linking sleep, circadian rhythms, and dementia in community-dwelling older adults

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Work in model organisms suggests that sleep and circadian rhythm disruption may be a contributor to and/or a consequence of Alzheimer's disease related brain pathophysiological processes. To investigate this, we studied older community-dwelling adults participating in the Rush Memory and Aging Project. We quantified sleep and diurnal rhythms by actigraphy, assessed cognition annually with a battery of neuropsychological tests, obtained brain MR imaging, performed a structured autopsy in decedents, and assessed the neocortical transcriptome and epigenome. We found that sleep fragmentation is associated with the risk of incident dementia, the rate of cognitive decline, local grey matter volumes, several dementia-related neuropathologies, and changes in the neocortical transcriptome. We also found that normal diurnal and seasonal rhythms in the neocortical transcriptome and epigenome are disrupted in the context of Alzheimer's disease pathology. These data support the hypothesis that sleep and circadian disruption may be a marker of or contributor to dementia-related brain changes in community-dwelling older adults and invite further investigations of sleep and circadian targeted interventions to delay or prevent dementia.

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Disclosure: Nothing to disclose.

56 | Age-related changes in circadian sleep-wake regulation: impact on cognitive performance and cerebral correlates

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The ageing process is variably associated with cognitive decline. Temporal organization of sleep-wake states is fundamental to brain function and prone to disruption by the ageing process. The two-process model of circadian and homeostatic sleep-wake regulation has not only been established as a powerful tool for the prediction of sleep timing and structure, but also accounts for human sleepiness and neurobehavioural performance modulation over day and night. We will first show results providing further functional significance of sleep-wake regulation onto cognition and its underlying cerebral correlates. In a next step, the impact of the ageing process on those modulations will be discussed. There is evidence that performance of older adults is less impaired by sleep deprivation compared to young adults. We will present data indicating that such reduced age-related responsiveness to sleep loss and circadian phase are also detectable at the cerebral level, both by probing task-dependent brain activity using functional magnetic resonance imaging and cortical excitability using transcranial magnetic stimulation coupled to high density electroencephalography. Finally, we will address more specifically the putative role of the temporal framework of sleep-wake regulation on cognitive and brain fitness in the aged. First data reveal large variability in circadian sleep-wake modulation over the 24-hr day. They further suggest that this variability is linked to cognitive performance in the aged such that a more distinctive allocation of sleep to night-time and wakefulness to daytime is indicative for better working memory performance. In the same vain, preliminary results suggest an association between circadian integrity and MRI-derived brain volume and surface measures in healthy older participants. Overall, the data suggest that both sleep fragmentation during night-time and wake fragmentation during daytime should be taken into account when assessing a putative link between sleep and cognition in the aged.

Disclosure: Nothing to disclose.

57 | Dynamic LED lighting: finding the right light at the right time for severely demented residents

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Light has potent effects on us beyond vision, light adjust our body clock, stimulates attention and modulates our mood and mental effort as confirmed in numerous laboratory studies. With the emergence of light-emitting diodes (LED) technology, the lighting industry has devoted designs to adapt lighting to the benefit of people's health. Such a tuneable lighting system has been installed in a dementia care home at the Ceres Centre in Horsens, Denmark, which is home for 16 individuals with severe dementia. Here every room has been fitted with colour temperature adjusted lighting to account for morning, daytime and evening exposure, which sets this installation apart from communal room only fittings. In order to assess the impact of the new dynamic lighting on the residents, individuals were studied for patterns of activity and rest, including several sleep parameters derived from actigraphy, as well as for changes in affective and behavioural abilities derived from observational ratings of the staff. The presentation includes data collected at three time points during the year over 3 weeks each: before installation in spring (April), and again after installation in summer (July) and in winter (November). The repeated measurement design has the potential to estimate the variability and trends within each session to evaluate the sustainability within and between sessions. Observational ratings of staff showed an improved Quality of Life and ratings on hallucinations and delusions were lower after changing the lighting. In terms of number of naps during the day no significant change occurred. No shifts towards timing of morning awakening, no worsening in sleep fragmentation and no decrease in sleep efficiency was found. The spread of habitual get-up time became smaller and this was sustained. Overall, high inter-individual variability in time patterns revealed small positive changes and improvements were seen in observational ratings.

Disclosure: Nothing to disclose.

ELECTROPHYSIOLOGY OF SLEEP

O058 | Sharpening the paradox of REM sleep: cortical oscillations, synchronization and topographical aspects during phasic and tonic REM microstates

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Objectives/Instruction: Rapid Eye Movement (REM) sleep is viewed as a homogeneous state characterized by high cortical activity, low muscle tone, and the occurrence of eye movements. REM sleep is composed of two markedly different neural states, termed as phasic and tonic microstates. These states differ in awakening thresholds, sensory processing, oscillatory activity, and cortical synchronization. Previous findings indicate that the tonic state is characterized by synchronized alpha and beta oscillatory activity resembling resting wakefulness, whereas the phasic state exhibits increased gamma power arising from more local networks. These findings however, are based on low density EEG, therefore, our aim was to explore phasic and tonic REM states using high density EEG, and to examine the topographical aspects and global synchronization of cortical oscillations during these microstates.

Methods: We analyzed the EEG data of healthy, young adults (N = 18) that spent an undisturbed second night in our laboratory. Segments of phasic and tonic REM were selected based on the presence or absence of eye movements, respectively. Independent Component Analyses and surface Laplacian transformation were applied to attenuate the confounding effects of artefacts, volume conduction, common reference, and microsaccades. We calculated the average spectral power and the global field synchronization within a frequency range between 2 and 48 Hz for phasic and tonic REM periods.

Results: Tonic periods were characterized by increased central high-alpha ($p < 0.01$) and frontocentral beta ($p < 0.001$) power, whereas phasic periods showed globally increased gamma activity. Interestingly, the phasic state was characterized by relatively higher global synchronization in the delta ($p < 0.001$) and theta ($p < 0.001$) ranges, while global beta synchronization was prominent ($p < 0.001$) during the tonic state. Global synchronization in the gamma range was not statistically different across phasic and tonic states.

Conclusions: Phasic and tonic REM states are different in terms of oscillatory activity and cortical synchronization. Widespread and synchronized activity in high alpha and fast frequency beta oscillations during tonic REM might reflect the reinstated activity of frontoparietal attentional networks. Increased, but globally desynchronized gamma oscillations might indicate sensorimotor activity, superimposed on synchronized low frequency oscillations that minimize external processing during phasic sates.

Disclosure: Nothing to disclose.

O059 | Bidirectional interactions between slow waves and synaptic plasticity

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Objectives/Introduction: Sleep has been proposed to serve a key function in reducing the net strength of synaptic connections in the brain, and thereby relieve sleep pressure. Sleep pressure is commonly quantified as slow wave activity (SWA), the signal power in the range of 0.5–4 Hz. Importantly, SWA is enhanced in a local and use-dependent fashion and dissipates across the course of sleep. While considerable evidence supports the occurrence of net synaptic weakening during sleep, it is unknown whether this is necessary and/or sufficient for the modulation of SWA. This is, in part, because the mechanisms of synaptic weakening during sleep remain unclear. We and others have recently shown that cortical slow oscillations can induce synaptic weakening. Here, we explore whether slow wave-induced synaptic weakening is sufficient to induce local changes in SWA.

Methods: We recorded the local field potential (LFP) and multi-unit activity (MUA) in the barrel cortex of anesthetised mice using an eight by eight channel array. We quantified responses to whisker deflections and assessed SWA in part of the interstimulus interval. Following a forty-minute baseline, we paired whisker deflections with either the UP-phase or DOWN-phase of the cortical slow oscillation, analogous to the plasticity protocol we used in our previous work. Subsequently, we continued monitoring whisker-evoked responses for sixty minutes.

Results: Pairing whisker deflections with UP but not DOWN states led to a lasting decrease in the whisker-evoked response both in the LFP and the MUA ($p < 0.05$ for time*group; mixed ANOVA, n = 6 per group). Concurrently with plasticity in the sensory response, there was a significant decrease in slow wave activity ($p < 0.05$ for time*group; mixed ANOVA, n = 6 per group). This decrease was not equal across all channels but was local and dependent on the extent of plasticity in a given channel.

Conclusions: We confirm that cortical UP states can facilitate synaptic weakening *in vivo* and find that synaptic weakening can locally reduce cortical slow wave activity in a dose-dependent manner. To our knowledge, this is the first experimental test of this important prediction of the synaptic homeostasis hypothesis of sleep.

Disclosure: Nothing to disclose.

O060 | Orexin-independent decreases in sleep propensity mark the onset of spontaneous torpor bouts in calorically-restricted mice

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Objectives/Introduction: In conditions of reduced food intake and ambient temperature, mice enter into torpor, a state of behavioural quiescence and controlled body temperature reduction. Sleep also entails quiescence and temperature reduction. Orexin neuropeptides control sleep, body temperature, and food intake. However, it is still unclear whether orexins mediate the relationship between torpor and sleep in mice. Here, we investigated whether

i) sleep alterations mark the onset of torpor in mice

ii) these alterations are orexin-dependent.

Methods: female orexin knock-out mice (n = 6) and congenic wild-type controls (C57Bl6/J, n = 5) were implanted with a thermistor to measure brain cortical temperature, a telemetric transducer (TA11PA-C10, DSI) to measure arterial pressure, and electrodes to record the electroencephalogram (EEG) and the neck muscle electromyogram (EMG). After recovery, signals were recorded together with oxygen consumption rate (VO_2, indirect calorimetry) in freely-behaving mice calorically-restricted and exposed to a 20°C ambient temperature. Sleep was scored manually on 4-s epochs based on EEG and EMG signals. Slow-wave activity (SWA) in non-rapid-eye-movement (non-REM) sleep was computed based on EEG spectral power at 0.5–4 Hz. Torpor onset was defined as the 20-min window centred on the start of a monotonic decrease in brain temperature >5°C. Baseline values were computed as averages over a 20-min window ending 30 min before torpor onset. Torpor onset was compared with baseline in orexin knock-out and wild-type mice employing analysis of variance (ANOVA) with significance at $p < 0.05$.

Results: compared with baseline, torpor onset entailed more time in wakefulness, higher EMG tone and VO_2, less time in non-REM and REM sleep, and lower SWA in non-REM sleep ($p < 0.05$ for all). None of these effects showed a significant interaction with orexin deficiency ($p > 0.16$).

Conclusions: Data suggest that an orexin-independent decrease in sleep propensity marks the onset of spontaneous torpor bouts in mice. The resulting increase in VO_2 may play a role in triggering torpor. Better knowledge of mouse torpor may help in developing synthetic torpor-like states to address problems of targeted temperature management and long-term space flight in humans.

Disclosure: Nothing to disclose.

O061 | Electrophysiological correlates of sleep and wakefulness in Aplysia californica

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Objectives/Introduction: Sleep in invertebrates resembles mammalian sleep as it is characterized by a heightened arousal threshold and a homeostatic sleep rebound after sleep deprivation. A long standing question is whether electrophysiological signatures of sleep and wakefulness can be found in invertebrates and whether these signatures relate to those seen in mammals. Characterizing neuronal activity during sleep in invertebrates might thus help to elucidate the mechanisms of sleep and also shed light into putative functions of sleep, like the processing and consolidation of memory during sleep. Here we studied the mollusk *Aplysia* that served as a pioneer model for invertebrate electrophysiology equipped with only 20.000 neurons, distributed in five pairs of ganglia. This allowed us to record the crosstalk between these neuronal nodes during wakefulness and sleep.

Methods: Aplysia californica (N = 10) were used for in vivo electrophysiological recording for up to 72 hr. We implanted up to six pairs of differential electrodes and recorded from the following ganglia connectives: Cerebro-Buccal Connective, Cerebro-Pedal Connective, Cerebro-Pleural Connective and Pleural-Abdominal Connective.

Results: Our analysis focused on the oscillatory nature of neuronal activity that is typically used to discriminate sleep and wake states in the mammalian brain.During sleep episodes we detected an oscillation in neuronal activity in the range of 0.2–0.5 Hz.

Conclusions: We found electrophysiological correlates of sleep and wake states in the invertebrate Aplysia californica that may help to elucidate the evolutionary basis of sleep.

Disclosure: Nothing to disclose.

O062 | Intranasal leptin treats sleep disordered breathing in obese mice

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Objectives/Instruction: Sleep-Disordered Breathing (SDB) is characterized by recurrent upper airway obstruction and/or hypoventilation during sleep. Leptin acts in the brain to regulate energy balance and stimulate breathing. Obesity in humans and mice is associated with leptin resistance, due to limited blood-brain barrier (BBB)

permeability. We hypothesized that intranasal (IN) leptin will overcome leptin resistance in mice with diet-induced obesity (DIO) at the BBB level and treat SDB acting at specific central nervous system sites.

Methods: Male C57BL/6J DIO mice, 26 weeks of age, 45.5 ± 0.9 g of weight, were treated with a single dose of IN (n = 9) or intraperitoneal (IP, n = 8) leptin at 0.4 mg/kg in 1% bovine serum albumin (BSA) versus vehicle (BSA only) followed by polysomnography using barometric plethysmography. Upper airway obstruction was detected based on inspiratory flow limitation (IFL) defined as a plateau in mid-inspiratory flow. Minute ventilation (V_E) was normalized per body weight. Effective delivery of leptin to the brain was confirmed by immunofluorescence of phosphorylated STAT3 (pSTAT3), a transcription factor activated by leptin signalling.

Results: Leptin administered by both routes did not affect the percentage of IFL, which was detected in 11.1 ± 2.8% of breaths in NREM sleep and 32.0 ± 3.3% of breaths in REM sleep. IN leptin increased V_E in non-REM sleep (from 0.74 ± 0.08 ml/g/min to 0.91 ± 0.10 ml/g/min, $p < 0.01$) and in REM sleep (from 0.69 ± 0.07 to 1.0 ± 0.09 ml/g/min, respectively, $p < 0.01$). In contrast, IP leptin had no effect on breathing. IN leptin did not raise plasma leptin, whereas IP leptin increased plasma leptin from 48.7 ± 8.5 ng/ml to a peak of 374 ± 53 ng/ml ($p < 0.01$) 1 hr after treatment. IN leptin activated the pSTAT3 in the hypothalamus and respiratory nuclei of medulla, including the nucleus of the solitary tract and the ventral respiratory group. pSTAT3 was not observed after vehicle treatment or after IP leptin administration.

Conclusions: Similar to humans, DIO in mice is associated with SDB. Leptin did not affect upper airway obstruction. IP leptin did not affect breathing, despite high plasma concentrations. IN leptin bypassed the BBB and acted as a potent respiratory stimulant.

Disclosure: Nothing to disclose.

SLEEP PROBLEMS IN EARLY CHILDHOOD – PERSPECTIVES INTO EPIDEMIOLOGY AND TREATMENT

63 | Disturbed sleep during early infancy: findings from the CHILD-SLEEP cohort

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Objective: Sleeping problems are reported to be common in early childhood, but only a few longitudinal studies describe the development of sleep quality in early childhood. In this study, we studied the prevalence of infant sleeping problems as reported by the parents.

Methods: Altogether 1667 families from Pirkanmaa Hospital District, Finland, participated in the CHILD-SLEEP birth cohort study. The data collection started during pregnancy approximately at 32nd week and infant sleep quality was measured at the ages of three, eight, 18 and 24 months. We studied sleep quality and quantity as well as development of circadian rhythm. In addition, we aimed to recognize some environmental factors related to persistence of sleeping difficulties in early childhood (e.g. gender, family structure).

Results: Average sleep duration was 14.1 hr (Standard deviation, SD 2.1) at the age of 3 months, 13.3 hr (SD 1.0) at 8 months, 12.3 hr (SD 0.9) at 18 months and 11.9 hr (SD 0.9) at 24 months. Proportion of daytime sleep decreased from 34.6% (SD 4.3) at the age of 3 months to 25.7% (SD 5.0) at 8 months, 16.9% (SD 3.0) at 18 months and 15.7% (SD 3.2) at 24 months. At these four measurement points, prolonged sleep onset latency (≥30 min) was reported in 24.9%, 9.7%, 9.9% and 18.3% of the infants while frequent night wakings (≥3) decreased clearly during the follow up (the prevalence being 18.4%, 14.1%, 10.0% and 5.3% at 3, 8, 18 and 24 months, respectively). Approximately 20% of infants had persistent difficulties in self-soothing. Overall, mild, moderate or severe sleeping problems were reported by 22.5%, 39.8%, 24.8% and 21.9% of the parents. We also evaluated gender differences and factors related to persistence of sleeping difficulties.

Conclusion: Infant sleep quality is highly variable in early childhood and many sleeping difficulties are highly prevalent and persistent in early childhood. Many of them may warrant treatment in clinical settings.

Disclosure: Nothing to disclose.

64 | Developmental trajectories of sleep problems in toddlers and later emotional and behavioral problems

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Introduction: Sleep and depression are interlinked throughout the lifespan, nut very few studies have examined the directionality of the sleep-depression link in children.

Objective and aim: To examine the bidirectional association between sleep problems and internalizing problems/depressive symptoms in toddlers and children aged 1.5 and 8 years.

Methods: A large population-based longitudinal study was conducted in January 2018 using data from the Norwegian Mother and Child Cohort Study conducted at the Norwegian Institute of Public Health from October 1999 to July 2009. A total of 28,725 children were included. Sleep duration, nocturnal awakenings, and internalizing problems (1.5 years) was provided by the mothers. Internalizing problems were measured with items from the Child Behavior Checklist and operationalized according to recommended clinical cutoffs, corresponding to T scores of greater than 65 (93rd percentile). Information on sleep duration and depressive symptoms at 8 years was provided by the mothers. Symptoms of depression were assessed using the short version of the Mood and Feelings Questionnaire (SMFQ). Risk ratios (RRs) were calculated using negative binomial regression.

Results: After accounting for previous internalizing problems, short sleep duration (≤10 hr) and frequent (≥3) nightly awakenings at 1.5 years predicted the development of depressive symptoms at 8 years of age (RR = 1.41; 95% confidence interval [CI] 1.15–1.72, and RR = 1.36; 95% CI 1.15–1.62, respectively). Also, internalizing problems at 1.5 years predicted onset of later short sleep duration (RR = 1.72, 95% CI 1.13–2.59) after accounting for early sleep problems.

Conclusions: This study demonstrated a bidirectional association between sleep and depressive symptoms from toddlerhood to later in childhood. Intervention studies are needed to examine whether targeting either of these problems at this early age may prevent onset of the other.

Disclosure: Nothing to disclose.

65 | Clinically oriented subtyping of chronic insomnia of childhood

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Introduction: Subtypes of insomnia have been proposed in the major classification systems; however, the reliability and validity of the different nosological entities included was so poor that they did not improve diagnostic accuracy suggesting that alternate diagnostic paradigms for insomnia classification should be considered.

Objectives and aims: Our aim was to identify different figures of chronic insomnia of childhood, based on the common descriptors used by parents and on the clinical pictures (nocturnal awakenings, difficulty in falling asleep, nocturnal restlessness, early morning awakenings).

Methods: A structured parent interview was conducted in 338 children (*mean* age 21.29, *SD* 10.56) referred by pediatricians because of insomnia resistant to behavioral approaches and common drug treatments. A latent class analysis (LCA) was run to identify profiles of insomnia. We then associated the profiles derived from the LCA to the history of the child and to the family sleep-related history. Analysis of variance and the chi-square test were used to examine differences between profiles.

Results: A three-class model was built by LCA: 17% (*n* = 58) of children constituted the first class characterized by difficulties in falling asleep with restlessness, nocturnal restlessness, and awakenings during the night; the second class, characterized by early morning awakenings comprised 21% (*n* = 71) of children; 62% (*n* = 209) of children fell within the third class because of their high frequency of nocturnal awakenings and difficulties in falling asleep. The first class reported longer sleep latency and the presence of restless legs syndrome and anemia in the family history; depression and/or mood disorders were more frequent in class 2 and allergies and/or food intolerance were more frequent in class 3.

Conclusions: In this study, we identified three different phenotypes based on the common presentations of insomnia in children, based on clinical, personal, and familiar data. These different phenotypes might underlie different pathophysiological mechanisms and might help optimizing the assessment and treatment of insomnia in young children.

Disclosure: Nothing to disclose.

66 | What have we learnt in the last 5 years of pharmacological treatments for children with sleep problem?

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Even after well conducted sleep behavioural interventions a percentage of children will still have significant sleep onset and maintenance problems. This is particularly relevant to children with neurodevelopmental disorders such as autism. Professor Gringras leads the Sleep Medicine Department at the Evelina London Children's Hospital and over the last 5 years has led large randomised-controlled trials of pharmacological and non-pharmacological interventions for children with neurodevelopmental disorders and sleep problems. He is determined that we think more about core objective and subjective outcome data sets, based on consensus between both professionals parents and their children. He published the MENDS immediate release melatonin study in 2012 and in 2017 a paper on a novel Paediatric Prolonged-Release Melatonin with important new outcomes and a longer follow-up period than any previous study. Although the evidence is greatest around melatonin there are other medications that deserve more careful evaluation with more randomised controlled studies and this presentation will touch on future opportunities.

Disclosure: I received funding from Neurim for my time as CI on the Neurim PR melatonin study. I do not have shares or any other COI

KEYNOTE LECTURE – CHARALAMBOS P. KYRIACOU

67 | Molecular analysis of biological clocks: beyond circadian rhythms

C. Kyriacou

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The molecular analysis of circadian rhythms has provided a milestone for how genes can determine complex behavioural phenotypes, underscored by the award of the 2017 Nobel Prize for Medicine or Physiology to Jeffrey Hall, Michael Rosbash and Mike Young for their pioneering work on the Drosophila clock. I shall outline a brief history of the major developments that led to this remarkable achievement and embroider the margins of the fly story with some recent findings from my own laboratory. I will then extend the discussion to the role of the circadian clock and the canonical clock genes in the determination of other timing-related phenomena.

Disclosure: Nothing to disclose.

SLEEP AND COGNITION

O068 | Selective tracking of relevant speech during human sleep

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Objectives/Introduction: Falling asleep leads to a disconnection that renders organisms vulnerable. Yet, despite the absence of behavioural responses, the brain remains sensitive to external stimuli. Here, we hypothesised that sleepers enter a 'standby mode' in which they continue to track relevant signals, allowing them to awake when necessary.

Methods: We used scalp electroencephalography in 24 healthy participants to reconstruct competing auditory streams in a multi-talker environment. Participants were exposed to concomitant auditory streams (one in each ear) during wakefulness and daytime naps (Non-Rapid Eye-Movement sleep). Auditory streams were made of either real speech or meaningless pseudo-speech. The pseudo-speech was identical to the real speech in terms of basic sensory properties (same phonemes and prosody as real speech) but was deprived on any meaning as it was composed of made-up words.

Results: Real-speech was better reconstructed, from brain activity, than its pseudo-speech counterpart in 60% of trials in wakefulness (signed rank test against chance level = 50%; $p = 1.02.10^{-4}$) and 52% of trials in NREM sleep (stage 2 and 3; $p = 2.84.10^{-2}$). Since real and pseudo-speech share common phonological properties and differ only by the presence or absence of meaning, we demonstrate here that the sleeping brain amplifies meaningful speech compared to irrelevant signals. However, although sensory encoding remained constant, attention allocation was transient. It was stronger during light sleep (stage 2: real-speech>pseudo-speech in 56% of trials) and vanished during deep sleep (stage 3). The impact of sleep depth reflected the promotion of attention by K-complexes in light-sleep and the active suppression of relevant signals by slow-waves in deep-sleep. Sleep spindles marginally modulated both stimulus encoding and attentional amplification, putting their role in sensory decoupling into question.

Conclusions: Thus, attentional mechanisms continue to operate during sleep, but are strongly modulated by sleep depth and specific brain rhythms. Our work highlights the role of sleep's micro-structure in the filtering and processing of external stimuli during sleep.

Disclosure: Nothing to disclose.

O069 | Maintaining vigilance with limited sleep opportunity: is it better to consolidate or split sleep?

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Objectives/Instruction: Adolescents are often faced with situations where they curtail their sleep across multiple school nights. Here, we examined whether among adolescents exposed to chronic sleep restriction, sustained attention was less impaired when sleep was scheduled during one consolidated session, as compared with a split sleep schedule with a shorter night time segment and a mid-afternoon nap.

Methods: Participants (age: 15–19 years) underwent two cycles of sleep restriction (TIB = 6.5 hr per 24-hr period) and recovery (TIB = 9 hr) that simulated sleep opportunities over two school weeks. During the sleep restriction periods, participants had either a 6.5-hr TIB at night (consolidated sleep group: $n = 29$), or a 5-hr nocturnal TIB plus a 1.5-hr afternoon nap opportunity (split sleep group: $n = 29$). Sustained attention was assessed by the number of lapses in the Psychomotor Vigilance Task (PVT).

Results: During the first cycle of sleep restriction, the split sleep group had fewer PVT lapses than the consolidated sleep group in the morning (6 hr before naps; $p < 0.003$), afternoon (1 hr after

naps; $p < 0.02$), and evening (4.75 hr after naps; $p < 0.04$). Consonant with our previous work, vigilance decline was greater in the second cycle of sleep restriction for both groups ($p < 0.03$), revealing carry-over effects from the previous week of sleep loss. The group difference in vigilance performance favouring the split sleep group was accentuated in the second week for PVTs taken after nap opportunities ($p < 0.001$).

Conclusions: In adolescents with total sleep opportunity limited to 6.5 hr per 24 hr, sustained attention was better maintained with a split sleep schedule relative to a consolidated nocturnal sleep schedule. These findings raise the possibility that a split sleep schedule may serve to minimize cumulative negative effects of recurrent sleep restriction. It should be emphasized, however, that vigilance in the split sleep group was worse compared with adolescents given 9 hr of TIB in our prior studies, indicating that the split sleep schedule did not adequately replace healthy nocturnal sleep.

Disclosure: This work was supported by the National Medical Research Council, Singapore (NMRC/STaR/0004/2008 and NMRC/STaR/015/2013), the National Research Foundation, Singapore (NRF2016_SOL002), and the Far East Organization.

O070 | Effect of total sleep deprivation on the recall of active avoidance response in rats

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Objectives/Introduction: Kamin's classical experiments, showed that 1 hr retention interval between learning and relearning sessions impairs two-way active avoidance response recall (Kamin effect). Our objective was to examine the effect of total sleep deprivation (TSD) on Kamin effect and its influence on memory recall of incompletely learned active avoidance task.

Methods: 80 inbred albino adult laboratory rats, both male and female, were randomly divided into 3 experimental groups. Learning task was 25 trials of standard active avoidance procedure, with CS-US interval of 5 s and time interval between trials with 1 min. All groups were given learning and two relearning sessions of active avoidance procedure. To measure learning level we counted the mean number of correct responses in each active avoidance session. In control group ($n = 55$) the retention interval between sessions was 0 hr. In first ($n = 12$) and second ($n = 13$) exp. groups the retention intervals between sessions were 1 hr, during which rats were placed back in their home cages. First exp. group during retention intervals stayed in home cages without any experimental manipulations while second exp. group underwent TSD, using gentle handling method.

Results: Control group's first and second relearning session values (18.2 ± 0.8 and 20.4 ± 0.7) was significantly higher than learning session value (8.9 ± 0.6; $p < 0.001$). During 1 hr retention intervals, animals of the first exp. group slept 20.8 ± 6.9 min and 26.1 ± 6.7 min, with sleep onset latency of 35.5 ± 6.2 min and 30.2 ± 6.7 min, respectively. First and second relearning session values (13.2 ± 1.0 and 14.2 ± 1.6), of this exp. group, was less than control group's corresponding session values ($p < 0.03$ and $p < 0.001$). When during 1 hr retention interval, animals underwent 1 hr TSD (second exp. group), first and second relearning session values (18.2 ± 0.9 and 21.8 ± 0.7) did not differ from control group's corresponding session values ($p < 0.9$ and $p < 0.4$).

Conclusions: Our data indicate that keeping animals in the waking state during retention intervals interferes with the development of Kamin effect and promotes the memory consolidation of active avoidance, while sleep bouts result in the Kamin effect manifestation and impairment of memory recall in relearning sessions.

Disclosure: Nothing to disclose.

O071 | The sleeping brain not only monitors the environment, but also detects relevant information

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Objectives/Introduction: During sleep our consciousness fades away, we become behaviorally unresponsive, and oscillatory activity of our brain changes entirely. The sleeping brain engages into "housekeeping" activities, like memory reorganization or removal of neurotoxic waste. Nevertheless recent research suggests that also during sleep the brain can process incoming stimuli, especially that of a potential relevance. "Cocktail party" phenomenon and studies with unaware participants showed that subject's own name (SON) has a very strong bottom-up drive, even during states of reduced consciousness, making it a good candidate for stimulus that could be processed during sleep. Therefore in the current study we investigated brain responses induced by names during different sleep stages.

Methods: Twenty-one young (mean age = 25 ± 2 years), healthy, and partially sleep-deprived subjects listened to auditory stimuli, while their brain activity was simultaneously recorded with EEG and MEG. After 20 min of wakefulness, participants were given an opportunity to sleep for 2 hr. During that time all of the subjects reached N1, 19 subjects reached N2, and 10 subjects reached SWS. Over the entire course of the experiment participants were presented with a stream of auditory stimuli that consisted of SON and other unfamiliar names, which were additionally spoken either by a close relative/friend or by a stranger. The event-related brain responses were analyzed by means of oscillatory power of magnetic fields. Statistical testing was done on clusters of brain activity

(adjacent in space-time-frequency), with cluster-based permutation statistics as implemented in FieldTrip software.

Results: During wakefulness, brain responses significantly differed depending on which type of voice ($p = 0.11$) and which type of name ($p < 0.001$) was presented. Interestingly, after falling asleep, SON kept inducing stronger oscillatory response than unfamiliar names, over a similar topography and frequency band as during wakefulness (N1: $p < 001$; N2: $p = 0.002$). During SWS however, it was the unfamiliar name that induced a stronger oscillatory brain response than SON ($p = 0.016$).

Conclusions: The sleeping brain not only continuous to monitor the environment, but also discerns relevant information. Even though a complete "shielding" of the environment during sleep seems beneficial, the brain's preserved capacity for processing external stimuli could have potential relevance for health and even survival.

Disclosure: Nothing to disclose.

O072 | Neural correlates of human cognitive abilities during sleep: an EEG-fMRI study

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Objectives/Introduction: Spindles are one of the only known electrophysiological oscillations identified as a biological marker of cognitive abilities typically assessed by intelligence tests. Spindles are highly correlated to trait-like "Reasoning", but not "Verbal" abilities. Simultaneous electroencephalography and functional magnetic resonance imaging (EEG-fMRI) have revealed brain activations which occur during spindles, including thalami, paralimbic, striatal and motor cortical areas. Interestingly, these regions are known to support Reasoning abilities. However, the neural correlates of the relationship between spindles and cognitive abilities are unknown. EEG-fMRI was employs to identify, for the first time, the neural activation patterns time-locked to spindles that are related to cognitive abilities. This will provide insight into the neural basis of the functional significance of spindles.

Methods: A total of 29 healthy adults (17 females; age = 24 ± 3.9) completed the Cambridge Brain Sciences (CBS) Trials online prior to the experimental session (21 h00–23 h00) where simultaneous EEG-fMRI was recorded while subjects slept in the MRI scanner. CBS Trials yields:

(1) a Reasoning subscale (i.e., "fluid intelligence"),
(2) a Verbal subscale (i.e., "crystalized intelligence"), and
(3) a Short Term Memory subscale (STM).

Results:

(1) Similar to previous studies, spindles detected at Cz (11–16 Hz) in non-rapid eye movement sleep were related to Reasoning ($p = 0.03$) but not Verbal ($p = 0.70$) or STM ($p = 0.53$) abilities, and
(2) activations time-locked to spindles were observed in the thalamus, bilateral striatum, middle cingulate cortex, and cerebellum ($p < 0.05$, FWE).
(3) Importantly, Reasoning abilities were correlated with spindle-related activation in a subset of these regions including the thalamus, bilateral striatum, medial frontal gyrus, middle cingulate cortex, and precuneus ($p < 0.05$, FWE). Importantly, No spindle-related activations were correlated to Verbal abilities or STM.

Conclusions: Our results show for the first time, that brain areas activated time-locked to spindles, and were related to interindividual differences in Reasoning but not Verbal, or STM. These results may help elucidate the physiological mechanisms which support the function of sleep for the capacity for reasoning. This may ultimately help to understand the significance sleep to a variety of normal and abnormal cognitive functioning in healthy individuals and in neurological conditions where spindle activity is abnormal or deficient.

Disclosure: Nothing to disclose.

O073 | Effect of interictal epileptic spikes on sleep spindles in medial temporal regions during NREM sleep: are there consequences on memory long-term consolidation? A SEEG study

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Objectives/Instruction: The hippocampal-neocortical transfer of memories is supposed to occur during non-REM (NREM) sleep (Rasch and Born, 2013). Specific brain oscillations or activities, such as sleep spindles, ripples or slow waves, probably play a key role in this process.

Some epileptic patients -generally with a medial temporal lobe epilepsy- suffer from a specific impairment of long-term memory consolidation, called accelerated long-term forgetting (ALF). In this impairment, patients perform normally to memory tests with standard delay of recall or recognition (30 min) but forget more than controls when tested with one to few weeks delay.

As epileptic activities are activated during NREM sleep, we aimed to study the effect of epileptic activities on physiological sleep activities in the hippocampus, such as sleep spindles, and the consequences on long-term memory consolidation with intracranial EEG recordings.

Methods: We prospectively studied patients with drug-resistant focal epilepsy hospitalized for a presurgical investigation with stereo-electroencephalography (SEEG), with at least one electrode localized in hippocampus.

Each patient had memory tests 48–72 hr after electrodes implantation, with immediate and delayed (30 min) recall and recognition, and a second test 1 week later to test specifically long-term consolidation processes.

We studied spike frequency and spindle frequency on contacts localized in hippocampus during the first cycle of NREM sleep of the night following the first tests.

Results: We included 13 patients and 13 matched-controls. We studied spike frequency and spindle frequency during NREM sleep in 20 hippocampi. There was a non-linear negative correlation between spike frequency and spindle frequency (–0.49, $p < 0.05$). We found an accelerated long-term forgetting in our group of patients compared to controls: there was no significant difference between patients and controls at immediate recall and 30 min-delay recall, but there was a significant impairment at 1 week-delay ($p < 0.05$). We found significant a negative correlation between spike frequency during sleep and test at 1 week, and between the number of seizures and performance at 1 week.

Conclusions: These results suggest that spike and spindle frequency in hippocampus during NREM sleep play a role in long-term memory consolidation.

Disclosure: Nothing to disclose.

O074 | Bad sleepers' night sleep quality improves after pre-sleep cognitive training

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Objectives/Introduction: Recently, we have reported that a complex ecological learning task (requiring the simultaneous activation of several cognitive functions), intensively administered at bedtime, improves daytime sleep continuity and stability, possibly as a result of ongoing memory processes[1]. Here, our aim is to extend these results to night time sleep in a sample of young adults with subjective sleep complaints.

Methods: The sleep of 18 subjects (27.9 ± 8.0 years), identified as bad sleepers (PSQI global score ≤5) was recorded in three experimental conditions: (1) baseline undisturbed sleep (BL); (2) post "active-control" sleep (AC), i.e. a sleep episode preceded by a non-learning control task, (tablet-based, similar to the Psychomotor Vigilance Task); (3) post "training" sleep (TR), preceded by a complex learning task, i.e. a modified version of the word-game *Ruzzle*, in which subjects have 1.5 min to form (by touching an iPad screen) as many words as possible with the 16 letters available on a 4 × 4 grid. At morning awakening from TR, subjects were retested at the cognitive task.

Results: Post-training sleep showed significantly decreased frequencies of arousals ($F = 3.54$, $p = 0.04$; BL>TR), state transitions ($F = 5.05$, $p = 0.01$; BL>TR and AC) and functional uncertainty (FU) periods ($F = 6.24$, $p = 0.005$; BL>TR and AC) as well as significantly less time spent in FU periods ($F = 5.22$, $p = 0.01$; BL>TR and AC). Awakening frequency was also reduced in TR relative to BL (total awakenings: $F = 3.1$; $p = 0.05$; BL>TR; short awakenings: $F = 3.63$, $p = 0.04$; BL>TR and AC). Finally, TR showed an increase in the number and mean duration of NREM-REM cycles (respectively $F = 9.25$, $p = 0.001$; TR>BL and AC; $F = 5.99$, $p = 0.006$; TR>BL and AC), and longer time spent in cycles ($F = 9.84$, $p < 0.001$; TR>BL and AC). In TR, retest score at awakening was significantly higher than pre-sleep score ($t = 5.048$, $p < 0.001$).

Conclusions: In our sample of bad sleepers, night sleep in TR was notably more continuous, stable and organized than baseline sleep, confirming previous results obtained on a daytime nap[1].

These findings challenge the assumption that pre-sleep cognitive activity impairs sleep quality and suggest to further explore cognitive training as a strategy to improve sleep in sleep-disordered individuals.

References: 1. Arzilli C. et al. *Behav Sleep Med* (2018) 25:1–9.

Disclosure: Nothing to disclose.

REM SLEEP FRAGMENTATION AND EMOTIONAL DYSREGULATION: EVIDENCE FOR A NEW MECHANISM LINKING SLEEP AND AFFECT?

75 | Restless REM sleep impedes overnight emotional resolution in insomnia

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Introduction: Insomnia disorder (ID) is the second-most common mental disorder. A prominent characteristic is fragmented REM sleep. Given the role of REM sleep in the adaptation of emotional memories, restless REM sleep might perturb specifically the overnight dissipation of emotional distress and underlying functional reorganization of emotional salience circuits.

Objectives:

(1) To uncover the direct and mediating associations between restless REM sleep, duration of emotional distress and hyperarousal in a large community sample.

(2) To evaluate the time-course of distress dissipation across periods of wakefulness and sleep in normal sleepers (NS) and ID.

(3) Finally, to study differences in the functional reorganization of emotional salience circuits underlying distress dissipation between NS and ID.

Methods:

(1) A survey on nocturnal mentation was validated to indicate restless REM sleep and was subsequently queried in *N* = 1,199 participants along with surveys on emotional distress and hyperarousal. Structural equation and mediation models evaluated directionality of associations.

(2) Self-conscious emotions were experimentally induced in people with ID (*N* = 26) and NS (*N* = 46) by exposing them to their out-of-tune solo singing. Mixed-effect models evaluated the dissipation of shame (experiential shame scale, ESS) across four intervals of wakefulness or sleep.

(3) In *N* = 57, fMRI was used to evaluate long-term effects of failing distress dissipation in ID on the functional reorganization of emotional salience circuits by comparing the reliving of past distress with novel emotional experiences.

Results:

(1) Structural equation and mediation models indicate that restless REM sleep specifically impedes overnight distress dissipation and leads to hyperarousal.

(2) Scores on the ESS showed selective overnight distress dissipation in NS that failed in ID.

(3) Participants suffering from ID showed similar neuronal network activity elicited by a novel emotional experience as by reliving distress from the distant past. While relived distress didn't activate the anterior cingulate cortex (ACC) anymore in NS, it continued to activate the ACC as if it was a new experience in ID.

Conclusions: ID is characterized by insufficient overnight distress dissipation, which accumulates into hyperarousal. People with chronic insomnia and restless REM sleep may never fully accomplish functional reorganization of emotional salience circuits underlying overnight distress dissipation.

Disclosure: Nothing to disclose.

76 | Awakening thresholds and (REM) sleep perception in insomnia patients and good sleeper controls

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Introduction: Insomnia disorder (ID) is a frequent sleep disorder coupled with increased risks for somatic and mental illness. While subjective complaints are severe, polysomnography (PSG) parameters show only modest differences between groups. In previous studies we have postulated that REM (rapid eye movement) sleep may be especially vulnerable to be perceived as wake. To assess this issue more directly, we determined auditory waking thresholds and sleep perception in ID patients and healthy control subjects (GSC) in N2 and REM sleep.

Materials and Methods: Twenty-seven ID patients and 27 age- and gender- matched controls were included. Four consecutive nights were assessed in the sleep laboratory, with nights 3 and 4 each containing three awakenings either from stable N2 or REM sleep.

Results: With subjective sleep of course strongly impaired, PSG data of the 1st and 2nd night showed the commonly observed relatively weak group differences. Awakening thresholds in ID patients did not differ from GSC, but decreased over the course of the night. ID patients indicated significantly more frequently than GSC having been awake when woken from REM sleep but not from N2 and were less sure when indicating they had been asleep. Additionally, ID subjects rated their REM sleep mentation as more emotionally negative compared to GSC.

Conclusions: This study presents direct evidence that the subjective experience of insomnia might be specifically coupled to the REM sleep state. Assuming chronic hyperarousal as a central pathophysiologically relevant pathway for insomnia, this might become especially evident during REM sleep, thus reflecting a "hybrid" sleep state in insomnia being coupled with altered sleep perception.

Disclosure: The study was funded by the DFG (Deutsche Forschungsgemeinschaft; RI 565/13–1).

77 | REM sleep fragmentation and depressive symptoms in late adolescence: evidence from a community cohort

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Introduction: The discontinuity of REM sleep has been associated with insomnia severity. Fragmented REM sleep also may also

contribute negatively to the overnight resolution of distress, where REM sleep plays a significant role. In the long run, this may reflect negatively on emotion regulation and mood. Alternatively, both fragmented REM and depressive symptoms may share a common genetic origin.

Objectives: We explored the associations between the continuity of REM sleep, depressive symptoms, and a polygenetic risk score (PRS) for depression based on a prior genome-wide analysis.

Aims: To increase understanding of fragmented REM in relation to mood and genetics.

Methods: 160 adolescents belonging to a consecutive birth cohort born in 1998 participated in the study at the mean age of 16.9 (SD = 0.1) years. They underwent a sleep EEG at home and self-reported their depressive symptoms with Beck Depression Inventory-II (BDI), and sleep quality with the Pittsburgh Sleep Quality Index (PSQI). Based on a recent genome-wide association study, we calculated PRS for depression across whole genome. We used Illumina OmniExpress Exome 1.2 bead chip in genotyping. REM fragmentation was manually calculated from all REM epochs by counting short (<3 s) and long (>=3 and <15 s) arousals, thus below threshold to be scored as awake epoch. The percent duration of fragmented REM in relation to entire REM duration was calculated.

Results: A higher level of self-reported depressive symptoms was associated with an increased number of arousals and with an increased fragmentation percent in relation to total time in REM, adjusting for age, and sex ($\beta = 0.20$; $p < 0.005$). When split according to fragmentation duration, this concerned only long arousals (>=3 s). PRS for depression was not associated with either BDI-II scores or REM arousals (p-values >0.11). Adjusting further for PRS did not change the significant associations. Subjectively assessed sleep quality as measured with PSQI was not associated with either PRS for depression or REM fragmentation (p-values >0.33).

Conclusions: Depressive symptoms are associated with more fragmented REM sleep. The association was not explained by a genetic risk for depression.

Disclosure: Nothing to disclose.

78 | Does school-aged children's anxiety reduce after sleep restriction therapy via REM sleep consolidation?

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Objectives: Sleep disturbance and anxiety are highly co-morbid during middle childhood. Some studies show sleep treatments can confer secondary benefits to children's anxiety. Several mechanisms have been proposed, including the recent REM sleep fragmentation hypothesis. The objectives of the present study were to

(1) examine an association between REM sleep fragmentation and anxiety in school-aged children experiencing insomnia, and

(2) whether REM sleep consolidation in response to sleep restriction therapy accounts for changes in anxiety.

Method: 13 children (mean age = 10.0 ± 1.6 yrs, 6f) diagnosed with chronic insomnia disorder and reporting anxiety were randomised to receive either sleep restriction therapy (SRT; $N = 5$) or a control treatment (bedtime regularisation, BR; $N = 8$) over a 2-week period. SRT involved providing 30-min less time in bed relative to their pre-treatment total sleep time. BR involved providing the same amount of time in bed, as per their average pre-treatment time in bed, yet specifying consistent bedtimes and rise times. Children completed sleep diaries, the Spence Children's Anxiety Scale, and underwent home-recorded polysomnography during pre- and post-treatment. Total micro- (<3 s) and macro-arousal (<15 s) were scored within REM sleep by two sleep technicians.

Results: Significant large correlations were found between pre-treatment self-reported anxiety and both the number of micro- ($r = 0.63$, $p = 0.02$) and macro-arousals ($r = 0.60$, $p = 0.03$) during REM sleep. A significant group*time interaction for total sleep time (TST) occurred ($p = 0.02$), with a greater decrease in TST for the SRT group; however, no significant interaction was found for REM sleep ($p = 0.74$). From pre-treatment to post-treatment there was no significant interaction in self-reported anxiety scores (SRT: Pre = 28.0, Post = 24.0 vs. Control: Pre = 39.0, Post = 35.0), $p = 0.14$. No significant interaction was found for REM micro-arousals between the SRT (Pre = 8.50, Post = 13.00) and control group (Pre = 11.63, Post = 11.13), $p = 0.43$, nor REM macro-arousals (SRT: Pre = 11.00, Post = 10.50 vs. Control: Pre = 12.25, Post = 13.50), $p = 0.89$.

Discussion: There was some evidence for an association between REM sleep fragmentation and self-reported anxiety scores in school-aged children. Despite total sleep time decreasing for children undergoing sleep restriction therapy, less sleep did not translate to less REM sleep minutes, nor fewer micro- or macro-arousals (i.e., REM sleep consolidation). No significant decreases in anxiety occurred due to sleep restriction therapy.

Disclosure: This study was supported by a Flinders University Faculty Research Grant.

INFORMATION PROCESSING DURING SLEEP: RECENT DEVELOPMENTS AND FUTURE PERSPECTIVES

79 | Associative learning during human sleep: an interplay between behavior, sleep stages and brain activity

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Recent finding suggests that humans can learn novel information during sleep, and that this information can modulate behavior during wakefulness in a sleep stage-dependent manner. Specifically, new associations learned during non rapid eye movement sleep (NREM) had larger and longer lasting influence on behavior than associations learned during rapid eye movement (REM) sleep. NREM sleep, unlike REM sleep, is rich in slow waves and these slow waves promote memory consolidation of information previously learned during wakefulness. We set out to test whether slow waves in delta frequency range (0.5–4 Hz) are also part of the mechanism underlying associative learning during sleep. We recorded electroencephalogram (EEG) during partial-reinforcement conditioning during NREM and REM sleep. On reinforced trials (two-thirds of trials), the conditioned stimulus was paired with an unconditioned stimulus (odor). On non-reinforced trials (one-third of trials), the conditioned stimulus was presented without an ensuing odor, which enabled us to measure learning without the interference of the unconditioned stimulus. We found an increase in delta power in non-reinforced trials during NREM sleep, but not during REM sleep. Moreover, during NREM the increase in delta power was significantly larger when the conditioned stimulus was previously paired with an unpleasant odor than when it was paired with a pleasant odor. This difference was not evident during REM sleep. Finally, we found a significant correlation between learning-related delta power in NREM sleep and retrieval up on awake. Our results demonstrate that new associations learned during natural human sleep modulates delta power in a sleep stage dependent manner, and that this modulation in linked to ability to learn during sleep. Altogether, these findings suggest that slow waves are involve in the process of sleep stage-dependent associative learning during sleep.

Disclosure: Nothing to disclose.

80 | The MemoSleep-Hypothesis: how does cognition influence sleep?

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Sleep is critical for optimal cognitive functioning and health. Sleep disturbances are highly frequent in our society and strongly influenced by cognitive factors, e.g. rumination, expectations and thoughts. However, the mechanism of how cognition influences sleep architecture is not yet understood. To explain how cognition influences sleep, I propose the "Memories-of-Sleep" (MemoSleep)-Hypothesis. Based on the theory of embodied cognition and evidence that memories are reactivated during sleep, the MemoSleep-Hypothesis makes the following assumptions: (1) Cognitions related to sleep/wake states encompass not only their semantic meaning, but also their sensorimotor body representation. Thus, the mental representation of the word 'wake' is directly linked to our body sensation of wakefulness. (2) If embodied sleep/wake memories are activated before sleep, they will have a higher probability of being reactivated during sleep. (3) During sleep, increased reactivation of embodied sleep/wake memories activates associated body responses and thereby affects sleep architecture. Thus, increased reactivation of the mental representation of 'wake' will activate wake-related physiological responses and disrupt sleep. In my talk, I will explain the rational of the MemoSleep-Hypothesis, present and discuss empirical findings related to the hypothesis as well as alternative accounts.

Disclosure: Nothing to disclose.

81 | What can be learned during sleep? Neurophysiological evidence for limitations and boundary conditions

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Introduction: Hypnopedia, or the capacity to learn during sleep, is debatable. *De novo a*cquisition of reflex stimulus-response associations was shown possible both in man and animal. Whether sleep allows more sophisticated forms of learning remains unclear.

Objectives: To probe the possibility to learn disjoint, probabilistic relationships between auditory elements during NREM sleep.

Methods: We recorded during diurnal Non-Rapid Eye Movement (NREM) sleep auditory magnetoencephalographic (MEG) frequency-tagged responses mirroring ongoing statistical learning. While in NREM sleep, participants were exposed at non-awakenings thresholds to fast auditory streams of pure tones, either randomly organized or structured in such a way that the stream statistically segmented in sets of 3 elements (tritones).

Results: During NREM sleep, only tone-related frequency-tagged MEG responses were observed, evidencing successful perception of individual tones. No participant showed tritone-related frequency-tagged responses, suggesting lack of segmentation. In the ensuing wake period however, all participants exhibited robust tritone-related responses during exposure to statistical (but not random) streams.

Conclusions: Our data suggest that associations embedded in statistical regularities remain undetected during NREM sleep, although

implicitly learned during subsequent wakefulness. These results suggest intrinsic limitations in *de novo* learning during NREM sleep that might confine the NREM sleeping brain's learning capabilities to simple, elementary associations. It remains to be ascertained whether it similarly applies to REM sleep.In this talk, we will also discuss the neurophysiological and protective conditions that may make high-level learning difficult to achieve during sleep.

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RECENT ADVANCES IN FATIGUE RISK MANAGEMENT: FROM FATIGUE COUNTERMEASURE STRATEGIES TO SLEEP SCIENCE-BASED POLICY MAKING

82 | Basic and clinical sleep and circadian science as a foundation for fatigue risk management in occupational settings

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Around-the-clock operations are common in large parts of the industrialized world. Many operational settings, including transportation, health care, emergency response, law enforcement, manufacturing, information technology, resource extraction, energy production, and the military, involve night or shift work and/or extended or irregular work hours. In such settings, there is a high prevalence of occupational sleepiness - or "fatigue" as it is typically called in the operational environment. Fatigue has the potential to adversely affect safety, productivity, profitability, health, and well-being, and increases the risk of errors, incidents, and accidents. Basic and clinical sleep and circadian science provides a foundation for contemporary approaches to managing these fatigue-related risks. As instantiated in the two-process model of sleep regulation, fatigue levels are a function of two primary biological mechanisms: the circadian and homeostatic processes. These two processes and their effects on fatigue interact with situational factors in the workplace, such as hours of service regulations, workload, caffeine use, and workplace napping policies. They also interact with situational factors outside the workplace, such as caregiver duties, home sleeping environment, light exposure, and lifestyle. Additionally, sleep disorders and other medical conditions may interfere with the recuperative potential of sleep, and thereby increase fatigue levels.

Fatigue is associated with instability in waking brain function, leading to an increase in attentional lapses, and degradation of attentional control mechanisms, leading to reduced cognitive flexibility. These effects have important implications for productivity and safety in the workplace. In addition, chronic exposure to dysregulation of the circadian and homeostatic processes causes metabolic disturbances and other physiological challenges, which may ultimately lead to poor long-term health outcomes.

A direct link between fatigue and adverse outcomes is typically difficult to demonstrate, because many other factors – both personal (e.g., genetic vulnerability) and circumstantial (e.g., hazard exposure) – are involved. Approaches to managing fatigue-related risk seek to remove factors causally involved in producing adverse outcomes and/or add layers of defense by introducing mitigation factors. Concrete examples include flexible work hours, sanctioned workplace napping, company-sponsored sleep disorder screening and treatment programs, fatigue education programs, and use of biomathematical modeling to develop fatigue-minimized work schedules.

Disclosure: Nothing to disclose.

83 | Fatigue risk management for the offshore oil and gas industry

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Introduction: Fatigue risk management (FRM) is an important risk mitigation strategy for managing the risk associated with offshore shift work scenarios (e.g. 2–4 weeks of successive 12-hr shifts) and offshore sleeping arrangements (e.g. noise disturbances). Yet, there is a lack of knowledge on the time courses and predictors of sleep and fatigue parameters during offshore shift rotations hampering customization and successful implementation of offshore FRM programs.

Objectives: A collection of studies will be presented that aimed to better understand sleep and fatigue parameters during offshore shift rotations to ultimately improve existing FRM programs and systems.

Methods: A longitudinal repeated measures study using both objective (e.g. actigraphy, PVT-B, saliva samples) and subjective measures (e.g. questionnaires and sleep diaries) was conducted among $N = 60$ offshore workers for the duration of one 28-day offshore rotation. Pre-offshore (1 week), offshore (2 weeks) and post-offshore (1 week) work periods were examined and compared.

Results: Pre-offshore work periods were identified as preparation periods in which sleep efficiency scores decreased. Post-offshore work periods were identified as recovery periods in which evening sleepiness scores were high and declined rapidly. During offshore work periods, sleep durations, perceived sleep quality and level of rest after awakening decreased and sleep loss and post-shift sleepiness scores accumulated over the 14-day period. The accumulation of post-shift fatigue scores was significantly related to successive days on shift and chronic sleep loss. On average, 1 in 6 offshore workers reported severe sleepiness (KSS>6) each day offshore.

Indications of a *third-quarter-phenomenon* were found in which post-shift fatigue scores peaked on day 10/11 of a 14-day offshore work period after which they slowly declined. Pre-offshore sleepiness levels, age, chronotype, smoking status and physical/mental health were predictors of individual sleepiness time courses during offshore work periods. BMI predicted pre-shift severe sleepiness scores.

Conclusions: Our results suggest that FRM programs should not only focus on the offshore work period, but should also include pre- and post-offshore work periods. Furthermore, prolonging offshore shifts will likely result in elevated fatigue/sleepiness risk. Findings from our studies should be incorporated in existing offshore FRM programs to aid the optimization of FRM programs and systems.

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84 | Alertness management strategies among long-haul truck drivers and airline pilots

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Long-haul airline pilots and truck drivers are similarly exposed to fatigue factors at work, but only pilots work under well-defined fatigue risk management (FRM) regulations and procedures. Four studies among these occupational groups will be presented. The main emphasis will be put on the results that may help to further develop FRM in the transport sector. All results are based on field measurements (diary, actigraphy, nine-step Karolinska Sleepiness Scale (KSS)) among commercial pilots (n = 86, 2-month measurement period) and truck drivers (n = 54, 2×2-week measurement period). The first two studies addressed personal fatigue management strategies (FMS). Caffeine and alertness-enhancing activity (e.g., slight body movements) were prevalent especially on night duties in both truck drivers (70% and 38% of night duties, respectively) and pilots (65% and 60%), whereas nap breaks were prevalent only among pilots (88%). 26% of night duties involved reduced alertness among truck drivers (KSS peak ≥7). For pilots, the corresponding proportion was similar (21%) even though a more stringent criterion for reduced alertness was applied (KSS peak ≥8). The third study (randomised controlled trial) examined whether a feasible fatigue management training actually improves FMS and on-duty alertness among truck drivers. Intervention-related improvements were observed in none of the outcomes. The fourth study investigated whether possible individual differences in on-duty alertness are associated with personal FMS. KSS ratings given during Helsinki-Asia-Helsinki flights showed that one-fourth rated a reduced alertness level (KSS 7–9) on each flight, whereas another one-fourth never rated correspondingly. The only clear difference in FMS between these groups was the length of prior sleep that was an hour longer for more alert pilots. Our studies show that reduced alertness levels are prevalent in nighttime long-haul transport operations, even if FRM regulations and procedures were in place. Second, FM training does not seem to be a sufficient measure to improve alertness. Third, there is a need for paying attention to individual differences in fatigue proneness and management strategies. In all, our findings emphasis the need for organisational, data-driven FRM policy. Otherwise it may be difficult to develop employees' own behaviors and operational demands to support on-duty alertness.

Disclosure: Nothing to disclose.

85 | Fatigue proofing: the next generation of fatigue risk management

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Traditionally, fatigue management has focussed on interventions that reduce the likelihood of fatigue by altering the working time arrangement (WTA). While potentially useful, changes to the WTA are often difficult. Operational constraints, labour contracts and employee expectations around overtime and income make changes politically challenging. From a risk-based perspective, risk can be reduced by either decreasing the likelihood of fatigue or by decreasing the consequence of a fatigue-related error. What we have labelled as 'fatigue-proofing'. In this paper we present a series of case studies describing informal protective behaviours that have evolved within workplaces to reduce the consequence of a fatigue-related error. Adopting Helmreich's principles of threat and error management, we demonstrate a novel methodology for eliciting common fatigue-related errors and re-proceduralising the task environment to prevent or attenuate adverse outcomes. This approach holds considerable promise for reducing fatigue-related risk in operational environments where fatigue is unavoidable including defence, emergency services, disaster relief, medical and health care services.

Disclosure: Nothing to disclose.

CARDIOVASCULAR AND OTHER CONSEQUENCES AND SLEEP APNEA

O086 | Risk factors for increased daytime sleepiness in sleep apnea – results from the National Swedish Sleep Apnea Registry

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Objectives/Introduction: Excessive daytime sleepiness (EDS) is one of the key daytime symptoms considered in patients with obstructive sleep apnea (OSA). However, recent research in population based samples has identified OSA phenotypes without EDS, suggesting a referral bias in clinical cohorts. This study aimed to analyze the risk factors for EDS in a national OSA patient cohort.

Methods: Data from an unselected group of 7,008 patients (Swedish Sleep Apnea Registry (SESAR), 20 sleep centers) was used to explore the Epworth Sleepiness Scale (ESS) Score in subgroups of patients defined by OSA measures (apnea hypopnea index (AHI)), anthropometrics, and comorbidities by means of general linear modelling. In a second model, EDS was defined as ESS≥11 and predictors of EDS were determined by logistic regression analysis.

Results: Mean ESS score was 9.5 (95% CI 9.2–9.8) in non-apneic OSA (AHI < 5 n/h) and 10.3 (95% CI 10.1–10.5) in severe OSA (AHI ≥ 30 n/h) ($p < 0.001$). Female gender, AHI, comorbid depression and diabetes were significantly associated with a higher ESS score. In contrast, hypertension and age were associated with lower ESS score (all $p < 0.001$). EDS criteria were fulfilled by 41.9% of OSA patients and independent risk factors included female gender (risk increase +26%), depression (+22%), and severe OSA defined by AHI > 30 n/h (+49%). A hypertension diagnosis (risk −17%) and higher age (risk −17% per 10 years) reduced the probability of a high EDS.

Conclusions: In this national patient cohort, OSA measures, anthropometrics and comorbidities strongly predicted ESS ratings. The ESS score was almost identical in those with and without OSA but severe OSA (AHI ≥ 30 events/h) remained as a risk factor for EDS. Phenotypic criteria suggestive of a lower ESS score were identified. The use of the ESS to identify OSA-related sleepiness may be insufficient, particularly in patients with mild to moderate OSA.

Disclosure: Ludger Grote: Speakers Bureau and/or scientific support from Resmed, Philips, Itamar, and Weinmann.

O087 | Differences in arousal probability and duration after apnea and hypopnea events in adult obstructive sleep apnea patients

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Objectives/Introduction: In obstructive sleep apnea (OSA) breathing cessations are often followed by arousals leading into sleep fragmentation and thus, impaired sleep quality and efficiency. Arousals and fragmented sleep are also related to detrimental cardiovascular events. The key index for OSA diagnosis is apnea-hypopnea index (AHI). AHI attributes equal diagnostic value to both apneas and hypopneas despite the physiological stress they induce may be very different. In this study, we investigate whether the probability and duration of apnea- and hypopnea-related arousals differ and whether the difference in severity of desaturations following apneas and hypopneas is dependent on sleep stage.

Methods: Polysomnographic recordings of 348 OSA patients were included for analysis. Duration of arousals and duration, depth, and area of desaturations related to hypopneas within different sleep stages were compared to those related to apneas. The probabilities of apnea- and hypopnea-related arousals and proportional time spent in different sleep stages were evaluated within different OSA severity categories.

Results: Apneas caused arousals less frequently than hypopneas in N1, N2, and N3 sleep in all OSA severity categories. However, in N1, N2, and REM sleep after adjustment for respiratory event durations, arousals caused by apneas were longer ($p \leq 0.004$) and desaturations related to apneas deeper, longer, and greater in area ($p \leq 0.001$) compared to those related to hypopneas. Also in N3 sleep desaturations related to apneas were deeper and greater in area ($p < 0.001$) compared to desaturations related to hypopneas.

Conclusions: Desaturations and arousals related to apneas are more severe compared to those related to hypopneas albeit hypopneas are more often followed by an arousal (except in REM sleep). Therefore, it would be beneficial to give different diagnostic significance for apneas and hypopneas in general but also while considering whether they are followed by arousal, by desaturation, or by both arousal and desaturation. This could enhance the estimation of true severity of OSA and risk of related severe health consequences.

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O088 | Analysing morphine-induced respiratory depression in obstructive sleep apnoea patients using new technologies: a randomised double-blind placebo-controlled study

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Objectives/Introduction: The effect of morphine on breathing during sleep has been rarely studied, while the gold standard measurement of polysomnography (PSG) is difficult to access and costly. In addition, a commonly used clinical dose of morphine may not cause significant respiratory depression. This study aims to detect and quantify opioid-induced subtle respiratory depression during sleep in obstructive sleep apnoea (OSA) patients using new technologies. Secondly, we aim to test correlations between the new technologies and PSG respiratory depression measures.

Methods: Under a randomised double-blind placebo-controlled crossover design, 60 male OSA patients attended 2 visits to the hospital sleep laboratory, at least 1-week apart. Either a 40 mg controlled-release oral morphine or placebo was administered. Breathing during sleep was measured using standard in-lab PSG. Besides conventional PSG analyses, we performed quantitative respiratory flow analyses-inter-breath interval (IBI) to quantify breathing irregularity. In addition, cardiorespiratory coupling (CPC) was analysed from PSG ECG channel.

Results: Following the consumption of morphine, the 60 OSA patients had significantly less number of breaths ($p = 0.0006$), longer breath interval (mean IBI 4.34 ± 0.52 s vs. 5.02 ± 0.57 s, $p < 0.0001$), and more irregular breaths with significantly increased IBI coefficient of variation (CV) (0.23 ± 0.09 vs. 0.29 ± 0.15, $p = 0.0015$) compared to the placebo night. We tested correlations of the key parameters of the new techniques with six key PSG respiratory depression parameters: apnoea-hypopnoea index, arousal index, oxygen desaturation index, pressure of transcutaneous CO2 (PtcCO2), SpO2 nadir and sleep time spent below SpO2 < 90%. The change of IBI CV significantly correlated with the change of all the six key PSG parameters (all $p < 0.05$). The change of CPC parameters of sleep quality index and two individual band measures also significantly correlated with the change of 5 out of 6 PSG measures (except from PtcCO2) (all $p < 0.05$).

Conclusions: The 40 mg controlled-release morphine resulted in mild respiratory depression with longer breathing cycle and increased breathing irregularity. The significant links between the IBI and CPC techniques and a range of PSG respiratory depression parameters may show clinical potentials for the new techniques as surrogate overnight cardiorespiratory measurements, since both respiratory flow and ECG can be measured by small portable devices.

Disclosure: Nothing to disclose.

O089 | Long-term mortality depending on severity of sleep apnea in patients after acute myocardial infarction

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Objectives/Instruction: Sleep apnea (SA) has a high prevalence in patients after myocardial infarction (MI). While SA might be a modifiable risk factor, recent data suggest that SA is severely underdiagnosed in patients after MI. There is also limited evidence about long-term prognosis of patients after MI according to SA categories. Therefore we sought to determine the relationship between SA and long-term prognosis among patients presenting with MI.

Methods: We prospectively studied 782 consecutive patients admitted to the hospital with the diagnosis of acute MI. The study was conducted in two tertiary care institutions, where primary percutaneous coronary intervention (PCI) is the standard of care in the treatment of acute MI. All subjects underwent sleep evaluations using a portable diagnostic device after at least 48 h post-admission, provided they were in stable condition. Patients were followed for median follow-up of 66 months.

Results: Almost all patients (98%) underwent urgent coronary angiography and 91% of patients underwent primary PCI. 175 (22.4%) patients had technically inadequate limited sleep studies (less than 4 h recording time or inability to score study due to excessive artifact). We therefore analyzed the data from 607 patients who had good quality sleep study records. Using a threshold of AHI ≥ 5 events/h, SA was present in 65.7% of patients after acute myocardial infarction. Mild SA was present in 32.6%, moderate in 20.4% and severe in 12.7%. There was a relation between the severity of SA and long-term prognosis. Patients after MI with increasing severity of SA had higher total mortality ($p = 0.002$, log-rank test). The Kaplan-Meier survival curves are presented. There was also a higher total mortality in reduced than in preserved left ventricular ejection fraction patients after MI (21.7% vs. 10.6%) in the group of moderate to severe SA ($p = 0.033$).

Conclusions: Mortality of patients after MI significantly increased with increasing severity of SA. Whether treatment of SA after MI

will significantly improve outcomes in these patients remains to be determined.

Disclosure: Nothing to disclose.

O090 | Nonfatal and fatal cardiovascular events in continuous positive airway pressure adherent obstructive sleep apnoea syndrome patients – a retrospective observational study

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Objectives/Introduction: Obstructive sleep apnoea syndrome (OSAS), especially moderate-severe disorder, predisposes to nonfatal and fatal cardiovascular disease (CVD) events. The data regarding the impact of continuous positive airway pressure (CPAP) treatment on risk reduction are inconsistent, possibly due to variance in the CPAP compliance. We evaluated whether CPAP reduces the risk of nonfatal and fatal CVD events in CPAP-treated in comparison to OSAS patients who had discontinued the CPAP treatment despite of the doctor's advice.

Methods: Retrospective observational cohort consisted of CPAP-treated and control OSAS patients matched for gender, age and apnoea-hypopnoea index (AHI). Prevalence of CVD and other common cardiovascular risk factors were determined for both groups at baseline. The study endpoint was a composite of nonfatal (primary or secondary) and fatal CVD events. Cox regression model was used to determine the association between CPAP treatment and event-free survival. The model was adjusted to known CVD risk factors.

Results: A total of 2060 patients (75.8% male, mean age 56.0 ± 10.5 years), of which 76.4% had moderate-severe OSAS (AHI ≥ 15 per h), were included. In the CPAP-treated group (N = 1,030), the median use of CPAP was 6.4 h/day during a median follow-up of 8.7 years. The control group (N = 1,030) was followed for a median of 6.2 years after the CPAP treatment had ended (prior use of CPAP 0.7 h/day for 4.0 months on average). The study endpoint occurred in 14.4% (N = 148) of the CPAP-treated and in 18.8% (N = 194) of the control patients (p = 0.006 for the trend). Using the Cox regression model adjusted for gender, age, AHI, body mass index and the history of CVD, hypertension, type 2 diabetes or chronic obstructive pulmonary disease at baseline, CPAP treatment protected against nonfatal and fatal CVD events (hazard ratio 0.64, confidence interval 95% 0.5–0.8, $p < 0.001$).

Conclusions: CPAP treatment associated with a decreased risk of nonfatal and fatal CVD events. The association was demonstrated independent from common cardiovascular risk factors.

Disclosure: Nothing to disclose.

O091 | Arrhythmias and sleep related breathing disorders: data from the European Sleep Apnoea Database (ESADA)

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Objectives/Introduction: Cardiac arrhythmias are presumed to be a common problem in patients with OSA, although their true prevalence and gender related differences remain to be determined. The aim of our study was to estimate the prevalence and risk factors for arrhythmias in a large cohort of patients in the context of European Sleep Apnoea Database (ESADA).

Methods: A multi-centric cohort of 22,169 patients in the ESADA network was evaluated. We estimated the prevalence of cardiac arrhythmias in the whole cohort and separately in four groups: no OSA (AHI < 5), mild (AHI = 5–14), moderate (AHI = 15–29) or severe OSA (AHI ≥ 30). We compared clinical and sleep study variables among the groups.

Results: The prevalence of arrhythmias in the whole cohort was 3.4%, 3.6% among males, 2.8% among females. Patients with arrhythmias were older (61 vs. 52 years), with a similar BMI as compared to the patients without arrhythmias (31.8 vs. 31.5 kg/m^2). Prevalence of arrhythmias was 1.9%, 3.5%, 3.8% and 3.7% (χ^2: p-value <0.001) in patients with no OSA, mild, moderate or severe OSA, respectively. Additionally, the strongest association between arrhythmias and OSA severity was observed in patients under 65 years of age. Interestingly we found peculiar gender differences with a significantly lower prevalence of arrhythmias in females (2.9%) as compared to males (4.2%) in group with moderate OSA (p = 0.032), in particular after 65 years (5.1% vs. 9.0%, p = 0.026).

Conclusions: Arrhythmias were common in the ESADA cohort, and an increased severity of OSA was related to an increased risk of arrhythmias, especially in younger individuals. Moreover, female gender seems to play a protective role towards arrhythmias in particular in moderate OSA. These results confirm that arrhythmias must be considered in the cardiovascular risk assessment of OSA patients and gender related differences can play a significant role in this association.

Disclosure: Nothing to disclose.

O092 | Associations of heart rate variability and sleep apnea with hypertension

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Objectives/Instruction: Cardiovascular (CVD) consequences of obstructive sleep apnea (OSA) may result from sympathetic overactivity related to hypoxia and arousals. OSA during rapid eye movement (REM) sleep has been associated with the development of hypertension. Heart rate variability (HRV), a measure of influence of the autonomic nervous system on the heart is also associated with CVD. This study aimed to examine any interaction of HRV with OSA in the association with hypertension, in a population-based sample of men.

Methods: The population-based Men Androgen Inflammation Lifestyle Environment and Stress (MAILES) Study of men ≥40 years conducted home-based full polysomnography (n = 837, Embletta X100). HRV measures (SDNN, standard deviation of normal-to-normal RR-intervals; RMSSD, root mean-square of successive differences of N-N intervals) were calculated during periods free from scored respiratory events or arousals during non-REM (n = 761) and REM sleep (n = 671). Cases with atrial fibrillation (AF) or frequent ectopic beats were excluded. Multivariable logistic regression models determined associations of hypertension (>140/90 mmHg/medication) with OSA and lowest quartile (Q1) of SDNN or RMSSD [vs. quartiles 2–4, entered in separate models] adjusted for usual factors. Odds ratios (OR) and 95% confidence intervals (CI) are presented.

Results: Hypertension prevalence was 53% (n = 403) and was associated with low non-REM HRV (e.g. RMSSD: 67.4% vs. 50.5% Q2–4; $p < 0.001$) and low REM HRV (RMSSD: 60.8% vs. 49.9% Q2–4; $p = 0.017$) and increasing total, non-REM and REM OSA severity ($p < 0.001$). In adjusted analyses during REM sleep, hypertension was significantly associated with moderate severe REM OSA (OR: 2.2, 1.4–3.1) but not with REM HRV (SDNN Q1: 1.3, 0.9–2.1; RMSSD Q1: 1.3, 0.8–1.9). During non-REM sleep, hypertension was significantly associated with non-REM RMSSD (Q1: 1.7, 1.2–2.6) but not SDNN (Q1: 1.0, 0.7–1.5) and was not associated with moderate-severe non-REM OSA (1.4, 0.95–2.2). Interaction terms in the models were non-significant indicating that HRV did not modify the association of OSA with hypertension.

Conclusions: In REM sleep, REM AHI severity but not HRV was associated with hypertension. However, in non-REM sleep, hypertension was associated with HRV (RMSSD) independently of OSA in men without AF. This may reflect differential effects of OSA across sleep stages on cardiac sympathetic and vagal activity.

Disclosure: Nothing to disclose.

O093 | The predictive value of loop gain measurements in determining continuous positive airway pressure efficacy in patients with obstructive sleep apnea

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Objectives/Introduction: Unstable ventilatory control (high loop gain, LG) is an important physiological trait that contributes to obstructive sleep apnea (OSA). A high LG means relatively high ventilatory response to a given blood gas disturbance, which will persistently destabilize breathing while upper airway mechanical load was partially or entirely eliminated by positive airway pressure therapy. We hypothesized that measures of high loop gain could predict the short-term efficacy of positive airway pressure therapy.

Methods: 42 adult patients with OSA (M/F = 39/9, aged 40 ± 8 years, apnea-hypopnea index, ahi were 68.2 [42.9, 81.0] events/h) were studied. The stability of the ventilatory control system (LG) was quantified by fitting a simplified mathematical model to the spontaneous ventilatory pattern obtained via polysomnography. LG, pulmonary function test results, and other PSG parameters were analyzed in patients who had post-treatment AHI > 10 events/h (non-responders) using auto-positive airway pressure therapy.

Results: Nine patients (34.6%) had post-treatment AHI > 10 events/h (non-responders). Twenty patients (47.6%) had residual AHI < 5 events/h. Loop gain and pre-treatment mixed apnea index were higher in the non-responders versus responders (0.74 [0.62, 0.82] vs. 0.49 [0.37, 0.77], $p = 0.035$) and (11.0 [4.3, 22.9] vs. 2.0 [0.2, 5.3], $p = 0.004$). In the 26 patients with LG>0.6, nine (34.9%) had post-treatment 5 < AHI < 10 events/h. And all of the non-responders had LG (n = 9, 34.9%). The difference were significant between the LG > 0.6 and LG < 0.6 group ($p = 0.007$).

Conclusions: Loop gain and mixed apnea index was higher in patients with residual AHI>10 events/hr after short-term auto-PAP therapy. Ventilatory control stability evaluation might have predictive value for PAP treatment efficacy in OSA patients.

Disclosure: This research was supported by National Key Research & Development Program of China (2017YFC0112500) and Key Research Fund of Beijing Tongren Hospital, Capital Medical University (TRYY-KYJJ-2017-016)

O094 | Psychological distress and depression preceding sleep apnea

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Objectives/Instruction: Depression is more prevalent among sleep apnea patients than normal population and obstructive sleep apnea has been shown to increase the risk of mood disorders. Reversed causality has also been suggested, but no evidence seems to exist. We aimed to examine psychological distress and self-reported diagnosed depression as predictors of sleep apnea.

Methods: The data were drawn from the longitudinal Finnish Public Sector study. The sample comprised of 47,867 current or former public sector employees aged 19–78 years (83% women), who responded to survey questionnaires in 2008–2009 (Time 1) and 2012–2013 (Time 2). At Time 1, Psychological distress was measured with the 12-item version of General Health Questionnaire and depression with self-report of having ever been diagnosed with depression by a doctor. The outcome was self-reported doctor diagnosed sleep apnea between Time 1 and Time 2. The data were analyzed using logistic regression analysis, and the analyses were adjusted for sex, age, socioeconomic status, employment status, chronic somatic diseases, and health behaviors.

Results: During the 4-year follow-up, 743 (1.6%) of the 47,867 participants were diagnosed with sleep apnea. Of all participants, 22% reported psychological distress, 13% depression, and 6% reported both. After full adjustments, psychological distress was associated with 1.40-fold [95% confidence interval (CI) 1.19–1.66, $p < 0.001$] compared with those without psychological distress. The odds ratio for depression was 1.99 (95% CI 1.67–2.37, $p < 0.0001$) compared with those without depression. Participants with both psychological distress and doctor diagnosed depression had a 2.27-fold (95% CI 1.78–2.89, $p < 0.0001$) risk of sleep apnea compared with participants without either.

Conclusions: Results from the current study support the hypothesis that depression may precede sleep apnea. Thus, based on the current and previous findings the association between depression and sleep apnea seems to be bidirectional. However, difficulties in differential diagnosis between depression and sleep apnea limit conclusions on direction of causality.

Disclosure: Nothing to disclose.

O095 | Relationship between risk factors for obstructive sleep apnea and cognitive function in middle-aged and older adults: cross-sectional analysis of the Canadian Longitudinal Study on Aging

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Objectives/Introduction: In obstructive sleep apnea (OSA), obstructed upper respiratory airways cause breathing cessation and daytime sleepiness. The prevalence of OSA (apnea-hypopnea index ≥5) reaches 38% in the adult population and increases with older age. Recent evidence shows that OSA presence and severity contribute to age-related impairments in cognitive function. The STOP-BANG is a validated 8-item questionnaire used to screen OSA patients. It includes questions on sleep habits and other risk factors for OSA. This study determined whether risk factors for OSA, based on the STOP-BANG, are associated with lower cognitive functioning in a large Canadian population-based cohort.

Methods: 30,097 participants aged 45–86 years old included in the Canadian Longitudinal Study on Aging (CLSA) completed health questionnaires, physical examinations and cognitive tests. Participants were included in the analyses if the dataset necessary to compute the STOP subscore (snoring; tiredness; observed apnea; high blood pressure-HBP) was completed. Multivariate linear regressions were used to determine the association between the STOP subscore and cognitive performance, and were adjusted for age, sex, education, depression and body mass index (BMI). Two models were developed for each test: model 1 included the STOP items individually, and model 2 included the STOP subscore (0–4). Significant threshold was set at $p < 0.05$ and a Bonferonni correction was applied.

Results: The STOP subscore was available for 25,563 participants, where 26.0% (N = 6,671) scored ≥2, predicting higher risk for OSA. Regression models showed that the STOP subscore, along with increasing age, increasing BMI, being a male, lower education and depression were associated with worse executive function (STROOP Inhibition condition: all p-values$< 10^{-3}$; adjusted model R^2=0.205). When included individually, only the STOP tiredness and HBP items were associated with worse cognitive abilities. Individual STOP items were also associated with impaired performance on memory and verbal fluency tests (Rey Audio Verbal Learning and Animal Naming Tests).

Conclusions: The presence of OSA risk factors is related to poorer cognitive functioning. The next step is to identify moderating factors, e.g. cardiovascular diseases, psychiatric comorbidities and lifestyle,

that impact the association between OSA risk factors and cognitive decline over time.

Disclosure: Nothing to disclose.

JOINT ESRS – EBRS SYMPOSIUM

96 | Gene expression changes associated with chronic sleep/wake disorders: insights from *Drosophila*

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Introduction: To elucidate the complexity of sleep and wakefulness, it is necessary to take into account not only the neuronal networks and their neurotransmission systems, but also their cellular, genetic and metabolic context. Recently, the "omics" technologies, monitoring the expression of almost every gene and protein within a tissue, have been applied to vigilance states in whole brain or in specific cell types. These strategies have provided a more integrated view of the physiology of the sleep-wake states and have revealed unexpected molecular and cellular pathways, in cell types that extend beyond neurons, such as glial cells.

Objectives: The majority of gene profiling studies so far have focused on temporally limited sleep disruption. While this strategy has many merits, it may miss mechanisms that are associated with chronic sleep disorders, which result in the reorganization of brain networks, particularly when it is associated with neuronal damage such as in narcolepsy, sleep apnea or neurodegeneration. Thus we focused on identifying cellular factors potentially involved in chronic sleep disruption.

Methods: We used gene profiling and transcriptomics in *Drosophila* and mouse models, combined with *Drosophila* molecular genetics for functional gene studies. In *Drosophila*, a short term memory assay was used to assess sensitivity to sleep loss.

Results: We conducted gene profiling studies in mutant flies as well as in wild type flies selected individually for traits revealing life-long resilience or vulnerability to sleep loss. The function of candidate genes showing differential expression in those conditions was investigated by inhibiting or activating them in specific cell types using *Drosophila* molecular genetics. This strategy led us to identify unexpected neuronal and glial factors that can modulate sleep/wake regulation as well as vulnerability to sleep loss. These factors are involved in innate immunity, ubiquitination, and Notch signalling. Gene profiling studies in a mouse model of narcolepsy allowed us to reveal a sleep/wake regulatory role for amino-acid transport in dopaminergic transmission.

Conclusion: These studies identify key molecular and cellular players influencing sleep/wake regulation and vulnerability to sleep loss. Such mechanisms could be involved in the maintenance of vigilance states in chronic sleep disruption.

Disclosure: Nothing to disclose.

RESTLESS LEGS SYNDROME AND DEMENTIA

O097 | Non-dipping pattern in restless legs syndrome

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Objectives/Introduction: The association between restless leg syndrome (RLS) and cardiovascular diseases (CVD) or hypertension remain controversial. Periodic leg movements during sleep (PLMS) found in 80% of RLS patients, are often associated with micro-arousals (PLMA) and repeated night-time increase in blood pressure (BP) and heart rate (HR). Only two studies assessed the relationship between RLS and the non-dipping BP pattern using a 24-h ambulatory BP monitoring (ABPM) with controversial results. The aim of the present study is to assess the 24-h HR and BP profile and endothelial function in patients with primary RLS and controls.

Methods: Eighty-four drug-free patients with primary RLS (53 females, mean age 55.1 ± 12.3 y.o.) and 76 controls (47 females, mean age 52.2 ± 15.3 y.o.) underwent semi structured evaluation, polysomnographic recording, endothelial function assessment and 24-h ABPM. Logistic regression models were used to compare characteristics between the two groups. Mixed models regression were performed to study the evolution of BP and HR over 24 h and the two groups.

Results: Mean age at RLS onset was 40.6 y.o. (±15.8). Moderate and severe to very severe RLS symptoms were reported in 52% and 36% of patients respectively. Controls and patients did not differ for clinicobiological features although a tendency for hyperlipidemia in patients was found ($p = 0.06$). Increased PLMS, PLMA, and sleep fragmentation were found in patients compared to controls. An increased frequency of systolic and mean BP non-dipping pattern (i.e. <10% drop in BP during sleep) were found in patients with RLS compared to controls ($p = 0.04$). Mixed models showed global changes on BP between the different periods, with interactions found between groups and periods for systolic ($p = 0.002$) and diastolic BP ($p = 0.003$), indicating differences in response profiles between groups. However, no between-group differences were found for 24-h, daytime or night-time BP or HR values, or for hypertension according to ABPM or endothelial function in unadjusted and adjusted models.

Conclusions: Patients with primary RLS exhibit a 24-h BP dysregulation with an increased frequency of systolic BP non-dipping than controls. This association may have major clinical consequences related to the increased risk for CVD morbidity and mortality, further requiring both precocious diagnosis and early optimal management.

Disclosure: Invitation to congress UCB pharma, Laidet.

O098 | Stroke-related restless legs syndrome: an anatomo-clinical entity with clues to pathophysiology

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Objectives/Introduction: Restless legs syndrome (RLS) symptomatic of well-defined lesions, such as observed in stroke-related situations is a promising way to further improve our understanding of its pathophysiology.

Methods: Sixteen patients with stroke-related RLS were included in this monocentric observational study. Structural imaging using brain MRI was performed in all patients for neuroanatomical analysis. In 11 patients stroke-induced metabolic modifications were assessed by isotopic explorations of both glucose consumption using ^{18}F-FDG PET and nigrostriatal dopamine terminal functioning. PET with ^{18}F-FDOPA evaluated the functional integrity of the presynaptic dopaminergic synthesis and dopamine reuptake was explored using ^{123}I-FP-CIT SPECT.

Results: Eight patients presented RLS symptomatic of a lenticulostriate infarct. The body of the caudate nucleus was the common anatomical structure affected in 6 of them. In all patients with lenticulostriate infarct, isotopic explorations showed increased ^{18}F-FDOPA uptake in the ipsilateral putamen associated with decreased dopamine transporter binding. Seven patients had stroke-related RLS due to brainstem infarction affecting the anterior part of the pons in 6 and the medulla oblongata in one. Metabolic imaging for dopamine was performed in two of them, none showed any abnormalities. Solely one patient presented stroke involving the vermis of the cerebellum and the left occipital lobe. Isotopic explorations regarding his dopaminergic system were normal. Unilateral or asymmetric RLS contralateral to the lesion was found in 3 patients, all other patients had bilateral and symmetric RLS symptoms. In 12 patients RLS appeared *de novo* and 4 had clear exacerbation of RLS present prior to stroke. Post-stroke RLS was most common; nevertheless RLS preceded stroke symptoms in two patients with a clear temporal relationship. Therefore, we suggest that the term of stroke-related RLS is more accurate than that of post-stroke RLS.

Conclusions: Stroke-related RLS seems to affect mainly patients with infarction in the territories of the middle cerebral artery and the perforating branches of the basilar artery. Further prospective studies with a systematic stroke-related RLS screening are needed to better determine predisposing factors and frequency. Given its poor literature, stroke-related RLS is a probably underdiagnosed anatomo-clinical entity. Clinicians should be aware of this condition, especially as efficient treatments are available.

Disclosure: Nothing to disclose.

O099 | Sleep-wake fragmentation is linked to amyloid beta brain deposition in healthy ageing

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Objectives/Introduction: Animal and human studies reported that Alzheimer's disease (AD) pathophysiology and sleep-wake regulation are strongly associated. The extent of this link remains to be fully characterized. For instance, the fragmentation of sleep and wakefulness states has been related to the risk of developing AD. The objective of the present study was to explore whether sleep-wake fragmentation is associated with Amyloid β (Aβ) and Tau brain burden, two key proteins for AD, in healthy ageing. We also investigated how these AD biomarkers are related to subjective sleep quality.

Methods: Thirty-seven healthy and cognitively normal late middle-aged participants (51–69 y.o.; mean 59 ± 5; 13 males) were included in our study. Intradaily variability was calculated using data obtained from 14 days wrist actigraphy. Subjective sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI). Aβ total brain deposition was assessed using 18F-flutemetamol radiotracer Positron Emission Tomography (PET) scan. Total brain Tau level was assessed using 18F-THK-5351 radiotracer PET scan.

Results: General linear mixed models, controlling for sex and age, revealed that intradaily variability is significantly associated with the interaction between whole brain Aβ burden and education (p = 0.04) and with whole brain Aβ burden (p = 0.02) and education (p = 0.04) alone, but not with whole brain Tau level (p = 0.54). Further analyses, controlling for sex and age, showed that PSQI scores were significantly associated both with whole brain 18F-flutemetamol uptake (p = 0.01), and with whole brain 18F-THK-5351 uptake (p = 0.01), both in interaction with education ($p < 0.01$).

Conclusions: These preliminary results confirm that sleep-wake fragmentation is associated with AD pathophysiology. They show that it is related to Aβ brain accumulation, one of the hallmarks of AD pathophysiology. In addition, subjective perception of sleep quality appears to be associated with both Aβ and Tau burden. This warrants further investigations of the respective roles of both Aβ and Tau proteins in age-related changes in sleep-wake regulation.

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O100 | EEG functional connectivity during REM sleep: a marker of cognitive status?

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Objectives/Introduction: Changes in the basal forebrain cholinergic system (BFCS) represent the most salient and earliest biochemical changes in Alzheimer's disease, and can be seen even in patients with mild cognitive impairment (MCI). During wakefulness, decreased EEG coherence in the alpha frequency band (Co-alpha) was reported to be related to the extent of cholinergic deficits in MCI patients. Cortical activation during Rapid-Eye-Movement (REM) sleep relies upon the BFCS to a far greater extent than activation during wakefulness. Accordingly, we compared Co-alpha during wakefulness and REM sleep in patients with MCI and in cognitively healthy controls (HC).

Methods: Thirty-two subjects with MCI (22 M; mean age 64 ± 6.1 years) and thirty-two HC (22 M; mean age 63.7 ± 6.6 years) underwent a neuropsychological assessment, a night of polysomnography and a resting-state EEG recording with 14 EEG electrodes. EEG Co-alpha was assessed using imaginary coherence computed on manually selected artefact-free epochs in both REM sleep and resting wakefulness. Differences in connectivity between REM sleep and wakefulness were assessed with a Welch's t-stat. A non-parametric test on the max-stat and a permutation resampling allowed to account for multiple comparisons (between pairs of electrodes) in a false discovery rate like thresholding ($p < 0.04$).

Results: During wakefulness, MCI patients showed lower Co-alpha on the frontal interhemispheric axis, compared to HC ($p < 0.04$). During REM sleep, both groups showed a global Co-alpha decrease compared to wakefulness ($p < 0.04$), but this reduction was less prominent in MCI patients. Hence, MCI patients showed higher Co-alpha on the left antero-posterior and interhemispheric axes during REM sleep than did HC ($p < 0.04$).

Conclusions: Our results corroborate previous reports of lower Co-alpha in MCI patients relative to HC during wakefulness. Compared to HC, MCI patients show a reduced capability to decrease functional connectivity in the alpha frequencies during REM sleep with respect to wakefulness. Insofar as the cholinergic projections from the BFCS to the cerebral cortex constitute an important substratum of alpha rhythms, observed changes within this band during REM sleep might mirror neurodegenerative process. Future research is required to further characterize the relationship between EEG functional connectivity and cholinergic denervation during REM sleep.

Disclosure: Nothing to disclose.

O101 | Serotine melatonin timing secretion in real life conditions in Alzheimer patients of mild to moderate severity

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Objectives/Instruction: The study focused on serotine melatonin secretion with calculation of dim light melatonin onset (DLMO) and AUC after DLMO in AD patients.

Methods: Twenty-one patients (11 males; 74.14 ± 5.4 years) with a diagnosis of AD according to McKhann criteria (2011), mean disease duration of 3.4 ± 1.6 years, were consecutively enrolled. Twenty-one healthy subjects comparable for age and sex served as controls (HC). Subjective sleep parameters were calculated. DLMO (set at 3 pg/ml) and quantitative aspects of the initial nocturnal melatonin secretion were calculated by means of a five- point melatonin salivary test. The sample size was determined using the "Open Source Epidemiologic Statistics for Public Health". Categorical variables were submitted to cross-tabulation and statistical significance was evaluated using the chi-square test or Fisher's exact test. Continuous variables were expressed as mean values ± sd. Differences between groups were tested with ANOVA (analysis of variance) followed by a post hoc Bonferroni test. The level of significance was set at 0.05.

Results: The percentage of PSQI score above 5 did not differ between patients and controls (AD: 38.1%, HC: 29.4%, $p = 0.57$) and neither did the mean PSQI score (AD: 6.24 ± 5.4, HC: 4.47 ± 3.0, $p = 0.24$).The mean MEQ score was comparable in the AD patients and HC ($p = 0.12$). Mid sleep values fell within the normal range of values of same age Caucasian general population, in both AD and HC. The mean DLMO time in AD patients occurred significantly later respect to controls (55 min; $p = 0.028$). Melatonin secretion after DLMO as measured by AUC was significantly lower in AD patients ($p < 0.001$). The linear regression analysis showed that DLMO patterns of secretion are independent from age and sex, while they are statistically related to AD diagnosis ($p = 0.038$).

Conclusions: Our data show that DLMO delay and decreased melatonin secretion may occur early in AD patients who have not developed overt sleep disorders yet.

Disclosure: Nothing to disclose.

RHYTHMS OF (UN)HEALTHY SLEEP: UNDERSTANDING AND MODULATION OF MULTI-SYSTEM OSCILLATIONS

102 | EEG correlates of multi-system oscillations: from visual identification to the analysis of complexity

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Since the first polysomnographic sleep recordings in the '60s and '70s, it appeared clear that during sleep, and especially during non-REM sleep, the EEG tends to show an oscillatory pattern with an alternation between higher and lower amplitudes, involving, in particular, slow waves (approximately 0.5–2.5 Hz) and higher frequencies, in the alpha and beta range. This oscillatory pattern is synchronized with oscillations in a variety of other recordable activities, including physiological (heart rate) and pathological phenomena (periodic leg movements, bruxism, sleep apnea). Interestingly, topographic mapping of the slow wave activity during these oscillations shows a mostly anterior (frontal) origin while faster activities (alpha) are generated over the parietal-occipital areas. Taken all together, these data show the importance of connectivity for the complex synchronization between the different underlying structures, which was shown to be characterized by nonlinear dynamics, rather than by simple oscillatory phenomena. This implies that these oscillations arise as the results of the complex nonlinear interaction between the different generators, which are able to oscillate by themselves even when pharmacologically or anatomically disconnected from each other, but also tend to synchronize when connected together. The analysis of the complexity of these oscillations has shown that during sleep high-amplitude slow-wave transients, the EEG signals tends to assume a low-complexity state, in conjunction with a functional connectivity organization carrying the signatures of the so-called "small-world networks".

Disclosure: Nothing to disclose.

103 | Autonomic background of multi-system oscillations: from humans to model organisms

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The power spectrum of the electroencephalogram (EEG) in different frequency bands, the occurrence of arousals, limb movements, epileptic discharges, and apneas have a loosely periodic structure and tend to synchronize together with oscillations of the autonomic nervous system during sleep. As a result, multi-system oscillations during sleep impact on heart rate and arterial blood pressure, with a potential role as a risk factor for cardiovascular disease. The mechanisms of this autonomic background of multi-system oscillations at system, organ, and cellular levels are still insufficiently understood despite their potential practical relevance. Greater mechanistic understanding is being provided by technical advancements that make it feasible to record multiple polysomnographic signals during sleep in freely-behaving small animals such as mice. These signals include: multiple EEG derivations and the electromyogram (EMG) of proximal (neck) and distal (e.g., tibialis anterior) muscles recorded with implantable miniature electrodes; breathing recorded with whole-body plethysmography; and heart rate and blood pressure recorded with implanted telemetric devices. The main challenges are to co-record multiple polysomnographic signals without perturbing sleep in small animals, to develop mathematical tools balancing complexity and interpretability for the analysis of complex autonomic-somatic interactions, and to explicitly test the translation of results from clinical studies to basic research and back.

Disclosure: Nothing to disclose.

104 | The interplay between sleep bruxism, arousals and breathing or period movement related events

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Sleep bruxism (SB), characterized by tooth grinding and sustained jaw muscle activity, is a repetitive motor activity. It presence during sleep is estimated by a biomarker, rhythmic masticatory muscle activity (RMMA). The role of such natural activity is debated from a physiological reactivity to autonomic cardiac and respiratory adjustments. SB-RMMA are highly prevalent in child; incidence drop with age. During sleep of young and healthy subject, most RMMA are associated with sleep arousals, with the A3 arousal phase of the Cyclic Alternating Pattern (CAP). Clonidine, an alpha 2 adrenergic agonist, reduce the autonomic activation and the frequency of RMMA. The occurrence of SB is dominant in light sleep and in the minutes before REM sleep. In some individuals, RMMA may be associated with some breathing events, either preceding or following RMMA. Then the putative association of RMMA to apnea is debate, i.e., probably coincidental and not a cause of SB. Furthermore, the timing of RMMA and period limb movement (PLM) is frequent with sleep arousals but its prevalence is also age dependent. SB and RMMA frequent in young subjects and PLM is more dominant with aging.

Disclosure: Nothing to disclose.

PARASOMNIAS

O105 | Negative stress coping is associated with structural integrity of posterior cingulate cortex in sleep walking

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Objectives/Introduction: Subjects with mood or anxiety disorders are thought to be at higher risk for a non-rapid eye movement (NREM) parasomnia. Studies that investigated the psychological features below the threshold of a psychiatric disorder are rare. Moreover, the neurobiological underpinnings of this disorder remain largely unknown. Recently, gray matter abnormalities in the left posterior midcingulate (MCC) and dorsal posterior cingulate cortex (dPCC) have been suggested as a neuroanatomical substrate of NREM parasomnia. Aim of the current study was to further investigate personality structure and, more specifically, stress coping skills in relation to posterior cingulate structural integrity in patients with NREM parasomnia.

Methods: Standardized questionnaires of personality and stress coping skills were administered in 15 drug-free and polysomnography-confirmed adult patients with NREM parasomnia and 15 age and gender matched healthy controls. 3 Tesla T1-weighted magnetic resonance imaging data of the patients were analyzed with voxel-based morphometry.

Results: In the Freiburg Personality Inventory FPI-R patients with NREM parasomnia showed significant higher extraversion ($p = 0.03$) and neuroticism ($p < 0.01$) compared to controls. Moreover, higher behavioral inhibition trait ($p < 0.04$) as assessed by the Reinforcement Sensitivity Theory of Personality Questionnaire and higher negative stress coping trait ($p < 0.01$) using the Stress Coping Questionnaire SVF 120 were found. Increased adjusted posterior cingulate volume predicted pronounced negative stress coping tendencies ($r = 0.67$; $p < 0.01$).

Conclusions: Results indicate a personality structure with emotionality, avoidance tendency and negative stress coping in patients with NREM parasomnia that is partly related to an increased PCC volume. This is congruent to the assumption in Gray's influential personality theory that the PCC is part of the brain's behavioral inhibition system. The findings add support to the idea that NREM parasomnia, PCC gray matter abnormality and negative coping strategies such as flight, resignation and social withdrawal are all part of a common pathophysiology.

Disclosure: MR, AU, PY, CS and AH claim that there is no conflict of interest concerning the contents of this abstract.

O106 | Topographical spectral power changes associated with NREM parasomnia episodes – a high-density EEG study

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Objectives/Introduction: Arousal disorders are NREM parasomnias characterized by incomplete awakenings from slow wave sleep (SWS) and abnormal behavior. Previous work suggested that parasomnia episodes (PE) display features of both sleep and wake in different brain areas. However, these observations are based on single episodes/patients and techniques that are not widely available (SPECT, intracranial recordings). Here we asked whether we could identify consistent changes in brain activity associated with PE using high-density (hd)-EEG

Methods: Six subjects (4F, age 24.3 ± 5.3, 18–33) presenting NREM parasomnia episodes (sleepwalking, confusional arousals or night terrors) at least 1×/week underwent a baseline and a second sleep recording after 24 h total sleep deprivation (hd-EEG with 256 electrodes). During the latter, acoustic stimulations were administered to provoke PE. Selected EEG segments corresponding to PE were cleaned from artifacts using independent component analysis. Channels with artifacts were removed and interpolated. Topographical spectral power (2–35 Hz) of PE was compared with SWS (60 s preceding each episode) and daytime wakefulness (20 s with eyes open) using paired *t*-tests. A cluster- and probability based correction for multiple comparisons was applied.

Results: 26 clear-cut PE in 6 subjects were recorded (confusional arousals and night terrors). Compared to SWS, PE were characterized by significantly lower delta (2–4 Hz) and higher beta power (18–30 Hz) in a centro-frontal region ($p < 0.05$). With respect to wakefulness, this area showed significantly increased delta activity during PE ($p < 0.05$). Alpha power was also significantly increased in temporal regions ($p < 0.05$) during PE. No significant differences were found for other frequency bands.

Conclusions: Our results suggest that it is possible to use hd-EEG recordings to study regional brain activity during behavioral episodes. EEG during episodes displays both features of wake (increased high-frequency activity with respect to sleep) and sleep (increased low-frequency activity with respect to wake). The most consistent changes were restricted to a circumscribed fronto-central brain region, which is known to receive major projections from arousal related structures.

Disclosure: Nothing to disclose.

O107 | Regional patterns of neuronal activity in REM sleep behavior disorder using high-density EEG

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Objectives/Introduction: Rapid eye movement (REM) sleep behavior disorder (RBD) is a sleep disorder characterized by REM sleep abnormalities, such as loss of muscle atonia and enactments of complex motor behaviors emerging from phasic REM sleep. To verify the hypothesis that regional distribution of neuronal activity is impaired in RBD, we performed quantitative analyses of sleep and wake, using high-density electroencephalography (hdEEG).

Methods: HdEEG recordings (256 channels), coupled with traditional sleep polysomnography, were obtained in 9 idiopathic RBD patients and 9 age- and gender-matched healthy subjects (50 ± 10 years old, 66.7% male). Epochs of steady stage of N2/N3 sleep, REM sleep and wake were extracted. EEG data was filtered from 1–40 Hz and average-referenced. Tonic REM sleep was separated from phasic REM sleep based on the absence/presence of REMs. Independent component analysis was applied to remove physiological noise. Absolute and subject-normalized (Z scores) power densities for each frequency bands (delta/theta/alpha/low beta/beta/gamma) were compared using unpaired two-sample t-tests between the two populations and in each state. Tests were thresholded at corrected $p < 0.05$ using nonparametric threshold-free cluster enhancement.

Results: In wake, RBD patients displayed reduced normalized delta activity in frontal regions compared to controls. In NREM sleep, compared to controls, RBD patients showed decreased absolute theta power over centro-parietal regions as well as reduced normalized gamma and alpha activity in centro-occipital regions. In REM sleep, compared to controls, RBD patients showed a trend for reduced global theta power and low beta activity in centro-occipital regions. Compared to tonic REM, phasic REM was characterized by increased delta/theta power in frontal and central regions and decreased alpha power in occipital regions, with greater visible difference in controls compared to patients.

Conclusions: Our findings suggest that decreased theta power during N2/N3 sleep in scalp regions overlaying motor cortex, and conceivably blunted differentiation between tonic and phasic REM sleep, might predispose RBD patients to motor behaviors during sleep. We also confirmed previously described reduction in absolute alpha - beta power in RBD patients during both wake and REM sleep. Future analyses using source localization reconstruction may help to identify cortical origins that are the sources of observed differences.

Disclosure: Nothing to disclose.

O108 | Actigraphic differences in the rapid eye movement sleep behavior disorder patients

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Objectives/Instruction: The patients suffering of the rapid eye movement sleep behavior disorder (RBD) are in high risk of developing a neurodegenerative disorder, most frequently from the group of alpha-synucleinopathies, such as Parkinson′s disease (PD) or multiple system atrophy (MSA). The definitive diagnosis of RBD is based on polysomnographic investigation. Actigraphy is much easier to perform adn reflects condition in patients home environment. The aim of this study was to find suitable biomarkers for RBD, which can be detectable by actigraphic recording.

Methods: High resolution actigraphic recording (MotionWatch, CamNtech ltd.) for all four extremities were performed along with polysomnographic recording in 37 RBD patients and 46 patients with other sleep diagnoses. Each individual file was analysed be software testing for amount of sleep (MotionWare 1.1.20) and secondly for periodic motor activity (PLMS analysis 1.0.16). The 10-item patient self-rating questionnaire (maximum total score 13 points) translated to Czech language was also used for screening purposes. We used an RBDSQ score of five points as a positive test result as suggested by the original publication of the scale.

Results: When using the actigraphic sleep detection, we found significant differences related to sleep fragmentation, more prominent in the recording from the non-dominant hand. Most notable was increased percentage of immobile bouts (45.3% vs. 28.4%, $p < 0.00001$), increased fragmentation index (69.1 vs. 41.6, $p < 0.00001$) and decreased sleep efficiency (75.6% vs. 86.3%, $p = 0.0004$). When analysing periodic motor activity, we also found more movements on upper extremities in RBD patients ($p = 0.006$) and surprisingly also more periodic hand movements ($p = 0.0006$). On the other hand, differences on lower extremities using either measurement were not significant. The discrimination function based on RBDSQ and short immobile bouts could allocated correctly the RBD status in 75.0% of cases with Wilks Lambda 0.71 and $p = 0.0002$.

Conclusions: Actigraphic recording from upper extremities show consistently more prominent sleep fragmentation in RBD patients compared to other sleep diagnoses. We suggest also usefulness of actigraphy in broader screening for RBD.

Disclosure: Supported by Grant of the Czech ministry of Health - AZV 16-28914A.

O109 | Efficacy of prolonged release melatonin for REM sleep behaviour disorder in Parkinson's disease: a double blind, randomised, placebo-controlled trial

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Objectives/Instruction: Half of all Parkinson's disease (PD) patients experience REM behaviour disorder (RBD) with dream enactment, which can be frequently injurious. Currently, melatonin and clonazepam are the most recommended treatments for RBD. However, current recommendations are based on poor evidence from case-reports and small case series. Thus, there is a need for high quality evidence from randomized clinical trials to inform the guidelines. We aimed to test the efficacy of prolonged-released melatonin for RBD in Parkinson's disease.

Methods: A phase-II, randomised, double blind, placebo-controlled, parallel group trial with an 8-week intervention period and 4 weeks of observation before and after the intervention. 30 PD patients with RBD were randomized into one of two arms (1:1) to receive 4 mg prolonged released melatonin (Circadin) or matched placebo (lactose monohydrate) ingested orally once daily within 1 h of bedtime. The efficacy of melatonin was assessed as the difference in the mean total number of RBD events as captured by the "weekly CIRUS-RBD questionnaire", which measures the frequency and severity of RBD symptoms using daily entries. The primary outcome was the aggregate of all incidents measured within weeks 5 to 8 of treatment compared to the 4 weeks prior to treatment.

Results: One participant dropped out after moving overseas and one participant with idiopathic RBD was mistakenly randomized as being diagnosed with PD at study inclusion. All data obtained were included in the mixed model analysis of variance (SAS 9.4). Adverse events were mild and included headaches, mild fatigue and morning sleepiness, (n = 4 in treatment and n = 5 on placebo). The dosage of one participant in the treatment arm had to be reduced to 2 mg daily for 4 weeks during treatment due to light-headedness and fatigue in the morning, as per protocol. The primary outcome analysis revealed no significant reduction in RBD events per week between groups within weeks 5 to 8 of the protocol (3.6 events in the melatonin group vs. 3.4 in the placebo group; difference 0.2 events/week; 95% CI = −3.2 to 3.6 events; p = 0.91).

Conclusions: Eight weeks of prolonged released melatonin did not alleviate self-reported RBD event rates in patients with RBD+Parkinson's disease.

Disclosure: Investigational product and matched placebo were provided to the investigators free of charge by the manufacturer for this trial

JOINT SYMPOSIUM ESRS – ERS INTERACTION BETWEEN SLEEP AND OBSTRUCTIVE AIRWAY DISEASE: A COCKTAIL PARTY

110 | Sleep disorders in COPD: etiology and consequences

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Sleep quality is typically poor in COPD with diminished amounts of rapid-eye-movement (REM) and slow-wave sleep, which may contribute to the daytime fatigue frequently reported by these patients, and may also contribute to reduced survival. Sleep impairment in COPD is linked to worse pulmonary function and lower daytime activity levels and lung hyperinflation also appears to relate to poor sleep quality in COPD patients. Furthermore, normal physiological respiratory adaptations that occur during sleep are frequently amplified in COPD patients, resulting in clinically significant disturbances in gas exchange, especially during REM sleep. These adaptations include diminished respiratory drive, reduced skeletal muscle activity that is particularly relevant to accessory muscle contraction, and changes in lung mechanics such as reduced functional residual capacity that adversely affect ventilation-perfusion relationships. These physiological adaptations do not produce clinically significant changes in gas exchange in normal subjects but may result in major oxygen desaturation in patients with COPD, which may result in serious clinical consequences including an increased risk of death at night during acute exacerbations, especially in hypercapnic patients.

Disclosure: Nothing to disclose.

THE DIFFERENT ENIGMATIC FACES OF REM SLEEP BEHAVIOR DISORDER

111 | Does isolated REM sleep behavior disorder exist? Lesson learned from the longstanding non-convertors

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An important proportion of individuals initially diagnosed with the isolated form of RBD (iRBD) eventually develop an overt neurodegenerative disease, particularly the α-synucleinopathies Parkinson disease (PD), dementia with Lewy bodies, and less frequently multiple system atrophy. Thus, it has become clear that iRBD represents a prodromal stage of the α-synucleinopathies in most, if not all, cases. However, some patients do not develop an α-synucleinopathy

10 years or more after the diagnosis of iRBD (longstanding non-convertor). It can be hypothesized, that these subgroup of patients is not at risk of developing an α-synucleinopathy. A recent study by the Sleep Innsbruck Barcelona (SINBAR) group investigated 20 longstanding non-cnvertors (mean follow-up 12.1 ± 2.6 years) and 32 matched controls, showing that objective smell loss, constipation, and mild parkinsonian signs were more frequent in iRBD patients than controls. Interestingly, dopamine transporter imaging showed decreased striatal uptake in 82.4% of the patients. All 20 patients showed clinical, neuroimaging, or histologic markers of PD, suggesting that they are affected by an underlying neurodegenerative process. These results have been later on confirmed in a cohort of eleven iRBD patients by the Montreal group. In this cohort, differences in progression speed, i.e. the annual increase in prodromal PD probability, have been reported. Patients with IRBD are obvious candidates for future disease-modifying trials. Some markers, like smell function and DAT-SCAN, have been reported to predict short-term conversion to overt α-synucleinopathy. However, an important proportion of longstanding iRBD patients presents these markers of short-term conversion. It can be speculated that iRBD patients who remain disease-free after a long period of follow-up might constitute a separate disease subtype, maybe associated with specific environmental or genetic factors. This needs to be defined and characterized in further studies. Studies on long-term non-convertors showed that the isolated form of RBD probably does not exist, and that all these patients are in a prodromal stage of PD. These data emphasize the difficulty in defining the ideal IRBD group to be recruited for disease modification trials. Identifying the modulators of latency to phenoconversion and exploring mechanisms for variable progression rates in IRBD is a critical research priority.

Disclosure: Ambra Stefani received research funding and honoraria for consulting from Axovant, travel support from Habel Medizintechnik and UCB.

112 | How to design a neuroprotective trial for idiopathic rem sleep behavior disorder

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REM sleep behavior disorder (RBD) is characterized by abnormal motor behaviors and vocalizations (e.g., jerking, kicking, shouting, crying, laughing) and nightmares (e.g., being attacked or chased by people or animals) linked to REM sleep without atonia. The idiopathic for of RBD (IRBD) is neither associated with cognitive complains nor parkinsonism. IRBD is the most specific predictor of the prodromal stage of Parkinson disease (PD) because (1) longitudinal studies conducted in sleep centers have shown that most patients diagnosed with IRBD eventually develop PD or related synucleinopathies (dementia with Lewy bodies and much less frequently multiple system atrophy), (2) IRBD patients show clinical and subclinical abnormalities that are characteristic of PD including subtle parkinsonian signs, asymptomatic cognitive deficits, hyposmia, constipation, depression and abnormal neuroimaging of the nigrostriatal system (e.g, hyperechogenicity of the substantia nigra, decreased dopamine transporter uptake in the putamen), and (3) in vivo examination of subjects with IRBD demonstrates alpha-synuclein aggregates in peripheral tissues such as the colon, the submandibular gland, the parotid gland, the minor salivary glands of the lips and the skin. This indicates that IRBD may be a good candidate to test disease-modifying interventions to stop the ongoing neurodegenerative process in prodromal PD. This talk will address how to design a clinical trial in patients with IRBD taking into account aspects such as

1) the duration of the trial,
2) the sample size,
3) the need for a placebo control,
4) the primary end point,
5) the secondary end point, and
6) the selection of the drug.

Disclosure: Nothing to disclose.

113 | Why do not all patients with Parkinson disease have RBD?

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Parkinson's disease (PD) is a widely heterogeneous disorder characterized by a variety of motor and nonmotor manifestations including REM sleep behaviour disorder (RBD). RBD is considered a harbinger of an evolving α-synucleinopathy, up to 81% of the patients converts to an overt neurodegenerative disease over 16 years. However, RBD prevalence in PD patients hardly reaches 40%, with many of them developing RBD after motor symptoms onset. This intriguing association can be discussed from both clinical and pathological points of view. Tremor-dominant PD patients show a lower prevalence of RBD, while RBD is frequently associated with an akinetic/rigid motor subtype. It has been observed that RBD is accompanied by more severe autonomic dysfunction and cognitive impairment. RBD presence in PD seems to affect also the prognosis, as recently confirmed by a prospective cluster analysis. RBD alongside two other nonmotor features of PD (mild cognitive impairment and orthostatic hypotension) is one of the main determinants of a "diffuse malignant" subtype of PD. In contrast, the "mainly motor-slow progression" subtype is usually spared by RBD. Braak's pathological staging model of PD progression suggests that RBD should appear as early as in stage 2 of the disease. However, some patients reach the advanced stages of PD without having never experienced RBD. Spreading models, although conceptually true, could be interpreted in the light of different spreading patterns, rather than different times of

progression. In fact, patients without RBD present with less density and range of synuclein aggregation at brain autopsy. This could explain the differences in clinical subtypes and prognosis. In conclusion, evidence has slowly been moving researchers' attention from "why do PD patients have RBD?" to "why does not everyone with PD have RBD?" correlating RBD absence with a better prognosis. The answers to these questions can only be investigated into a broader prospective considering not only the presence or absence of sleep disorders, but also the whole clinical, instrumental and pathological spectrum characterising PD.

Disclosure: Nothing to disclose.

114 | The universal presence of RBD in autoimmune/neurodegenerative disorders: the anti-IgLON5 disease

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The evidence that REM sleep behaviour disorder (RBD) plays a key role in the development of alpha synucleinopathies is scientifically undisputed. Isolated RBD's actuating variable is accordingly an early marker of neurodegeneration. This is reflected in the high risk (>80%) of RBD to convert into Parkinson's disease (PD), Dementia with Lewy Bodies (DLB) or Multiple System Atrophy (MSA) within a decade or longer. Beside this, RBD is occasionally applied as symptom in the diagnosis of diseases such as immune mediated sleep disorders. Different autoantibodies including paraneoplastic antibodies are associated to these. RBD was described in encephalitis with antibodies against CASPR2, Ma2 and LGI1 but also in anti-IgLON-5 disease. The anti-IgLON-5 disease is an antibody associated novel neurological disorder. It was first characterized in 8 patients in 2014 by Sabater et al. This newly discovered disorder recaps a complex neurological disorder with sleep, movement, neuroimmunological and neurodegenerative aspects. It is characterised by parasomnia involving NREM and REM sleep, insomnia, and hypersomnolence. Beside this, sleep disordered breathing with stridor is often observed. Other neurological symptoms involving gait instability, bulbar, oculomotor and autonomic symptoms, and cognitive impairment can be present. Till today 4 different syndromes according to the predominant symptom of Anti-IgLON5 disease are described:

1 Sleep Disorder,
2 Bulbar Syndrome,
3 PSP like Syndrome,
4 Cognitive Impairment.

It is associated with IgG4 antibodies to IgLON5, a neuronal surface cell adhesion molecule. Neuropathological examination showed neuronal loss and gliosis associated with an atypical tauopathy mainly involving the tegmentum of brainstem and hypothalamus. REM sleep behaviour disorder was found in the majority of the described patients and tended to be mild.This presentation gives an overview of the current knowledge of the anti-IgLON-5 disease and the role of REM- behaviour disorder in this recently described complex neurological disorder.

Disclosure: Anna Heidbreder received honoraria for lecturing from UCB, Bioprojet, Servier, and Vanda.

INSOMNIA DISORDER

O115 | Feeling awake while asleep: a high-density EEG assessment of sleep perception

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Objectives/Introduction: The impression of being awake despite polysomnographically documented sleep is sometimes observed in healthy individuals and to an extreme degree in patients with paradoxical insomnia. The mechanisms underlying the subjective perception of sleep are not well understood. Here we asked whether high-density (hd)-EEG, a technique with a refined spatial resolution, could identify local patterns of brain activity related to the subjective perception of sleep.

Methods: 14 healthy subjects (age 33.6 ± 8.5 years, 10 females) underwent a serial awakening paradigm in the sleep lab while recorded with hd-EEG (256 electrodes). 969 awakenings were performed across all sleep stages. At each awakening, subjects were asked to describe what was going through their mind and to estimate if immediately prior to the awakening they had been asleep or awake.

Results: 10 of 14 subjects presented at least one instance in which they reported feeling awake (FAW) during sleep (15.92 ± 8.76% times per subject, total of n = 99 times). 70.83% of FAW instances occurred in N1, 18.77% in N3, 9.79% in N2 and 3.57% in REM sleep. Only stages N2 and N3 were further considered for analysis. Compared to when subjects reported feeling asleep (FAS), FAW instances occurred earlier in the night (147 ± 79 min after lights off vs 231 ± 25 min; p = 0.0038). The presence of conscious experiences during sleep did not distinguish FAW from FAS, but experiences associated with FAW tended to be more thought-like and less perceptual compared to FAS (Score: 0.52 ± 1.17 for FAS; −1.00 ± 1.84 for FAW; p = 0.076). FAW was associated with increased alpha (8–12 Hz) and sigma power (12–16 Hz) in central and posterior brain regions in the 20 s before the awakening. No significant differences were observed for other frequency bands.

Conclusions: The preferential occurrence of FAW early in the night (N3 > N2), its quasi-absence during REM sleep and its

association with increased alpha power in posterior (sensory) brain regions may indicate that the subjective perception of sleep depends on the degree of sleep-related environmental disconnection.

Disclosure: Nothing to disclose.

O116 | Insomnia with objective short sleep duration is associated with cardiometabolic, cardiovascular and cerebrovascular disease risk

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Objectives/Introduction: Insomnia with objective short sleep duration has been previously associated with cardiometabolic risk factors (CMR); however, there is a key gap on data regarding the presence of an increased risk of cardiovascular (CVD) or cerebrovascular (CBVD) disease in insomnia with objective short sleep duration.

Methods: We examined this question in the Penn State Adult Cohort (N = 1,741, 52.2% women, 48.8 ± 13.6 years). The presence of CVD was defined as a history of heart disease (n = 219) and that of CBVD as a history of stroke (n = 40), while the presence of CMR was defined as a history of hypertension and/or type 2 diabetes (n = 877). The presence of sleep difficulty was defined based on 3-levels of severity of normal sleep (n = 1022), poor sleep (n = 520) and chronic insomnia (n = 199). Given the small number of CBVD cases and similar distribution of CVD among poor sleep and chronic insomnia, our primary outcome was the presence of CVD/CBVD (n = 259) and our primary exposure the presence of poor sleep or chronic insomnia (n = 719). Objective short sleep duration was defined as <6 h based on in-lab polysomnography.

Results: A significant interaction indicated that objective short sleep duration modified the association of insomnia with CMR and CVD/CBVD ($p < 0.05$). Insomnia with short sleep duration was associated with a significant increased risk of CVD/CBVD (OR = 1.85, 95% CI = 1.10–3.10) and CMR (OR = 42.37, 95% CI = 1.62–3.45), while insomnia with normal sleep duration was not (CVD/CBVD: OR = 1.33, 95% CI = 0.78–2.26; CMR: OR = 0.98, 95% CI = 0.66–1.45).

Conclusions: Insomnia with objective short sleep duration is associated with an increased prevalence of CMR and CVD/CBVD. These data further support that the insomnia with short sleep duration phenotype is a more biologically severe form of the disorder, whose underlying pathophysiologic mechanisms and treatment needs require further investigation.

Disclosure: This study was funded by the American Heart Association (14SDG19830018; PI: Fernandez-Mendoza) and the National Heart Lung and Blood Institute (R01 HL51931, R01 HL40916; PI: Bixler).

O117 | Bedtime social media use and insomnia in adults

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Objectives/Instruction: Insomnia prevalence has increased during the last decades. At the same time use of electronic media, especially social media, has increased. Social media is associated with sleep disturbances among adolescents and young adults, especially prebedtime use. In this study on adults, we distinguished speed messaging, the more interactive part of social media use, from overall social media use. Also watching television, as a more passive media type, in bed was analyzed for comparison.

Methods: Two separate adult samples (aged 18–69) were combined for analyzes. Participants (n = 587) were asked about volume and frequency of their electronic media use in bed, insomnia symptoms and background information. Association between social media use and insomnia was analyzed with logistic regression analysis, where sex, age, relationship status, depression, self-reported health and sampling method were adjusted.

Results: Association between insomnia and volume and frequency of social media was observed. More than one hour use of speed messaging in bed was associated with 3.16-fold (95% CI 1.28–7.81, p = 0.013) risk for insomnia in fully adjusted model, comparing with those who did not use speed messages in bed. Regarding social media, 30–60 min use in bed was associated with 2.02-fold (95% CI 1.00–4.05, p = 0.049) and >60 min use with 2.62-fold (95% CI 1.05–6.50, p = 0.038) risk for insomnia compared with non-users. Frequency of use was associated only with speed messaging with odds ratio of 1.93 (95% CI 1.13–3.31, p = 0.017) for risk of insomnia when speed messages were used in bed every night, compared with non-users. As a comparison, duration or frequent use of TV in bed was not associated with insomnia.

Conclusions: Frequent or long lasting use of social media in bed before bedtime was associated with higher risk for insomnia in adults. The effect of speed messaging, which is more socially and emotionally interactive, was slightly stronger than the other use of social media. There was no association between passive media use and insomnia. That may indicate the underlying mechanism of social interaction in this context. Further research using more objective measures and exploring direction of causality is needed.

Disclosure: Nothing to disclose.

O118 | Treatment response of insomnia disorder phenotypes and subtypes to standardised digital cognitive behavioural therapy

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Objectives/Instruction: Sleep duration phenotypes and clinical subtypes are used to classify symptom and physiological differences between patients with Insomnia Disorder. Whilst emerging evidence suggests that phenotypic response to treatment may be different between these groups, these results have been derived from *post hoc* analyses of clinical trials. We aimed to evaluate treatment response for phenotypes and subtypes of insomnia to standardised digital cognitive behavioural therapy.

Methods: Participants were screened and diagnosed with Insomnia Disorder (DSM-5) and sleep physicians determined clinical subtypes (sleep onset, maintenance, early morning awakening, mixed). Patients attended two consecutive nights in a sleep laboratory for measurement of: (i) objective (PSG) sleep duration; and, (ii) circadian measure (dim light melatonin onset). All patients were enrolled in 16 weeks of digital Cognitive Behavioural Therapy for insomnia (dCBTi: SHUTi). Insomnia phenotypes were classified as short and normal sleep duration using cluster analysis of sleep onset latency, wake after sleep onset, total sleep time and circadian delayed (DLMO after 22:00). Primary outcome was Insomnia Severity Index (ISI) measured at baseline, weekly (×6) during dCBTi and follow-up. (ACTRN 12615000751572).

Results: 130 insomnia patients (47.2 (14.8) years; 69% female) entered the study with 29 lost to follow-up. 78 (60%) of patients completed at least 4/6 modules. Across all patients, there was a significant decrease in ISI (19.9 [4.1] to 11.7 [5.8]; $p < 0.001$). Insomnia clinical subtypes did not differ in treatment response ($p > 0.05$). Objective short-sleep duration ($n = 62$; TST 295.8; SOL 27.7; WASO 116.4) and normal-sleep duration insomnia ($n = 67$; TST 390.1; SOL 15.6; WASO 54.6) treatment response was not different (delta ISI: 7.7 (6.2) vs. 7.4 (6.0); $p = 0.806$). Similarly, the ISI treatment response of circadian-delayed insomnia phenotypes ($n = 32$; DLMO clock time 23:03 h; post-treatment ISI 10.4) were not different from non-delayed ($n = 79$; DLMO 20:33 h; post-treatment ISI 12.3; $p = 0.150$).

Conclusions: This is the first *a priori* study showing dCBTi does not have different efficacy in insomnia sleep-duration and circadian phenotypes. Despite short-sleep duration insomnia phenotype with heightened physiological hyperarousal having been posited to exhibit treatment resistance to CBTi, their response rates were similar to their normal-sleep duration counterpart. The severity of physiological derangement may not preclude treatment response.

Disclosure: CBM is a Research lead at Big Health (Sleepio) Ltd. CJG, DB, RG were provided support from the Alertness, Productivity and Safety CRC.

O119 | How best to sequence cognitive behavioural therapy and medication when treating chronic insomnia with and without psychiatric comorbidity?

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Objectives/Instruction: There is little information on how best to combine or sequence medication and cognitive/behavioural therapies for insomnia to optimize outcomes. This paper reports findings from a two-site randomized clinical trial examining the efficacy of these therapies, when used individually and in various sequences.

Methods: Patients were 211 adults (132 women; M age = 45.6 ± 14.9 years old) with an insomnia disorder, including 72 with a comorbid psychiatric disorder. They were randomly assigned to first-stage 6-week therapy involving either behavioural therapy (BT, $n = 104$) or zolpidem ($n = 107$). Individuals not achieving remission were randomized to a second treatment involving either pharmacotherapy (zolpidem or trazodone) or psychological therapy (BT or cognitive therapy-CT). The primary end points reported in this paper was based on the Insomnia Severity Index and included treatment response (ISI change score ≥8 point) and remission (ISI total score <8).

Results: Intent-to-treat analyses showed that there were similar proportions of treatment responders (44% vs. 43%) after initial treatment with BT or zolpidem, but a larger proportion of remitters in BT (33% vs. 26%). For those who did not remit with BT, the addition of zolpidem or cognitive therapy yielded equivalent response rates after 12 weeks (52% and 56%, respectively), but larger remission rates when there was a switch of treatment modality (BT to zolpidem; 33%) than when patients remained within the same modality (BT to CT; 22%). For those who did not remit with zolpidem, the addition of BT or trazodone yielded similar response rates after 12 weeks (44 vs. 48%) and identical remission rates (22%). Although response/remission rates were generally lower among patients with psychiatric comorbidity, treatment sequences that involved BT followed by CT or zolpidem followed by trazodone led to better outcomes for comorbid insomnia than for insomnia without comorbidity.

Conclusions: These findings suggest that sequential therapy is an effective strategy to optimize insomnia management. Adding a second treatment modality produces an added value for those who fail to respond to initial therapies. Patients with comorbid insomnia may

also benefit from therapies (cognitive therapy, antidepressant) that target mood in addition to sleep.

Disclosure: CM has served as speaker for Merck and as consultant on an advisory board for Phillips.

LOCAL NETWORK SLEEP IN VIVO AND IN VITRO

120 | The slow oscillation in vitro: a model for sleep regulation

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Cortical networks in mature cortical cultures show a slow oscillation characterized by a synchronized burst-pause activity. When cortical cultures grown on microelectrode arrays are stimulated with a cocktail of waking neuromodulators, a tonic network activity appears but the slow-oscillation returns after 24 h. The recovery from stimulation results in a dose-dependent homeostatic response with decreasing inter-burst intervals and increasing burst duration. Additionally, the network shows higher cross-correlation and strong phasic synchronized burst activity. Spectral power below <1 Hz significantly increases and the increase is due to steeper slopes of bursts. This in vitro synchronized and sleep-like activity seems to be generated by cortical neurons only. Thalamic cultures, for instance, show a continuous tonic activity, while thalamo-cortical co-cultures show mixed tonic and synchronized burst activity. Thus, we propose that this simple *in vitro* model can be used for dissecting network mechanisms of sleep homeostasis.

Disclosure: Nothing to disclose.

121 | Neuronal network dynamics of sleep and wakefulness in *C. elegans*

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How are global brain states like sleep and wakefulness reversibly generated and maintained? The nematode worm *C. elegans* is a tractable model system to address this question. It has a stereotypic nervous system of just 302 neurons. We recently developed a Ca^{2+}-imaging approach to record the activity of nearly all neurons in the brain, in real time and at single cell resolution. We applied this approach to investigate how the brain switches between sleep and wakefulness. Our previous work in awake animals discovered brain-wide neuronal population activity that involve a large fraction of the animal's interneurons and motorneurons. This brain-wide network activity exhibits properties of a dynamic limit cycle attractor, which corresponds to a neuronal representation of an action commend sequence. Sleep is the pervasive brain state during specific episodes of development, termed lethargus, when animals transit to the next larval stage. We developed a sensory arousal paradigm that enabled us to rapidly control the brain state of lethargus animals: aversive atmospheric O_2 concentrations, sensed by dedicated O_2 sensory circuits, evoke a sustained state of arousal, while preferred intermediate O_2 levels permit sleep. We found that when these animals are left unaroused, neuronal population dynamics converge spontaneously towards a fixed-point attractor. At this fixed point, most neurons that are active during wakefulness are systemically down-regulated, with the exemption of a few sleep-active GABAergic motor- and interneurons, which retain sustained activity. During wakefulness, these sleep active neurons also participate in network dynamics. However, activity of the sleep promoting interneuron class RIS is elevated when the sleep pressure of the system is high, like during lethargus. In summary, we show that sleep in *C. elegans* exhibits a specific signature in brain-wide network activity. Our data support a view of sleep as a default convergent state of the brain, from which it must be aroused during wakefulness. In this model, the role of sleep promoting neuronal circuits is to modulate the bias of the network to approach the fixed-point attractor. We propose that this attractor state mechanism could be a means of switching effectively between drastically different global states of the brain.

Disclosure: Nothing to disclose.

122 | Local origin of slow EEG waves during sleep

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Neuronal activity mediating EEG slow waves consists of synchronous alternation of intracellular active and silent states. Recent data demonstrate that each active state of a sleep slow wave originates in a particular cortical location and propagate to involve other cortical areas. Preferential site of origin of these waves is the frontal cortex in adult humans, and some animal species. At the site of origin of these slow waves any neuron can initiate a particular cycle, however there are neuronal groups with high likelihood of triggering a particular cycle. In epileptic patients, these neurons are mostly located in superficial layers, but in healthy experimental animals, populations of intrinsically bursting neurons with a high probability of triggering spontaneous active states have been found in deeper cortical layers. I will present data showing that each slow wave starts in some set of neurons and from there, it propagates, occasionally involving the whole cortical regions.

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Disclosure: Nothing to disclose.

123 | Gene-dependent state oscillations in vivo and in vitro

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We posit sleep is an activity-dependent property of local brain networks based on;

- **(a)** after all brain lesions, surviving subjects sleep;
- **(b)** slow EEG waves wax and wane within isolated cortical islands;
- **(c)** marine mammals exhibit unilateral cortical EEG slow waves during sleep; and
- **(d)** human dissociated states within individuals suggest awake and sleep can occur simultaneously.

Our hypothesis predicts that any neuronal/glial small network e.g. cortical columns *in vivo* and co-cultures *in vitro*, will oscillate between sleep- and wake-like states. Rector described individual cortical columns oscillating between sleep- and wake-like states *in vivo*. The cortical column sleep-like state is dependent on its prior activity, and manifests sleep homeostasis. Small network sleep was extended to *in vitro* cell-cultures, by Corner who described their sleep-like default state. Independently, Tafti and Krueger extended those observations. Culture state is changed by electrical or chemical stimulation and the sleep-like state in culture has homeostatic properties. Briefly, our group showed that sleep regulatory substances, e.g. TNF, induce a deeper sleep-like state *in vitro* as evidenced by enhanced delta wave power and that prolonged cell culture electrical stimulation promotes the wake-like state, which is followed the next day by a sleep-like state rebound. Cells lacking both TNF receptors have lower spontaneous delta wave power suggesting they are in a more wake-like state than wild type (WT) cells. Further, WT cells and cells lacking the TNF receptors have reduced delta wave power after treatment with a soluble TNF receptor, suggesting that reverse TNF signaling, i.e. soluble TNF receptors binding to transmembrane TNF, wakes up cultures. In contrast, soluble TNF binding to transmembrane receptors promotes sleep. Cells derived from mice lacking a neuron-specific interleukin-1 receptor accessory protein, (AcPb), develop sleep linked emergent network properties more slowly than WT cells. Further, electrical stimulation of cells lacking AcPb is less effective as a waking stimulus than in WT cells. Mice lacking AcPb, lack a homeostatic sleep rebound after sleep deprivation. We conclude that small neuronal/glial cultures manifest sleep-defining emergent network properties which are dependent upon sleep regulatory genes. Supported by NIH (USA) NINDS grant #'s NS025378 and NS096250A.

Disclosure: Nothing to disclose.

SHOULD WE BANK OUR SLEEP AND CLOCKS? HOW AND WHY CREATING LARGE MULTIMODAL DATABASES

124 | Regulations and ethics in biobanking

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Science has entered the big data era. Multiple initiatives have demonstrated the power of large reference databases including tens of thousands of individual data to uncover the physiology and genetics of complex diseases and their biomarkers (e.g. Alzheimer's, Parkinson's, autism, diabetes, etc.). These initiatives imply multicenter international consortia and require a lot of standardization for acquisition, storage and analysis. They also raise interoperability concerns about the Web diffusion of anonymized data. Perhaps most importantly, researchers are beginning to realize the potential of sharing their data, encouraged by funding agencies and journals increasingly requiring data to be openly available (e.g. FAIR principle). Several sleep and chronobiology research have successful banked large amount of data to gain insight notably in narcolepsy, chronotype, insomnia and sleep duration. These examples remain however far from being the norm, probably because sleep and wakefulness regulation is such a rich phenomenon requiring multimodal and multilevel detailed phenotyping (omics, electrophysiology, behavior, etc.). This symposium will bring together three important actors of the biobanking world. This first presentation will breifly set up the stage for the other three speakers of the round table with an overview of the legal and ethic issues that need to be taken into account in biobanking initiatives.

Disclosure: Nothing to disclose.

125 | The Canadian Sleep Research Biobank

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The Canadian Sleep Research Biobank has two primary goals: i) assist individual researchers to with the collection of biological materials such as blood, cells and DNA to enable genetic, biochemical and biomarker studies for sleep and circadian research, and ii) enable larger scale collaborative projects that would not be possible otherwise. Since many sleep/circadian traits and disorders are known to have a strong genetic component, there is tremendous interest in performing genetic studies, although not all investigators currently have the facilities and capabilities to perform these studies. The Biobank is an integral part of the Canadian Sleep and Circadian Network, and can assist researchers in any of the steps in the process of consenting patients, collecting and storing samples, producing

blood marker or genotype data, and analyzing results. In addition to the biological samples, the biobank stores phenotypic information such as questionnaires or metadata from polysomnography studies. The biobank provides a unified framework to standardize the collection of biological samples and information to maximize the usefulness of the data in the future. Investigators involved in biobanking retain control over the decision of where and when to share the samples they have collected, and the biobank facilitates the sharing of the samples and information when appropriate. One specific focus of the biobank is the overlap between sleep/circadian disorders and their relationship with cognitive decline, psychiatric disorders and neurodegenerative disease. The identification of genes and blood markers involved in this relationship will help develop therapies to treat these conditions.

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CHRONOBIOLOGY

O127 | Objective sleepiness is reduced by daytime polychromatic white light exposures depending on melanopic lux

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Objectives/Instruction: The aim of this study was to determine the impact of daytime light exposure on objective and subjective sleepiness, by using polychromatic white light conditions which differed in peak wavelength of the blue light spectrum and/or light intensity.

Methods: Seventy-two healthy participants visited the laboratory four times, arriving 1 hr after habitual wake-up times while wearing dark goggles (48 female; 24.4 ± 2.7 years; mean ± SD; within-between-subject design). Starting ~3 hr after wake-up, they were exposed for 3 hr to polychromatic white light which differed in the peak wavelength of the blue portion of the light spectrum but had similar CCT (=3,500 K; blue light peak at 435 nm or at 480 nm), or differed in illuminance (100, 200, 600, 1,200 lx; randomized order), or a dim light (DL) condition. Subjective sleepiness assessed by visual analogue scales and objective sleepiness in the electroencephalogram (EEG; Karolinska drowsiness tests of 5 min closed and open eyes) were measured hourly.

Results: During 3 hr of light exposure, objective sleepiness (as determined by the EEG alpha attenuation index) was at 100 lx significantly reduced by light with a spectral peak at 480 nm compared to 435 nm or DL. We also found a trend for a reduction of objective sleepiness by higher light intensities, which was greatest at 1,200 lx. In addition, there were significant differences between the lighting conditions in the EEG delta, theta, sigma and beta ranges depending on the peak wavelength and light intensity. Subjective sleepiness showed a significant and acute reduction in the first hour of exposure to light with a spectral peak at 480 nm, when compared to 435 nm or DL.

Conclusions: The impact of the different spectral compositions of light on the waking EEG was most pronounced at low light intensities (at 100 photopic lux), with higher melanopic lux (i.e. greater blue portion at 480 nm) showing stronger alerting effects during daytime in well-rested participants. At higher light intensities the alerting effects were mixed and interacted with spectral compositions, and thus were less obvious.

Disclosure: Funding: This study was funded by the German Federal Ministry of Education and Research (OLIVE project) and Intellux GmbH (Berlin), Germany Disclosures: none

O128 | Influence of habitual caffeine intake and its withdrawal on circadian phase and nap sleep in the evening

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Objectives/Introduction: Acute caffeine intake is well-known for its interference with the sleep homeostatic process and there is also evidence that caffeine shifts circadian phase. Usually these effects have been investigated in low caffeine consumers who were previously withdrawn from caffeine. Thus, our aim was to examine the influence of habitual caffeine intake and its withdrawal on circadian phase and on a nap sleep episode scheduled to a time of high circadian wake-promotion.

Methods: Seventeen male volunteers (age 25.9 ± 4.1 years, habitual daily caffeine consumption 480.9 ± 110.0 mg) participated in a double-blind, balanced, crossover study comprising a caffeine (3 × 150 mg caffeine for 11 days), a placebo (3 × placebo for 11 days), and a withdrawal condition (3 × 150 mg caffeine for

9 days followed by 2 days placebo). Salivary melatonin was regularly collected on days 10 and 11 of treatment under constant routine conditions. Sleep electroencephalography was assessed in the evening during a 1-hr nap episode scheduled 14.5 hr after habitual wake time.

Results: Dim light melatonin onset did not reveal any significant differences among the three conditions ($p > 0.1$). During nap sleep, latency to sleep stage 2 was shorter ($p < 0.05$) and sleep efficiency enhanced ($p < 0.05$) during withdrawal compared to caffeine and placebo condition. In addition, during withdrawal, slow-wave sleep (stage 3 + 4) was prolonged ($p < 0.05$) and delta activity (0.75–4.5 Hz) increased ($p < 0.05$) compared to caffeine condition. However, in the caffeine condition, sleep latency, sleep structure and spectral power density did not significantly differ from placebo ($p > 0.1$).

Conclusions: Our results corroborate that the acute challenge of withdrawal from caffeine is associated with a higher sleep pressure as mirrored in an increased sleep propensity and enhanced sleep intensity compared to placebo and caffeine condition even at a time of high circadian wake-promotion. Furthermore, our data indicate that habitual caffeine intake does neither result in a clear circadian phase shift nor in a stronger wake-promotion in the evening. This might be related to adaptive processes to the regular consumption of the stimulant.

Disclosure: Nothing to disclose.

O129 | Entrainment of circadian system and sleep to extremely long photoperiods in modern life and nature

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Objectives/Introduction: Light influences physiological processes in humans, chiefly through synchronizing the internal circadian clock. We have previously demonstrated that the human circadian clock synchronizes to solar phase following exposure to only natural light, moreover, the human clock adapts to seasonal changes in the natural light-dark cycles at ~40°N. In addition, living in natural environments without artificial lights leads to a longer biological night during the winter, predominantly driven by a large advance in melatonin onset timing with no change in melatonin offset. Herein we aimed to elucidate a circadian response to extremely long natural photoperiods, measuring melatonin timing before and after 1 week of camping in nature.

Methods: Participants wore Actiwatch Spectrums for assessment of sleep, activity, and light exposure during 1 week of urban living in Stockholm, Sweden (~59°N) and 1 week of camping in nature at Sweden's High Coast (~63°N; 20 hr 40 min: 3 hr 20 m in natural light-dark cycle), within 2 weeks of the summer solstice. Salivary melatonin levels were assessed from hourly samples taken during two in-laboratory 24-hr dim-light melatonin onset (DLMO) circadian phase assessments conducted immediately before and after camping.

Results: On average, participants' (n = 10) melatonin onset was not different between environments (p = 0.45). Melatonin midpoint and offset occurred ~0.7 and ~1.3 hr earlier, respectively ($p < 0.01$). Melatonin offset occurred ~2.2 hr following the average sleep offset prior to camping, and ~0.4 hr following sleep offset after camping. Participants' actigraphy-estimated sleep onset, offset and duration were similar etween environments ($p \geq 10$).

Conclusions: Exposure to an extremely long summer photoperiod in nature phase advanced the timing of the melatonin offset resulting in the biological night ending closer to wake time than when compared to the urban environment. The latter is consistent with prior findings and demonstrates that the end of the biological night occurs closer to wake time even in extreme natural photoperiods as compared to urban environments.

Disclosure: Kenneth P. Wright Jr., PhD serves on the Sleep Disorders Research Advisory Board—National Heart Lung and Blood Institute, the Board of Directors of the Sleep Research Society, the Scientific Advisory Board of CurAegis Technologies, as a consultant for Circadian Therapeutics, has research support from, CurAegis Technologies, Philips Inc., Somalogics, NIH, Office of Naval Research, the PAC-12. The other authors have no conflicts of interest to disclose.

O130 | Greater sleep inertia in young adults in early biological morning

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Objectives/Introduction: Alertness is often impaired immediately upon waking due to sleep inertia (SI), and this effect is magnified under chronic sleep deficiency. Aging is associated with weaker circadian sleep-promoting signal in the early biological morning, but whether there is an age difference in the severity of SI after waking up has not been extensively studied.

Methods: 12 healthy young (18–27; 6f) and 12 older adults (55–70; 6f) participated in a 39-day inpatient study. The study consisted of 3 baseline days (time-in-bed (TIB) 10 hr/24 hr), followed by 3 weeks of chronic sleep restriction (CSR-6.5 hr time TIB/28 hr, equivalent to 5.6 hr/24 hr) in a forced desynchrony protocol. The effect of SI during CSR was assessed by Karolinska Sleepiness Scale (KSS, administered every 5 min) and the number of Slow Eye

Movements (SEM, 30 s epochs) during the first hour of scheduled waking. Mixed-Model ANOVA was used for statistics.

Results: Subjective and objective alertness were most impaired when waking from sleep at circadian phases 300, 0, and 60 (corresponding to the biological night) and improved with time awake. Young adults reported higher levels of sleepiness and had more SEMs than older adults when waking up at circadian phase 60 ($p = 0.009$ for KSS; $p = 0.002$ for SEM), which corresponds to late biological night/early biological morning. Young adults also spent less time awake during the last hour of their 6.5 hr sleep opportunity (2.2% vs. 27.0%, $p < 0.001$) and were more likely to have their final awakening from REM than from NREM sleep than older adults ($p = 0.009$).

Conclusions: These results support a weakened circadian sleep-promoting signal in the early biological morning with aging, and have important implications for the scheduling of work in occupational settings which require alertness immediately upon awakening.

Disclosure: Nothing to disclose.

O131 | Subjective sleepiness and waketime are related to light perception

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Objectives/Introduction: We aimed at identifying possible relationships between sleep-related measures (sleep duration in the night prior to the experiment, time awake, and subjective sleepiness) and light ratings.

Methods: We pooled self-report data from four psychophysiological studies in which participants, after 10-min baseline (2,800 K light), spent 15 min in one of the experimental light conditions, followed by a 5-min cognitive task. Participants filled in Karolinska Sleepiness Scale (KSS) upon the arrival to the lab and after the light exposure episode. Light ratings (sense of color temperature as cool to warm and preference of color temperature as rather cooler or warmer, both on a scale from 1 to 7) were filled in at the end of the experimental session. Two of four experiments included two experimental blocks. For the present analysis, only KSS ratings concerning the first block were considered. All designs were between-subject. We selected only experimental lighting conditions of 2,800 and 6,500 K to have a comparable number of participants for each condition (total $N = 197$; 140 women). Physiological data were not considered for this analysis.

Results: The results revealed that lighting color temperature perception and preference are related to subjective sleepiness and waketime. KSS ratings were significantly correlated to lighting color preference, $r = 0.157$, $p = 0.028$: the sleepier a person felt upon arrival to the lab, the warmer the light they have preferred (independently of experimental lighting condition). The results also revealed that the light was perceived as cooler the longer the waketime, $r = 0.188$, $p = 0.008$. Other correlations between sleep measures and light ratings were not significant ($ps > 0.192$). Experimental lighting did not affect the change in subjective sleepiness nor color temperature ratings ($ps > 0.165$).

Conclusions: Subjective sleepiness and wake time are related to light perception. It is possible that higher subjective sleepiness leads to preference of warmer, i.e. less activating, light because this way the environment would better match the subjective state. Similarly, wake time possibly modulates the perception of lighting color temperature as a function of sensitivity to light.

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SLEEP IN REAL LIFE

O132 | Sleep, fatigue and cognitive performance on different types of fishing vessels

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Objectives/Introduction: Trawlers, netting vessels, and long liners are the main vessels on which Faroese fishermen work. Longliners typically have a regular working schedule, whereas trawlers and netting vessels have more irregular shifts (6–16 hr in a row), respectively. This study compares sleep, fatigue and cognitive performance on these three types of vessels and investigates how these parameters are affected during the length of a fishing trip.

Methods: Crew of trawlers ($n = 15$), netting vessels ($n = 32$), and longliners ($n = 79$) participated during their 3-day, 4-day, and 14-day fishing trips respectively. During these periods, sleep diaries were filled in and sleepiness was rated every second hour or more, using the Karolinska Sleepiness Scale (KSS). Moreover, a cognitive test battery was performed at the start and end of each fishing trip.

Results: Although reaction times of crew of all types of vessels were slower at the end of the trip (trawers from 428 to 455 ms; netting vessels from 426 to 1206 ms; longliners from 471 to 761 ms), no statistical significance was reached. Even working memory remained stable (varying from 77 to 80% correct) on all types of vessels. Severe sleepiness (KSS > 7) was significantly more prevalent on trawlers (26%) and netting vessels (23%) as compared to longliners (14%; chi squares respectively 15, 77, $p = 0.0001$ and 27, 51, $p < 0.0001$). Crew of netting vessels had significantly longer sleep periods than that of longliners and trawlers ($p < 0.001$). Sleep dairies showed that working patterns on-board netting vessels allowed for the longest consecutive sleep periods (average of 347 min), but with

only one period per day, while the work patterns on-board trawlers allowed for the shortest consecutive sleep periods (average of 228 min), but usually divided over 3 periods per day. Longliners were the vessels that had a fixed shift system. Their consecutive sleep period was 266 min twice a day.

Conclusions: Although cognitive performance did not differ between different vessel types, levels of severe sleepiness were considerably higher on-board trawlers and netting vessels, despite the fact that crew on netting vessels had the possibility to obtain the longest sleep periods.

Disclosure: Nothing to disclose.

O133 | Do rats avoid a radiofrequency exposed environment to sleep?

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Objectives/Introduction: Some people living near a base station antenna reported sleep disturbances and discomfort but whether there is any causal link with radiofrequency (RF) exposure remains questionable. In a previous study, we demonstrated physiological (tail vasoconstriction) and hypnic (fragmentation of REMS, preference to sleep at higher ambient temperature) modifications when rats were continuously exposed to radiofrequency electromagnetic fields (RF-EMF), suggesting a thermal discomfort (Pelletier A. et al., 2013, 2014). This study assesses whether rats discriminate RF-EMF constraint and if hypnic impairment appears when they are free to choose between a shielded and a RF-EMF exposed environment.

Methods: Three weeks-old male Wistar rats (n = 17) have been chronically exposed during 5 weeks to low RF-EMF (900 MHz, 2 V/m, whole-body SAR = 30 mW/kg). During the 5th week of exposure, the RF-EMF preference was assessed during four consecutive days with an experimental chamber made of 2 interconnected compartments. Each day, alternatively, one compartment was exposed to RF-EMF (more than 2 V/m) and the other control compartment was less exposed (less than 1 V/m). Wakefulness, NREM and REM sleep were recorded continuously with a telemetric system to allow free moving of rats. The time spent in each compartment, the total durations of sleep stages, the mean durations of episodes and their frequencies were tested using analysis of variance. The results are expressed in mean ± SD.

Results: During the 11-hr light-rest period, rats spent more time in the control compartment with respect to the RF-EMF exposed one (+82.6 min, $p < 0.01$). In contrast, during the 12-hr dark period, there is no statistical preference (344.6 ± 103.9 min vs. 375.4 ± 103.9 min). There is no difference in sleep parameters whether the rat sleeps in the control or in the RF-EMF exposed compartments.

Conclusions: Our results point out for the first time that rats "feel" RF-EMF exposure since they partially avoid the more exposed RF-EMF compartment during the daytime-sleep period. This strategy prevents them from sleep disturbances observed in our previous studies. This result could explain some discrepancies in the epidemiological studies regarding sleep disturbances and RF-EMF.

Disclosure: Nothing to disclose.

O134 | Exercise effects on the circadian rhythm of adolescents with extreme evening-type circadian preference: a novel treatment to improve sleep health

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Objectives/Introduction: Over the course of adolescence, biological sleep patterns shift to later sleeping and waking times, leading to a greater gap between sleep duration on every night of the week. Delayed sleep pattern seem to be a normal part of adolescent development. However a severe form of eveningness has been identified as delayed sleep-wake phase disorder (DSWPD). The delay in falling asleep can be a hindrance to academic achievement. In contrast, morning exercise before school may be a novel intervention that can be easily incorporated into adolescents' weekly routine, with beneficial effects on sleep. Therefore, the main goal was to measure short-term effects of morning exercise on phase of melatonin rhythm in adolescents with an extreme eveningness preference.

Methods: 18 male adolescents aged 15–18 participated in this randomised controlled trial, with exercise as the between-subjects factor. The primary outcome variable is timing of dim light melatonin (DLMO) and core body temperature. Secondary outcomes include daytime sleepiness, sleep, and mood. Data assessment took place during school holidays, allowing participants to spend six consecutive nights at the sleep laboratory. Morning procedure included either 45 min walking on a treadmill (IG) or sedentary activities (CG) in dim light (<10 lux). Saliva DLMO, core body temperature and mood were assessed during the first and last night of laboratory attendance. The treatment protocol for morning exercise is based on the bright light approach described by Bjorvatn & Pallesen (2009). Sleep and physical activity pattern were controlled in the week prior and throughout study assessment subjectively and objectively.

Results: Individuals in the control group had delayed their circadian timing (M = −22 min, SD = ±37 min), while the exercise group has slightly advanced (M = +5 min, SD = 22). In other words, 5 days of morning exercise appeared to have a preventive effect of a negative circadian shift by 27 min ($p < 0.07$).

Conclusions: Given the dearth of knowledge on adolescent sleep, this study adds to our current understanding about exercise-induced phase advances on human melatonin rhythm. Research in this area will add to the identification and current treatment procedures of young patients with a DSWPD.

Disclosure: Nothing to disclose.

O135 | Chronotype, social jetlag and work performance in a sample of Japanese workers

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Objectives/Instruction: Several studies have suggested that social jetlag have negative effects on daytime function, such as academic performance, daytime sleepiness. Individual chronotype has been also associated with a range of health behaviors, depressive symptoms. The shift-work research reported significantly slower reaction times during morning shifts, as compared to night shifts, in a sample of late chronotype. The aim of this study was to investigate the relationship between self-reported work performance, chronotype, and social jetlag.

Methods: A web-based cross-sectional survey was conducted among registered monitors of a survey company in Japan. A total of 10,000 monitors who were matched in age, sex and resident area to a Japanese representative sample, were randomly invited to participate in the survey. We excluded those who provided invalid answers (n = 198), who has not worked (n = 3,966) or engaged in shift work (n = 1,232), and who reported sleep times on free days with use of alarm clocks, a requirement for determining chronotype (n = 2,389). The final sample comprised 3,708 participants (57.8% male, average age: 44.2 [13.5] years old). This study was approved by the ethics committee of Tokyo Medical University. Questionnaires consisted of demographic variables, Munich Chronotype Questionnaire (MCTQ), and Japanese version of the Work Limitations Questionnaire (WLQ). The WLQ is a self-administered questionnaire measuring the degree to which health problems affect job performance (on-the-job work disability) and the work productivity impact of these work limitations in the previous 2 weeks.

Using MCTQ, we calculated mid-sleep (the mid-point between sleep onset and sleep end) on free (MSF) and work days (MSW). To determine individual chronotype, mid-sleep on free days was calculated, corrected for accumulated sleep debt on work days (MSFsc). Social jetlag (SJL) is computed by the absolute difference between MSF and MSW.

Results: There was no significant difference in workplace performance between SJL >= 1 hr and SJL < 1 hr in early chronotype. The groups of SJL >= 1 hr/late and intermediate chronotype showed larger productivity loss (F (5, 3464) = 9.39, $p < 0.01$), whereas workplace performance outcomes (presenteeism, mental interpersonal demands) were kept in the groups of SJL < 1 hr/late and intermediate chronotype.

Conclusions: Our results suggested that circadian misalignment, but not chronotype *per se*, may be critical for work performance.

Disclosure: This work was supported in part by a Grant-in-Aid for Scientific Research from the Japan Society for the Promotion of Science (JSPS KAKENHI Grant Number 16K07545). Komada has received grant support from Otsuka Pharmaceutical Co., Ltd., Eisai Co., Ltd., and MSD K.K.

O136 | Dreaming of Mars: inter-individual differences in sleep, sleepiness and performance during a year-long stay in Antarctica

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Objectives/Introduction: Manned spaceflights from Earth to Mars will likely become reality within the next decades. Humans will be exposed to prolonged isolation and confinement and altered photoperiods in artificial atmospheric conditions, with potential adverse effects on sleep and performance. On Earth, polar environments serve as space-analogues to study human adaptation, yet few studies include polysomnography (PSG) due to operational constraints.

Methods: Polysomnography, subjective sleep, sleepiness and fatigue and psychomotor vigilance tested every 6 weeks in 13 males (Hivernauts) during a winter-over campaign at Concordia (Antarctica; corrected altitude = 3,800 m) and compared to controls (n = 13; 2 females) in normobaric normoxia. Stability and robustness of inter-individual differences are examined by means of intra-class correlations (ICCs).

Results: Hivernauts present with periodic breathing ($p < 0.001$), increased sleep onset latency ($p < 0.001$), reduced sleep efficiency ($p < 0.05$) and increased sleep fragmentation ($p < 0.001$). Latency to REMS appeared to be shorter ($p < 0.005$), REMS duration ($p < 0.05$) increased and light sleep decreased ($p < 0.001$). Reaction speed is reduced in Hivernauts ($p < 0.005$) and lapsing is increased ($p < 0.05$). Situational sleepiness is moderate in Hivernauts, but higher than controls ($p < 0.05$). Hivernauts with fixed work schedules went significantly earlier to bed and rose earlier than participants with variable schedules, especially during the polar winter season ($p < 0.01$). Subjectively reported sleep onset latencies are shorter for crewmembers with variable sleep/wake schedules ($p < 0.001$), but no significant differences are observed in PSG parameters. Over time, all polysomnographic, chronometric and

questionnaire variables showed significant inter-individual variability (between-subject effects; all p's < 0.001) and were eligible for meaningful ICC calculations. Individual differences in respiratory variables show the highest degree of stability and robustness (>60% of explained variance), followed by fatigue and situational sleepiness, sleep fragmentation and cognitive speed (40 to 60% explained variance), suggesting moderate to substantial trait-like characteristics.

Conclusions: Under prolonged exposure to extreme conditions, the initial individual variability of sleep-related responses to the environment play a major role in how humans will adapt to it. Hence, specific in-depth, but not necessarily extended simulations are warranted for selecting eligible candidates for extra-terrestrial sojourns.

Disclosure: Nothing to disclose.

KEYNOTE LECTURE – SUSAN REDLINE

137 | Sex and gender differences in sleep apnea: a window into understanding disease susceptibility

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Obstructive sleep apnea is an explemar of a complex, chronic disease that displays sexual dimorphisms in regards to symptom presentation, polysomnographic attributes, associated co-morbidity, and clinical impact. Women tend to report a higher frequency of insomnia symptoms, have shorter hypopneas, and have a higher prevalence of REM-predominant sleep apnea. While early data suggested that women may be at lower risk of cardiovascular complications, more recent data with longer term follow-up show that older women with sleep apnea may be at greater risk for experiencing cardiac dysfunction, heart failure or death, compared to men with sleep apnea. Emerging data also indicate that the association between physiological endotypes as well as genetic variants with sleep apnea vary in men and women. These data indicate that women have a higher loop gain, lower arousal threshold and less airway collapsibility compared to men. Differences in presentation and polysomnographic findings likely have contributed to under-recognition of sleep apnea in women compared to men. Sleep apnea also varies in prevalence across the lifespan, increasing both during pregnancy and after menopause. This talk will review the key features that distinguish sleep apnea in men and women with the goals of improving recognition and treatment of sleep apnea in women, and advancing the scientific understanding of this complex disorder.

Disclosure: Received grants from the National Institutes of Health, Jazz Pharma, and Beckman Coulter. Received consulting fees from Jazz Pharma.

KEYNOTE LECTURE – WENBIAO GAN

138 | Learning and sleep-dependent dendritic spine plasticity and maintenance

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Dendritic spines are the postsynaptic sites of most excitatory synapses in the mammalian brain. In vivo imaging of dendritic spines in the mouse cerebral cortex indicates that spines are highly plastic during development and become remarkably stable in adulthood. In my presentation, I will discuss how learning experiences and subsequent sleep regulate the plasticity and maintenance of dendritic spines. Because dendritic spines are the key elements for information acquisition and retention, understanding how they are regulated by sleep in the living brain provides important insights into the functions of sleep in learning and memory.

Disclosure: Nothing to disclose.

HEADACHE AND SLEEP

139 | Headache and sleep

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There is strong association between sleep and headache which both show significant comorbidity in either children or adults. This comorbidity is linked to common neurophysiological and neuroanatomical substrates. Several types of headache show correlation to sleep or chronobiology. One of the strongest association are noted for hypnic headaches. There is evidence in favor of an association between episodic cluster headache and sleep and circadian factors. However other types of headaches including migraine also show relation to sleep-wake pattern. Headache also show association to specific sleep disorders like parasomnias, restless legs syndrome, sleep apnea, periodic limb movements during sleep, and narcolepsy. The assessment of children and adults with headache should always include an accurate anamnesis for the presence of sleep problems. Management of headache should furthermore include relevant sleep diagnosis and potential treatment.

Disclosure: Nothing to disclose.

140 | Cluster headache & the clock

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Cluster headache is one of the most painful disorders known, with daily up to 8 attacks of headache so excruciating that is it often referred to as 'suicide headache'. The disease affects 0.1% of the population. An extraordinary feature of cluster headache is its episodic nature: daily attacks occur in clusters of weeks to months, alternating with periods of months without pain attacks. Furthermore, attacks have a daily rhythmicity.

In a recent study of our group, 82% of patients reported attacks to exhibit a predictable, daily rhythmicity, with most attacks between 00:00 and 04:00 hr. Clusters of attacks occur in certain, with an intriguing relation with the solstices and equinoxes. In cluster headache, alterations of secretion patterns have been described for melatonin, cortisol, testosterone, gonadotrophins, prolactin, growth hormone and thyrotropin. Our biological clock resides in the suprachiasmatic nucleus of the hypothalamus. This is a brain structure which contains the biological clock and regulates essential bodily functions, such as sleep. A higher activation during attacks was found in the ipsilateral posterior inferior hypothalamus using functional magnetic resonance imaging (fMRI). At the end of cluster periods, patients show decreased functional connectivity between the hypothalamus and pain networks using resting state fMRI. Recent work of our group shows that the anterior part of the hypothalamus (the location of the biological clock) is enlarged in cluster headache.

Cluster headache attacks are often linked to sleep. In a recent study of our group, the most common headache trigger was sleep (80%). Attacks often occur around 1.5 hr after sleep onset, suggesting a link with REM-sleep. In clinical anecdotes, patients can have a fear of going to bed, actively postpone sleep or use voluntary sleep deprivation to avoid an attack. The exact nature of the link between cluster headache and (REM)-sleep has never been fully elucidated, with contrasting results in the few studies that have looked into this topic.

The episodic and circadian nature, the association with sleep as well as neuroimaging data suggest a role for the hypothalamus and its biological clock.

Disclosure: Nothing to disclose.

141 | Hypnic headache – the undesired alarmer

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Background: Hypnic headache is a rare headache disorder that is strongly connected with sleep. It occurs typically in elderly patients and wakes them up at the same time at night. Caffeine can have a paradoxical beneficial effect.

Objective and aims: To give an overview and update about hypnic headache with a focus on headache-sleep-interaction. Clinical presentation, differential diagnosis, pathophysiological background and treatment options will be discussed.

Methods and results: Review of the literature on the clinical description of the syndrome and on pathophysiological mechanisms that have been investigated using brain imaging as well as sleep, electrophysiological and hormonal studies.

Conclusion: Hypnic headache and sleep are closely related. The exact mechanism remains unclear, but hypothalamic involvement is possible.

Disclosure: Nothing to disclose.

142 | Hypothalamic pathways in headache & sleep

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Primary headache disorders represent a group of diverse neurological disorders that present with varying intensity, duration, frequency and associated symptoms. Despite these underlying differences the hypothalamus has emerged as a critical component of several attack forms, including migraine and cluster headache. Migraine is commonly associated with sleep disruption, shows a circadian pattern of attack onset and is associated with abnormal fatigue during the earliest premonitory phase. Similarly, cluster headache often occurs during sleep and attacks show clear circadian and circannual periodicity. As such, there is a clear clinical association between sleep and headache, with several lines of evidence pointing to hypothalamic involvement.

Of particular interest the hypothalamic orexinergic system has emerged as a key regulator of migraine-related nociceptive processing and targeted modulation of orexin receptors remains a valid therapeutic target for primary headaches. In conjunction recent genetic data has highlighted a key role for disruption of casein kinase 1-delta in the generation of familial advanced sleep phase system and comorbid migraine with aura.

The hypothalamus is thus a key regulator of homeostatic mechanisms including sleep-wake cycles under circadian regulation. It has emerged as a key structure for the regulation of primary headaches and sleep and recent evidence points towards shared anatomical, physiological and genetic points of convergence in hypothalamic networks.

Disclosure: PRH reveals no actual or perceived conflicts of interest. Funding was received by the Medical Research Council.

BIOMARKERS FOR SLEEP DISRUPTION AND SLEEP DISORDERS

143 | Computational approaches to identify and validate blood transcriptome biomarkers for sleep and circadian health

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Blood is an easily accessible tissue, enabling the repeated and longitudinal assessment of an individual. Technologically, transcriptomics has been shown to be less error prone than other -omics and provides the opportunity to assess all transcripts. We and others have shown that the whole-blood transcriptome provides more information than just the response of blood cells and can be used as an 'accessible window' to the status of the human system. Blood transcriptome biomarkers are therefore a viable solution on which to base objective clinical assessments of circadian and/or sleep perturbations. The development of objective assessments is important for treatment and diagnosis, with applications in many real world situations e.g. suspected sleepy (drowsy) driver accidents, assessing 'fitness for duty', interpretation and diagnosis of circadian rhythm and/or sleep-wake disorders, and evaluation of therapeutic interventions. Here we present computational approaches to identify and validate panels of transcriptome biomarkers for predicting the circadian (melatonin) phase and sleep debt status (experience of acute and chronic sleep loss) of an individual from just one or two blood transcriptome samples. For each target variable we were able to identify a panel of biomarkers with >89% accuracy when applied to independent validation sets. Use of *a priori* knowledge did not produce top performing panels for the majority of variables. Biomarker panels for sleep debt status showed little overlap with biomarkers for circadian phase.

Our novel analyses demonstrate the feasibility of the human blood transcriptome as a reservoir of biomarker panels related to sleep and circadian processes, and highlight important methodological considerations for future research.

Disclosure: Nothing to disclose.

144 | Systems genetics of sleep loss in the mouse

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Sleep is an essential state to maintain optimal brain functioning. Chronic disruption of sleep results however has negative impact on health well beyond the central nervous system, with an increased risk of metabolic disorders such as diabetes. To gain insight into relationship between sleep-wake behavior and metabolism, and identify possible novel biological substrates involved in the sleep regulatory process, we assembled an extensive multi-scaled dataset in mouse using systems genetics. This approach allows to interrogate such dataset at the genetic level and how genetic factors interact with environmental factors such as a sleep deprivation. Furthermore, the use of machine learning algorithms and high-throughput sequencing technology permit to appraise the plethora of physiological and molecular phenotypes that constitute sleep at many systems levels. This dataset is composed of 33 mouse recombinant inbred lines (RIL) from the BXD panel that were interrogated under sleep deprivation and undisturbed conditions for 341 sleep-wake related physiological phenotypes, 124 blood plasma metabolites, and cortical and liver transcriptomes. First analyses pointed out the pervasive effects of short sleep deprivation, which reshaped the systems genetics landscape by altering the mouse cortex and liver transcriptomes, and blood metabolome. The strong genetic contribution could be measured at all phenotypic levels and could also drives the response to sleep deprivation. Our findings led to the discovery of a bidirectional relationship between fatty acid turnover and sleep homeostasis but also between brain slow-waves activity and ionotropic glutamate receptor transport. The addition of supplementary data like chromatin accessibility may further complete this dataset for better comprehension of the molecular mechanisms involved. Using cloud-based technologies, we aimed at transforming this powerful hypothesis-building resource into a digital research object that can be datamine by the sleep community.

Disclosure: Nothing to disclose.

145 | DNA methylation in blood leukocytes as putative biomarkers for insufficient sleep

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Sufficient sleep is essential for our health. Lack of sleep affects basic physiological processes, including systemic inflammatory reaction, and leads to an increased risk for various psychiatric and somatic disorders. The identification of key players of molecular processes associated with curtailed sleep could improve the assessment and early prevention of the long-term health risks. Though sleep is precisely regulated, the detailed mechanisms of the brain processes during sleep remain unclear. As DNA methylation plays crucial role in the regulation of cell gene expression, the study of differentially methylated positions (DMPs) might enhance our understanding of the molecular mechanisms underlying insomnia. We performed epigenome-wide association studies for two independent cohorts of males to identify DMPs in whole blood samples of individuals suffering from insufficient sleep (a population-based sample) or diagnosed with shift-work disorder (an occupational cohort of shift workers). Genes corresponding to DMPs common for both cohorts were analyzed by various tools to investigate affected biological pathways in individuals lacking sleep. The data analysis showed that processes related to neuronal plasticity and neurodegeneration were compromised in people lacking sleep, as well as there is an enrichment of genes involved in visual processing and regulation of circadian rhythm. The majority of these DMPs were hypomethylated in cases in both cohorts, as compared to controls, suggesting that insufficient sleep may be associated with loss of DNA methylation. The results give evidence for the importance of the epigenetic regulation in mediating both brain-specific and systemic stress caused by compromised sleep and diurnal rhythm.

Disclosure: Nothing to disclose.

PHARMACOLOGICAL THERAPY OF OBSTRUCTIVE SLEEP APNEA. NOVEL TOOLS AND PRINCIPLES

146 | The challenge of designing trials in OSA

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Before implementing a study, careful consideration should be given to the appropriateness of the proposed study design, especially in terms of practical feasibility, study information to be obtained, expected duration of the study and resources. Apart from the type of study choosen, the following problems can be encountered: sample size, access to patients, the time available to investigate a research problem and measure change or stability over time (short-term versus long-term risk and effect of treatment), selection bias, use of gold standard techniques (polysomnography versus polygraphy; esophageal pressure cathethers versus noninvasive markers; inhospital versus ambulatory techniques), scoring rules for EEG and respiratory events, subclassification of respiratory events into obstructive, central, mixed apneas and hypopneas, pathophysiological phenotype, clinical phenotype (symptomatic versus asymptomatic subjects, comorbidities or not (comorbidities may produce changes in symptoms that are similar to OSA symptoms), concommittant sleep disorders, level of obesity), intensity of follow-up, application of telemonitoring, use of medications that cause side effects or that provoke respiratory events, compliance for treatment or intervention. Lifestyle characteristics such as socioeconomic and cultural background, health status, smoking, alcohol habits, and exercise are confounding but unmeasurable factors. Finally, an important problem is the occurrence of missing data for participants in a clinical trial (lost to follow-up, withdrawal due to adverse effects of an intervention). Use of an intention-to-treat approach (patients to be included even if they did not fully adhere to the protocol should still be kept in the analysis) versus a per-protocol analysis (only patients who complete the entire clinical trial according to the protocol are counted towards the final results). A per-protocol analysis will lead to an overestimation of the treatment effect. Clinicians and researchers should carefully consider this potential spectrum bias in study designs and data analyses.

Disclosure: Nothing to disclose.

147 | Pathophysiological phenotyping as a rational for drug development

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Existing therapies for obstructive sleep apnoea (OSA) such as continuous positive airway pressure (CPAP), mandibular advancement splints (MAS) and upper airway surgery focus on alleviating the upper airway anatomical predisposition to OSA. CPAP is highly efficacious although poorly tolerated with adherence rates of 50% or less. Second-line therapies, including MAS and upper airway surgery have variable and unpredictable efficacy. Thus, given the burden of disease, the shortcomings of existing therapies, and the major health and safety consequences of untreated OSA, development of new therapies for OSA is a priority. In recent years there have been major advances in our understanding of sleep apnoea pathogenesis. The concept of pathophysiological phenotyping has emerged. In addition to varying degrees of impairment in upper airway anatomy,

this body of work has identified three key non-anatomical contributors to OSA:

1) impaired upper airway dilator muscle function,
2) a low respiratory arousal threshold and
3) unstable respiratory control [high loop gain].

Identification of these non-anatomical phenotypes, one or more of which are present in ~70% of OSA patients, has unlocked new targets for therapy including pharmacotherapies. Indeed, proof of concept physiology studies that deliver pharmacotherapies to improve impairment in each of the three non-anatomical causes of OSA (in isolation or in combination) using a targeted phenotypic approach have been shown to reduce OSA severity. Inadequate consideration of the heterogeneity of OSA pathogenesis combined with incomplete understanding of the neurobiology for pharmacological targets likely explain why substantial previous attempts to develop pharmacotherapies for OSA in unselected patients have largely failed. This presentation will highlight the latest knowledge in sleep apnoea phenotyping and its crucial role in the development of targeted pharmacotherapies to treat OSA for which there is considerable promise.

Disclosure: DJE is supported by a National Health and Medical Research Council (NHMRC) of Australia Senior Research Fellowship (1116942). His research is funded by the NHMRC and Cooperative Research Centre (CRC) funding programs, a collaboration between the Australian Government, Academia and Industry (Industry partner: Oventus Medical). He serves as a consultant for Bayer.

148 | Cannabinoid receptor modulation in sleep apnea

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Sleep related breathing disorders (SRBD), especially obstructive sleep apnoea (OSA), represent an important worldwide health problem, conferring substantial cognitive/behavioral symptoms and increased risk of motor vehicle accident, hypertension, myocardial infarction, stroke, diabetes and death on at least 3% of the population. Identifying novel treatments for OSA is of great public health significance, because fully effective and acceptable treatments are lacking. Despite basic research advances regarding the pathogenesis of OSA and numerous clinical trials, generally effective drug treatments have not been identified. Over the past two decades a range a basic and clinical studies have supported the hypothesis that increased activity of vagal afferent sensory pathways may importantly increase apnoea propensity during sleep due to both disruption of respiratory rhythm generation and inhibition of motor outputs to upper airway dilator muscles. If correct, this view suggests novel pharmacotherapeutic targets in OSA. For example, vagal sensory neurons express both excitatory serotonin type-3 and inhibitory cannabinoid type 1 and 2 receptors. Studies in an animal model of spontaneous sleep related central apnoea showed that intraperitoneal injection of serotonin dramatically increased apnoea frequency - an effect that could be abolished by pretreatment with dronabinol, a cannabinoid receptor agonist. Further, dronabinol alone suppressed spontaneous apnoeas in a dose-dependent fashion. Moreover, direct injection of dronabinol into the vagal afferent cells of the nodose ganglia yielded a dramatic increase of upper airway dilator muscle activity. The concept of cannabimimetic therapy for OSA has now been translated to clinical proof of concept. Most recently, dronabinol was tested in a phase II randomized, placebo-controlled, fully blinded, parallel groups design in 78 adults with moderate or severe OSA. Again, dronabinol treatment was associated with a clinically significant dose-dependent reduction of apnoea/hypopnea index. Collectively, these findings support the view that cannabimimetic modulation of vagal afferent signaling may prove effective in the treatment of at least some individuals with OSA. Larger pivotal clinical studies will be required to demonstrate the best potential approach(es) to cannabinoid based therapy of OSA.

Disclosure: DWC is an inventor on patents and patent applications related to cannabinoid-based treatment of sleep apnea. These patents and applications have been assigned to the University of Illinois at Chicago which has licensed relevant intellectual property rights to RespireRx Inc. None of the work to be presented or discussed has been sponsored by RespireRx. Within the past year, DWC has served as a consultant to RespireRx and to Jazz Pharmaceutical, Inc.

149 | Carbonic anhydrase activity modulation in sleep apnea

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Current therapy in obstructive sleep apnea (OSA) is mainly mechanical by e.g. positive airway pressure or an oral appliance. Several attempts to identify a pharmacological remedy targeting respiratory drive (directly or indirectly) or upper airway collapsibility have been made but there is yet no clinically documented drug available. Further along these lines, a recent Cochrane review of drug treatment in OSA (2013) stated that there is no currently evaluated substance could be recommended for clinical use. Recent developments in the area of precision medicine and the proposal of specific physiological subtypes of OSA have sparked a renewed interest in the area and lead to initiation of new trials. This presentation will deal with novel insights into the effect of drugs with carbonic anhydrase (CA) inhibitory properties in OSA. Experimental studies suggest that CA activity may be increased in OSA in relation to the severity of the condition. Such elevated activity has also been linked to hypertension in OSA. In line with this data our recent studies suggests that CA inhibitors, which have been used for treatment of high altitude illness and glaucoma, may reduce the number of obstructive respiratory events during sleep and reduce an elevated blood pressure in patients with

OSA and hypertension. Several CA inhibitors have also been shown to possess other potentially beneficial effects in OSA such as drug-induced weight loss. Besides reviewing these specific effects of CA inhibitors, this presentation will address aspects of trial design, definition of efficacy and the potential of future strategies for pharmacological treatment of OSA.

Disclosure: Hoff Erik, Ding Zou: none. Hedner Jan, Grote Ludger, Stenlöf Kaj: 2 patent applications related to the topic

HYPERSOMNIA

O150 | Kleine-Levin syndrome is associated with LMOD3 variants

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Objectives/Introduction: Kleine-Levin syndrome (KLS) is a rare periodic hypersomnia with associated behavioral abnormalities but with often favorable prognosis. There is excess risk of KLS in first-degree relatives, suggesting a strong genetic contribution. So far, no mutation is identified in KLS and comprehensive genetic analysis of affected individuals is lacking.

Methods: We performed whole genome SNP genotyping and exome sequencing in a large family with seven affected members. The identified gene with a mutation was resequenced in 38 sporadic KLS patients and the expression of the gene product was mapped in the mouse brain.

Results: Linkage analysis mapped the disease locus to chromosome 3 and exome analysis identified a heterozygous missense variant in LMOD3 (p.E142D) in the linkage interval. The variant was found to segregate in all affected and one presumably unaffected member of the family. Resequencing LMOD3 in 38 other KLS patients and their families revealed three other low frequency or rare missense variants in 7 cases that were inherited with incomplete penetrance. LMOD3 is expressed in the brain and co-localized with major structures involved in the regulation of vigilance states. LMOD proteins are structural proteins and seem to be developmentally regulated.

Conclusions: Our findings suggest that KLS might be a structural/neurodevelopmental brain disease.

Disclosure: Nothing to disclose.

O151 | ADHD symptoms in H1N1-vaccinated youths with narcolepsy type 1

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Objectives/Introduction: Narcolepsy pathophysiology may include ADHD like symptoms, and high occurrence of ADHD symptoms have been described in narcolepsy. Previous studies have mainly reported from medicated patients, possibly causing underreporting as narcolepsy treatment (stimulants) also target core ADHD symptoms. Norwegian Centre of Expertise for Neurodevelopment Disorders and Hypersomnia (NevSom) has since 2010 followed up patients who developed narcolepsy after 2009 H1N1-vaccinations. This study report preliminary ADHD findings from youths (n = 44 age range 7–20, 63.6% girls) with narcolepsy type 1(NT1).

Methods: Patients were all medication free in a fourteen day period previous to clinical sleep evaluation. ADHD symptoms, as they occurred in the medication free period, were rated by parents on the ADHD Rating Scale. ADHD Rating Scale sum scores were compared with age and gender adjusted population norms. An item scored as occurring either "often" or "very often" were considered an ADHD symptom.

Results: A total of 22/44 youths (50.0%) had ADHD symptoms in a clinical range; 8/16 (50%) of boys and 14/28 (50%) of girls. In all but 2 cases ADHD manifested after onset of narcolepsy. Ten youths (22.7%) had combined type; nine (20.5%) had predominantly inattentive, while three (2.3%) had predominantly hyperactive/impulsive type. A total of 34/44 (77.3%) of youths had at least one ADHD symptom. The most frequently reported inattentive symptoms were "failure to sustain attention" (n = 28, 63.7%), followed by "forgetfulness" (n = 43.2%), and "not follow though" (n = 18, 40.9%). The most frequently reported hyperactive/impulsive symptoms were "fidgets/squirms", "talks excessively", "blurts out ", and "difficulties waiting turn" all n = 12, 27.3%.

Conclusions: Medication free youths with NC1 have high occurrence of ADHD symptoms, especially inattention symptoms, occurring mostly after onset of narcolepsy. This may reflect true comorbidity, symptom overlap between ADHD and narcolepsy, or symptom misinterpretation such as daytime consequences of impaired sleep mimicking ADHD symptoms.

Disclosure: Nothing to disclose.

O152 | Repeated measures of hypocretin-1 level in individuals with narcolepsy type 1 and clinical controls

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Objectives/Introduction: Hypocretin-1 (Hcrt-1) regulates several important homeostatic functions including sleep/wake cycle and arousals. It is a small neuropeptide produced in the lateral hypothalamus. The hcrt-1 level is rather stable in healthy individuals but may variate with seasonal changes. Further, hcrt-1 deficiency causes narkolepsi type 1 (NC1) and measuring hcrt-1 in the cerebrospinal fluid (CSV) is a highly specific and sensitive test in diagnosing NC1. However, it is still not clarified how Hcrt-1 level changes within the individual over time. Therefor we evaluated the changes in hcrt-1 over time in patients diagnosed with NC1 and in clinical controls.

Methods: Individuals previously evaluated for narcolepsy were recruited in a clinical study to validate the diagnosis of narcolepsy including repeating hcrt-1 evaluation. Further, individuals who previously underwent lumbar puncture twice were identified in a register study. All the hcrt-1 results were normalized using the Stanford reference.

Results: We have repeated measures of hypocretin level in 26 patents and clinical controls. Hereof 12 individuals from the clinical study and 14 individuals from the register study. The first measurement (T1): Of the total 26 individuals 8 patients had NC1 with a hypocretin level below 200 pg/ml at T1: 6 had low hcrt-1 level (<110 pg/ml); 2 had intermedia Hcrt-1 level (110 pg/ml< hcrt-1 < 200 pg 7 ml). They all had cataplexy. Thus 18 individuals had a normal hcrt-1 level (>200 pg/ml) at T1. They were grouped as followed: 4 had narcolepsy type 2; 4 had idiopathic hypersomni; 1 had Klein Levin diseases; 1 had sleep apnoea; 5 with normal sleep examinations; 3 without access to further record. The second measurement (T2): One NC1 patient with intermedia hcrt-1 level dropped to low hcrt-1 level (131→31 pg/ml). This patient experienced a worsening of cataplexy, sleepiness and a more fragmented sleep. Two NC1 patients increased in hcrt-1 level (10→131 pg/ml and 10→pg/ml, respectively). In both patints the symptoms were reduced. All individuals with normal hcrt-1 level at T1 had normal hcrt-1 level at T2 (>200 pg/ml).

Conclusions: We found that hcrt-1 level at T1 is fairly stable in clinical controls with normal hcrt-1 level. We forund changes in tree NC1 patients which all were correlated to clinical changes.

Disclosure: Nothing to disclose.

O153 | Sustained attention to response task (SART) shows impaired vigilance versatility in narcolepsy type 1: a simultaneous EEG-fMRI study

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Objectives/Introduction: Narcolepsy type 1 patients suffer from reduced vigilance levels, severely impairing their daytime performance and quality of life. As hypocretin is known to normally project towards neural attention regulation areas, we assessed the capacity of patients to adapt to changes in vigilance demand using a modified Sustained Attention to Response Task (SART), while simultaneously acquiring EEG-fMRI to identify the functional neural correlates underlying patient's vigilance deficits.

Methods: Twelve drug-naïve ICSD-3-diagnosed narcolepsy type 1 patients and 12 one-on-one age- and gender-matched controls completed the SART while simultaneous EEG-fMRI measurements were recorded. During the SART participants were asked to refrain from pressing keys to one in nine stimuli in two difficulty levels, which differed in stimulus duration. Between-group and repeated-measures analyses (to evaluate the effect of increasing vigilance demand) were performed. Outcome measures were average reaction speed of correct presses, percentage of mistakes and d-prime score as a weighted performance indicator correcting the hit-rate for the false alarm-rate.

Results: By switching from medium to high vigilance demand, patients - but not controls - made significantly more mistakes ($p = 0.018$) and had a lower d-prime score ($p = 0.013$). Patients reacted significantly slower than controls in the more difficult level ($p = 0.048$). No significant differences between groups in test performance and within-group average reaction speed between difficulty levels were found.

Conclusions: We conclude that narcolepsy patients tend to react more slowly than healthy controls, explained by their intrinsically reduced reaction speed and as a coping mechanism to improve precision. When vigilance demand increases, patients are unable to further utilise this speed-accuracy trade-off mechanism, indicating that narcolepsy type 1 patients suffer from impaired regulation of vigilance. The modified SART is a reliable vigilance test in an MRI environment. The behavioural results will be presented in the light of EEG/fMRI brain imaging findings.

Disclosure: Nothing to disclose.

O154 | Alternative MSLT cutoffs for diagnosis of pediatric narcolepsy type 1

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Objectives/Introduction: Central disorders of hypersomnolence diagnosis strongly relies on the characterization of daytime sleepiness by MSLT mean sleep latency and number of sleep onset REM periods (SOREMP), while only narcolepsy type 1 (NT1) has an exclusive biological marker (cerebrospinal hypocretin deficiency). Scarce data are available on MSLT in pediatric patients, thus we aimed at validating MSLT in a large population of patients below 18 years old.

Methods: Clinical, neurophysiological (nocturnal polysomnography - PSG, and MSLT), and available biological data (HLA DQB1*0602 positivity, hypocretin levels) of 377 consecutive subjects below 18 years of age evaluated at the Centers for Narcolepsy of Bologna and of Montpellier were collected together with final diagnosis according to the third International Classification of Sleep Disorders criteria (122 subjective hypersomnolence - sEDS, 13 idiopathic hypersomnia, 19 narcolepsy type 2, 9 secondary narcolepsy/hypersomnia, 214 NT1). Best MSLT cut offs were obtained by ROC curve analysis by contrasting among patients with available hypocretin assay (n = 229) those with and without hypocretin deficiency and applied to the whole population.

Results: Hypocretin deficiency was best indentified by a mean sleep latency $\leq$ 8.6 minutes and 2 SOREMPs at the MSLT (area under the ROC curve of 0.950 ± 0.018, $p < 0.00001$). When considering patients' age, the combination of two SOREMPs best identified hypocretin deficiency combined with a mean sleep latency of 10 and of 8.6 min in patients' subgroups with age up to and above 12 years old respectively (area under the ROC curve of 0.959 ± 0.017, $p < 0.00001$). These cut off well identified NT1 in patients without hypocretin assay as well as in the whole dataset.

Conclusions: A mean MSLT sleep latency ≤8.6 min in teenagers or 10 min in patients up to 12 years old combined with 2 SOREMPs is a reliable neurophysiological marker for NT1 in pediatric patients.

Disclosure: Nothing to disclose related to the presented work.

ACUTE OR CHRONIC CAFFEINE CONSUMPTION: WHAT KEEPS YOU AWAKE?

155 | Mechanisms of caffeine's effect on sleep

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Adenosine is an inhibitory neuromodulator that, through pre-and post-synaptic mechanisms, promotes sleep, while caffeine promotes wakefulness. Caffeine is a non-specific adenosine receptor antagonist, preventing thus the sleep-promoting actions of adenosine. Of the four known adenosine receptors (A1, A2A, A2B and A3), the effects on sleep are mediated through A1 and A2A receptors. A1 receptor is inhibitory while A2A receptor is excitatory. Increasing brain levels of adenosine, or administration of adenosine A1 receptor agonists promotes sleep in many species. During sleep deprivation, adenosine levels increase in the cholinergic basal forebrain area, promoting sleep through A1 receptors. However, while caffeine administration to A1 receptor knock-out mice reduced their sleep, administration to A2A knock-out mice had no effect (Huang et al. 2005). This implies that the effects of caffeine are mediated via the excitatory A2A receptors. These receptors have been found on VLPOA neurons, which are sleep promoting, offering an explanation for the finding. This view is supported by the finding that a polymorphism in the A2A receptor gene (ADORA2A) modulates individual sensitivity to caffeine (Retey et al. 2007). Fly studies have suggested non-adenosine receptor-mediated mechanisms for caffeine's effects. Chronic administration of caffeine reduced and fragmented sleep in fruit flies, but mutants lacking fly adenosine receptor had both normal sleep and normal response to caffeine, implying that adenosine receptor is not mediating the sleep effects in flies (Wu et al. 2009). Dopamine is required for the wake-promoting effect of caffeine in the fly, and caffeine likely acts presynaptically to increase dopamine signaling (Nall et al. 2016). Whether such mechanism are limited to non-mammalian species is presently unclear. Huang ZL et al. Adenosine A2A, but not A1, receptors mediate the arousal effect of caffeine. Nat Neurosci. 2005 Nall AH et al. Caffeine promotes wakefulness via dopamine signaling in Drosophila. Sci Rep. 2016. Rétey JV et al. A genetic variation in the adenosine A2A receptor gene (ADORA2A) contributes to individual sensitivity to caffeine effects on sleep. Clin Pharmacol Ther. 2007. Wu MN et al. The effects of caffeine on sleep in Drosophila require PKA activity, but not the adenosine receptor. J Neurosci. 2009.

Disclosure: Nothing to disclose.

156 | Deeper sleep during chronic caffeine consumption in mice

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Caffeine has a well-known impact on sleep and circadian physiology and is one of the most widely consumed psychostimulants. Most laboratory studies available investigated the acute effect of caffeine on sleep. However, in society caffeine is generally consumed chronically on a daily basis. We therefore investigated the acute and chronic effect of caffeinated drinking water on sleep and the electroencephalogram (EEG) in mice. We recorded the EEG and electromyogram on a control day, on the first day of caffeine consumption (acute), and following 2 weeks of continuous caffeine consumption (chronic). In the latter condition, a 6-hr sleep deprivation was conducted during the light period. For extra comparison, an additional control group of mice provided with normal drinking water was also recorded and sleep deprived. We found that caffeine induced contrasting effects following acute and chronic consumption. Over 24 h, waking increased in the acute condition, at the expense of non-rapid eye-movement (NREM) sleep, whereas no changes over 24-hr were found in the chronic condition. In the acute condition EEG slow-wave activity (SWA), a well-known marker for sleep pressure, was significantly reduced. The light-dark amplitude of vigilance states increased in both acute and chronic conditions, with the highest amplitude in the chronic condition, showing an increase in sleep during the light period and an increase in waking during the dark. Furthermore, EEG SWA in NREM sleep was significantly increased during the first half of the light period of the chronic condition, compared to both controls. The sleep deprivation was more challenging and less successful under chronic caffeine. Together with the increased SWA results, this indicates an increased sleep pressure in the chronic condition. In contrast to the traditional conception of the impact of caffeine consumption on sleep, chronic caffeine intake seems to enhance circadian amplitude, improve daily sleep-wake cycles and increase sleep depth. The results will be discussed in the context of chronic daily caffeine consumption in society.

Disclosure: Nothing to disclose.

157 | Acute and chronic caffeine intake and human sleep

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There is general consensus that caffeine can interfere with the quality of sleep. Indeed, the available literature of epidemiological studies and placebo-controlled trials supports the notion that caffeine prolongs sleep latency, reduces total sleep time and sleep efficiency, lowers EEG markers of sleep intensity, and worsens perceived sleep quality (Clark & Landolt, *Sleep Med Rev*, 2017). The studies, however, suggest possible evidence of a dose-response relationship between caffeine intake and sleep quality, and individuals typically respond differently to caffeine based on factors including their age, habitual consumption, and genetic factors contributing to individual sensitivity to sleep disruption by caffeine. Based on this evidence mainly derived from studies investigating acute caffeine effects on sleep, the expected consumption of caffeine in society appears sufficient to interfere with sleep. Nevertheless, insights into the effects of prolonged, chronic caffeine intake and its repercussions on sleep need to be obtained, to fully disentangle the complex relationships between caffeine and sleep. This research is currently very scarce. In this presentation, the present knowledge of acute and chronic caffeine use in humans and its influence on sleep will be summarized, actual research topics and issues will be addressed, and some prospects for future research will be outlined.

Disclosure: The author's research on caffeine is supported by the Swiss National Science Foundation, the University of Zürich, and the Institute for Scientific Information on Coffee (ISIC).

158 | Effects of chronic caffeine consumption and caffeine withdrawal on human waking performance, sleep and brain structure

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Caffeine is the most widely used psychoactive substance worldwide, often consumed on a daily basis. The stimulating properties of caffeine have often been confirmed in so-called caffeine-naïve individuals, particularly during extended wakefulness. However, only little is known about whether the alerting effects of caffeine persist under habitual chronic intake. In our double-blind placebo-controlled crossover laboratory study, volunteers consuming 450 mg caffeine daily (i.e., around 5 cups of coffee) did neither feel more alert nor did they perform better in a vigilance task after a 9-day caffeine-treatment compared to 9 days of placebo. Furthermore, in cerebral blood flow during resting, assessed six hours after caffeine ingestion after 9 days of treatment, we did not observe the prominent reductions, which have been reported after acute caffeine consumption in low- or non-consumers. In contrast, we have first evidence from voxel-based morphometric whole-brain analyses that grey matter in the superior and middle frontal gyrus is reduced after a 9-day caffeine treatment compared to 9 days of placebo. Similar to what has been

reported for slow-wave sleep after a long-term caffeine-treatment, EEG delta activity (0.75–4.5 Hz) during an evening nap did not significantly differ between caffeine and placebo when measured after 9 days of treatment. Interestingly, the effects of withdrawal from a 9-day caffeine consumption period were clearly detectable as indexed by significantly higher sleepiness, worse vigilance performance, increased thalamic cerebral blood flow, higher parietal grey matter density, and higher EEG delta activity during nap sleep compared to placebo. Taken together these data indicate that differences in sleepiness, performance, and sleep delta activity due to chronic daily caffeine consumption are much less pronounced than the negative effects associated with its cessation. Thus, in these variables, daily intake of high doses of caffeine may lead to a progressive reduction in responsiveness to the drug. Furthermore, the observed caffeine-induced differences in frontal grey matter suggest that brain morphology might be changed under conditions of constant long-term caffeine consumption. Importantly, these caffeine-induced grey matter changes seem to be reversible within the range of several days once consumption is discontinued.

Disclosure: Nothing to disclose.

SLEEP IN PSYCHIATRIC DISORDERS

O159 | The role of sleep spindles in procedural memory consolidation in depression

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Objectives/Instruction: There is robust evidence that sleep facilitates the consolidation of procedural memory. In depressed patients, however, sleep-related procedural memory consolidation is impaired. Sleep spindles have been shown to be involved in the off-line processing of simple motor procedural memory during sleep. Neural mechanisms of off-line components of procedural memory in affective disorders, however, remain unclear so far. We investigated the specific influence of sleep spindles on overnight consolidation of a procedural memory task in patients with depression and in healthy controls.

Methods: All participants were trained on a sequential finger-tapping task. Finger tapping performance was estimated by the number of correctly tapped sequences per 30-s trial. The percent increase in mean performance between the last three trials during training on the first day and the first three retest trials on the second day was the measure of overnight consolidation. We examined the influence of spindle activity during the total night and depression on overnight consolidation. Spindles were analyzed automatically using the SpiSOP toolbox (Weber, 2013) over two central channels. Participants included 40 depressed patients (Hamilton Depression Scale >17, 22 female, age: M = 50.1, SD = 8.6) and 40 healthy volunteers (19 female, age: M = 46.8, SD = 10.7) matched for age and gender as control group. All patients were medicated with antidepressants.

Results: Patients showed worse performance on the finger tapping task at the start of the task (F (1, 78) = 11.441, p = 0.001), compared to healthy controls. They did not show, however, any difference in online training effect of the task (F (1, 78) = 0.002, p = 0.963). In contrast, patients showed worse procedural overnight memory consolidation (F (1, 78) = 28.052, $p < 0.000$) than healthy controls. Interestingly, an interaction between spindle density and group on offline overnight memory consolidation approached significance (b = 0.15, SE b = 0.09, β = 3.73, p = 0.09), suggesting that overnight consolidation depends more on the density of sleep spindles in depressed patients as their relation of spindles and consolidation appeared stronger.

Conclusions: Our results suggest that, despite disturbed sleep pattern and general performance and overnight consolidation impairments, depressed patients show a surprisingly strong relation between overnight memory consolidation and sleep spindle activity.

Disclosure: Nothing to disclose.

O160 | Poor sleep and its relation to impulsivity in forensic psychiatric patients with antisocial or borderline personality disorders

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Objectives/Instruction: Studies investigating sleep and personality disorders consistently demonstrate a relation between personality disorders characterized by behavioural disinhibition and/or emotional dysregulation (traditionally termed cluster B personality disorders) and poor sleep. This finding is in line with previous studies associating insomnia with impulsive behaviour, since this is a core characteristic of both antisocial and borderline personality disorder. Both sleep problems and antisocial or borderline personality disorders are highly prevalent in forensic psychiatry. However, studies on the prevalence of sleep disturbances and its relation to impulsive behaviour in forensic psychiatric patients are scarce.

Methods: This cross-sectional study investigates a group of forensic psychiatric inpatients with antisocial or borderline personality disorder or traits thereof. Data will be drawn from an ongoing prospective observational study, monitoring treatment outcomes at the Forensic Psychiatric Hospital in Assen, the Netherlands. Subjective sleep characteristics and impulsivity were assessed with the Pittsburgh Sleep Quality Index (PSQI), the Sleep Diagnosis List (SDL) and the Barratt Impulsiveness Scale (BIS-11), respectively. Poor sleep quality was defined as having a PSQI score >5, whereas chronic insomnia was defined as having a SDL insomnia subscale score >3.

Results: A total of 112 patients was included in the analyses. More than half of the patients (53.6%) report poor sleep quality and 22.3% appears to suffer from severe chronic insomnia. Both poor sleep quality (B = 0.74, $p < 0.01$) and chronic insomnia (B = 5.22, $p < 0.001$) are associated with self-reported impulsivity, in particular with attentional impulsiveness (F (21, 109) = 2.54, $p < 0.001$ for sleep quality; F (44, 67) = 2.03, $p < 0.01$ for insomnia). These associations were not moderated by comorbid psychiatric disorders.

Conclusions: Poor sleep is highly prevalent in forensic psychiatric patients and significantly related to self-reported levels of impulsivity. Actively treating sleep problems in these patients may not only improve sleep quality, mental health and physical wellbeing, but may also have impact on impulsivity-related behaviour by increasing self-control.

Disclosure: Nothing to disclose.

O161 | The influence of genetic variants on sleep and health improvement in adolescents with an eveningness chronotype

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Objectives/Instruction: Genetic variants have been proposed to moderate the effect of both positive and negative environments on mental health outcomes. This may have important implications for identifying predictors of treatment response to psychological interventions. In this study we tested if a cumulative genetic score (CGS) composed of sleep and circadian gene variants moderates the effects of a psychological intervention that targets sleep, circadian dysfunction, and health.

Methods: Adolescents with an eveningness chronotype were randomized to either the Transdiagnostic Sleep and Circadian Intervention for Youth (TranS-C; n = 87) or Psychoeducation (PE; n = 86). Sleep and circadian measures included weekday total sleep time (TST) and bedtime assessed via sleep diary, the Children's Morningness-Eveningness Preferences scale, and dim-light melatonin onset (DLMO). Emotional, cognitive, behavioral, social, and physical health composite risk scores were derived from self-report measures. The CGS was created based on gene variants for PER1, PER2, PER3, ARNTL, AANAT, and CLOCK.

Results: At post-treatment, a higher CGS was associated with less social risk at the trend level (z = −1.93, p = 0.054) whereas a lower CGS was related to more social risk (z = 2.27, p = 0.023) controlling for treatment condition. For participants with a higher CGS, an earlier DLMO was associated with reduced emotional risk (z = 2.03, p = 0.042) and social risk (z = 2.05, p = 0.040) during treatment controlling for treatment condition. Similar findings were obtained for bedtime such that an earlier bedtime was associated with reduced social risk during treatment (z = 2.32, p = 0.020).

Conclusions: The present study provides preliminary evidence that a higher CGS is associated with reduced social risk during treatment. Furthermore, an earlier shift in a marker of the endogenous circadian rhythm was associated with improved emotional and social risk, but only for participants with a higher CGS. Replication is needed, and future research should further examine if genetic variants influence treatment response among adolescents.

Disclosure: Nothing to disclose.

O162 | Synaptic mechanisms of therapeutic sleep deprivation in major depression

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Objectives/Introduction: Major depressive disorder (MDD) is the leading cause for reduced quality of life due to illness worldwide. Therapeutic sleep deprivation presents a unique paradigm to study the neurobiology of MDD. Yet up to now, the neurobiological basis of the rapid antidepressant effect, which is most likely different from today's slow first-line treatments, remains to be determined. We recently integrated two prominent hypotheses of MDD and sleep, the synaptic plasticity hypothesis of MDD and the synaptic homeostasis hypothesis of sleep-wake regulation, into a synaptic plasticity model of therapeutic sleep deprivation in MDD. We further tested this model positing that homeostatically enhancing net synaptic strength through sleep deprivation shifts the initially deficient inducibility of associative synaptic long-term potentiation (LTP)-like plasticity in patients with MDD into a more favorable window of associative plasticity.

Methods: We used paired associative stimulation (PAS), a transcranial magnetic stimulation protocol (TMS), to induce synaptic LTP-like plasticity after one night of therapeutic sleep deprivation in the primary motor cortex of 28 patients with MDD according to DSM-IV criteria (14 men, 14 women, age 40.3 ± 13.0 years).

Results: Consistent with the concept of significantly enhanced LTP-like plasticity in SD responders, we observed an increased inducibility of LTP-like plasticity in clinical responders (>50% improvement on the 6-item Hamilton-Rating-Scale-for-Depression, n = 13) compared to non-responders (n = 15). Specifically, a rm-ANOVA showed a significant effect for the factor Group, no significant effect for the factor Time and a significant Group × Time interaction. Post-hoc t-tests yielded similar MEP amplitudes at baseline and post 1, but significantly higher MEP amplitudes in SD-responders at post 2 (t_{26} = 2.9, p = 0.008) and post 3 (t_{26} = 2.8, p = 0.009).

Conclusions: The results are consistent with the notion that sleep deprivation might act via shifts into a more favorable window of associative LTP-like plasticity in MDD. Further determining the

mechanisms of action of therapeutic sleep deprivation might help to identify novel rapid pathways to treatment for MDD.

Disclosure: Nothing to disclose.

O163 | Let there be (blue-depleted) light in psychiatry

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Objectives/Introduction: Sleep-wake cycle and circadian dysrhythmias are shared features of an acute episode in major mental disorders, and restoration of rhythmicity is associated with recovery. This has stimulated the development of a new psychiatric intensive care unit in Trondheim, Norway, that aims to optimize circadian rhythms in acutely admitted psychiatric patients by using a tunable light system. All light sources in half the unit are depleted of blue light between 18:30 and 07:00 h, whilst the other half has normal lighting at all times. The primary aim of the current study was to test the effect of the blue-depleted light environment on circadian rhythms/melatonin. Secondary aims were to test its effect on sleep, arousal, and to assess the acceptability of the blue-depleted environment. Findings in both aims will be presented.

Methods: In a randomized crossover trial, 12 healthy participants were admitted for 5 days in each light environment, with 1 day break between admissions. Melatonin was assessed using hourly saliva samples collected from 19:00 to 23:00 h, in dim light on day 0, 6 and 12, and in the respective light environments on day 5 and 11. Phase shift of melatonin onset and melatonin suppression in each light condition was estimated from these assessments. The effect of 'condition' on phase-shift and suppression was estimated using a linear mixed model. Sleep was assessed with polysomnography, actigraphy, and a novel radar technology. Arousal was assessed with neuropsychological testing, motor activity, subjective reports, and resting-state electroencephalography. Acceptability was assessed with questionnaires and a color-perception test.

Results: Relative to dim light, melatonin levels were less suppressed in the blue-depleted environment compared to the normal environment 15% versus 45% (p = 0.007). Dim light melatonin onset showed a greater phase advance after the blue-depleted environment (1:45 h versus 0:35 h, $p < 0.001$). Analyses are currently being finalized on secondary outcomes including sleep, arousal and acceptability and will be presented.

Conclusions: This proof-of-principle study demonstrates that it is possible to create a hospital environment that has a meaningful impact on the circadian system, and so far we have not identified any discernable adverse effects.

Disclosure: Nothing to disclose.

EPIDEMOLOGY OF SLEEP

O164 | Sleep duration and mortality-does weekend sleep matter?

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Objectives/Instruction: Previous studies of weekday sleep duration found a U-shaped relationship with mortality. These studies have mainly focused on weekday sleep, but it is possible that weekend sleep may also be of relevance. We here address the association of combined weekday and weekend sleep duration with overall mortality.

Methods: A cohort of 43,880 subjects was followed for 13 years through record-linkages. Cox proportional hazards regression models with attained age as time-scale were fitted to estimate multivariable-adjusted hazard ratios (HR) and 95% confidence intervals (95% CI) for mortality. Additional stratified analyses on age (below and above age 65) were conducted.

Results: Among individuals <65 years, short sleep (£5 hr) during weekends at baseline was associated with a 52% higher mortality rate (HR 1.52; 95% CI 1.15–2.02) compared to the reference group (7 hr), while no association was observed for long (9 or longer) weekend sleep at baseline. When weekday and weekend sleep durations were combined, we observed a detrimental association with consistently sleeping 5 h or less (HR 1.65; 95% CI 1.22–2.23) or 8 h or longer (HR 1.25; 95% CI 1.05–1.50), compared to consistently sleeping 6–7 hr per day (reference group). The mortality rate among participants with short sleep during weekdays, but long sleep during weekends, did not differ from the rate of the reference group.

Conclusions: It was concluded that short, but not long, weekend sleep was associated with an increased mortality in subjects below the age of 65 and that individuals <65 years with short sleep on both weekdays and weekend have an increased mortality, as do individuals <65 years with long sleep on both weekday and weekend.

We suggest that long weekend sleep may reduce the association of short weekday sleep with mortality.

Disclosure: Nothing to disclose.

O165 | Sleep fragmentation in sleep disordered breathing based on a large database (ESADA)

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Objectives/Introduction: Sleep disordered breathing is accompanied by fragmented sleep. Sleep fragmentation can be analyzed by non-linear analysis of sleep stage duration and sleep stage transitions. Both methods require large datasets to systematically address the effects of apnea severity (AHI) and potential confounders like age and gender. It is hypothesized that sleep apnea severity significantly increase sleep stage transition pattern independent of confounders.

Methods: The European Sleep Apnea Database (ESADA) collects data from patients with sleep disordered breathing across Europe. For the purpose of this study sleep scoring data on an epoch-by-epoch basis from standard overnight polysomnography had been assembled (1,118 hypnograms from 11 sleep centers). Subjects were analyzed in groups separated by age (<40, 40–59, >59 years) and by AHI groups (5–14, 15–30, >30 events/hr). Sleep stage transitions were analyzed according to sequences of three epochs.

Results: The duration of wake stages follows power laws and the duration of sleep stages follows exponential laws. Older people had more N1-W-N1 (<40: 4.16%; 40–59: 4.90%; >59: 8.16%) and W-N1-W (<40: 4.64%; 40–59: 5.21%; >59: 35%) sleep stage transitions than the other age groups. Younger people had a more continuous sleep with less transitions from and to wake state which was independent of AHI. Severe AHI had more transitions within light sleep (N2-N1-N2 and N1-N2-N1). Conventional sleep parameters showed less N3 and REM sleep with increasing AHI (e.g. REM for AHI 5–15: 21.2; for AHI>30: 17.9; $p < 0.001$). The pattern of sleep stage transitions varied significantly between sleep centers independent of age and AHI ($p < 0.05$).

Conclusions: Our results in a large scale clinical OSA patient population show that sleep regulation is systematically affected by the degree of sleep apnea, but even more by age. The analysis of sleep stage transitions showed very stable pattern mostly affected by age and center specific sleep scoring practice. It is very important to analyze further the differences in scoring habits between sleep centers. Genetic traits reflected by regional differences or center specific scoring differences may account for these findings and further systematic analysis of this question is required.

Disclosure: The ESADA group has received grants from Weinmann, ERS, University Gothenburg to support the data hosting and consortium meetings.

O166 | Sleep disturbances associated with increased risk of mortality: UK Biobank Study

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Objectives/Introduction: Inadequate sleep has been associated with increased prevalence and incidence of a variety of diseases, including diabetes, cardiovascular disease and cancer. Some characteristics of sleep, such as sleep duration, have also been associated with increased mortality risk. The objective of this analysis was to determine whether sleep disturbances were associated with mortality in a large cohort study in the United Kingdom.

Methods: The UK Biobank is a prospective, population-based cohort study designed to investigate risk factors for major diseases of middle and older age. It enrolled 502,642 participants aged 37–73 years (53% women) from across the UK. Mean follow-up time was 6.5 years. Primary outcomes were all-cause, cancer, and cardiovascular disease (CVD) mortality. Primary exposure was "sleep disturbances", based on the question (asked at the time of enrollment), "Do you have trouble falling asleep at night or do you wake up in the middle of the night". Responses were "never/rarely", "sometimes", or "usually". Cox proportional hazard models were used adjusting for age, sex, smoking, body mass index and depression.

Results: The frequency of sleep disturbances was "never/rarely" for 24.1%, "sometimes" for 47.7% and "usually" for 28.2% of the sample. Compared to those who never/rarely had sleep disturbances, risk of all-cause mortality was significantly higher in those who sometimes (HR 1.07, 95% CI 1.02–1.12) or usually (HR 1.27, 95% CI 1.21–1.34) had sleep disturbances. Risk of cancer mortality was also higher in those who sometimes (HR 1.09, 95% CI 1.02–1.15) or usually (HR 1.24, 95% CI 1.16–1.33) had sleep disturbances. Those who usually had sleep disturbances were also at increased risk of CVD mortality (HR 1.17, 95% CI 1.05–1.30).

Conclusions: Sleep disturbances were common in this middle-aged and ageing cohort; only one-quarter of participants reported never/

rarely having sleep disturbances. Age-adjusted mortality risk was significantly higher in those who reported sleep disturbances. Our findings reinforce the hypothesis that sleep disturbances could have a significant public health impact.

Disclosure: Nothing to disclose.

O167 | Sleep in major psychiatric disorders: results from nationwide SUPER Finland study

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Objectives/Introduction: Persons with major psychiatric disorders have an increased frequency of sleep disturbances. These disturbances include changes in total sleep time, increased sleep onset latency and increased wake time after sleep onset. This study's goal was to describe the sleep disturbances among the different diagnostic, gender and age groups, and to investigate the relationship between sleep disturbances and subjective health among persons with psychotic disorders.

Methods: Altogether, 5,046 persons with a major psychiatric disorder (schizophrenia: 2972, schizoaffective disorder: 640, bipolar disorder: 1097 and psychotic depression: 330) and aged 18–80 participated in a nationwide Super project. The Finnish SUPER (Finnish acronym for "Finnish study on genetic mechanisms of psychotic disorders") study is a part of the international Stanley Global Neuropsychiatric Genomics Initiative. The results were compared with a representative general population sample of 8018 adults (Health 2000). Sleep was evaluated in a self-report questionnaire. The following questions were included: Total sleep time, tiredness (defined as feeling more tired than other people of the same age during day time at least weekly, yes/no), difficulties in falling asleep without sleep medication often or almost every night (yes/no) and early awakenings either often or almost every night (yes/no).

Results: Long sleep (≥10 hr per day) was the most frequent finding compared to the general population ($p < 0.001$ in every diagnostic and age group), especially among young people with schizophrenia and schizoaffective syndrome. Tiredness was the most common sleep-related symptom, with over 40% prevalence in every diagnostic group. Difficulty in falling asleep and increased frequency of awakenings was more prevalent in every psychiatric disorder in patients below 60 years of age ($p < 0.001$), especially among persons with psychotic depression and bipolar disorder. Schizoaffective disorder was in every sleep variable found between schizophrenia and affective disorders.

Conclusions: Sleep disturbances seem to be common in persons with major psychiatric disorders. Tiredness was widely reported in all diagnostic groups. Long sleep was most common in schizophrenia and schizoaffective syndrome and difficulties in falling asleep and early morning or night awakenings in affective psychoses. More research is needed on factors affecting and possibilities to treat sleep disturbances in major psychiatric disorders.

Disclosure: Nothing to disclose.

O168 | Seasonal differences in obstructive sleep apnea severity. Results from the European Sleep Apnea Database (ESADA)

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Objectives/Introduction: Several internal and external factors, including sleep stage, body position, anthropometrics, comorbidities and ambient temperature, are suggested to produce ultradian or circadian changes in obstructive sleep apnea (OSA) severity. The current analysis addressed the possibility of circannual OSA severity changes in the large ESADA study cohort derived from more than 30 sleep laboratories across Europe.

Methods: We included 20,996 patients (age 52.6 ± 13, BMI 31.4 ± 7, apnea/hypopnea index (AHI) 27.8 ± 25, oxygen desaturation index (ODI) 24.3 ± 25, mean SaO2 93.1 ± 3) from the ESADA cohort. Data was adjusted for recording month and the Koeppen-Geiger climate classification (http://koeppen-geiger.vu-wien.ac.at) for the geographical location (Bsk, Cfa, Cfb, Csa, Dfa and Dfb) of the study sites ($n = 28$). Variations of AHI and ODI across month of the year were tested by ANOVA. Means for AHI and ODI according to month were calculated with general linear models (GLMs) adjusting for age, BMI, gender and climate zone.

Results: The mean AHI and ODI varied significantly according to month of the year ($p = 0.004$ and $p = 0.009$, respectively, ANOVA). The mean number of patients per month ranged from 1483 (July) to 1914 (January). The factor 'month of the year' independently predicted AHI and ODI ($p = 0.009$ and $p = 0.012$, respectively, GLM). The mean adjusted AHI extremes were 26.5 n/hr (September) and 29.1 n/hr (December) corresponding to a 10% difference. The

corresponding numbers for ODI were 26.8 n/hr (August) and 24.1 n/hr (September), 11%.

Conclusions: The severity of sleep disordered breathing showed a circannual variation which was independent of important confounding factors including climate zone. Our data suggest that traditional sleep apnea risk factors as well as environmental factors influence the degree of sleep disordered breathing across the year. A further in-depth analysis of such factors is warranted.

Disclosure: The first author receives travelling grants from VitalAire and Linde-Healthcare.

RLS

169 | Brain iron metabolism and its effects on brain neurocircuitry in RLS

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Brain iron deficiency (BID) is the best-established biological abnormality in RLS with 11 imaging studies, two ultra-sound studies, two cerebrospinal fluid studies and several clinical studies showing iron treatment benefit for all RLS with or without peripheral iron deficiency. Only two of the research studies failed to find brain iron deficiency, possibly type 2 errors related to sample size or methods. BID produces several significant CNS effects, e.g. Dopamine receptor balance change favouring D1, hypoxic pathway activation, decreased myelination and hypoadenosinergic, hyperglutamatergic and hyperdopaminergic states. BID increase of striatal dopaminergic activity is particularly surprising given the treatment benefits of dopamine agonists, but this BID effect occurs in animals and is documented in CSF and imaging studies of RLS patients. The BID increase in hypoxic-inducible factor-1 (HIF-1) relates to increase in striatal tyrosine hydroxylase (TH) and dopamine production. The dopamine receptor and transporter changes also support dopamine increase. BID not only increases striatal dopamine but also exaggerates the normal dopamine circadian pattern. These BID dopaminergic changes provide a biological basis for the circadian pattern of RLS symptoms and for the major clinical problem of RLS augmentation. BID has a complicated impact on Adenosine receptors that overall decreases brain adenosine activity significantly affecting sleep patterns. The BID in substantia nigra relates specifically to the periodic limb movements of sleep, the motor sign of RLS. This may impact pathways involving the thalamus, cortex and spine. BID also produces decreased myelination particularly for the corpus callosum, anterior cingulum and prefrontal gyrus possibly related to some of the RLS cognitive deficits. Overall, BID accounts for four major features of RLS: dopamine responsive, circadian pattern, sleep disturbances and periodic limb movements. BID also provides a basis for development of iron treatments for RLS. IV iron appears needed to increase peripheral levels enough to alter brain iron. Pre-clinical studies showed IV iron increased brain iron in regions with iron deficiency without increasing iron where there was no deficit thus producing no iron overload. This supports both utility and safety of IV iron for treating RLS.

Disclosure: I have consulting services and clinical research funding from Luitpold pharmaceutical and research funding from AMAG pharmaceuticals.

170 | Balance-shift of spinal dopamine receptors during long-term treatment. A possible mechanism for augmentation

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Restless Legs Syndrome (RLS) is a highly prevalent chronic sensorimotor disorder that severely disrupts sleep, affects quality of life, and usually requires lifelong treatment. It is identified by patient-subjective sensory features ("urge to move"), but clinical outcome measurements usually assess more readily quantifiable motor functions associated with RLS (periodic leg movements during sleep, PLMS). Dopamine receptor agonists, in particular those targeting the inhibitory (*Gi*-coupled) dopamine (DA) D3 receptor subtype (D3R), have shown fast and significant relief from RLS and PLMS symptoms in the clinic and decrease spinal reflex amplitudes and increase thermal pain withdrawal latencies in the animal model. However, over time these prolonged D3R agonist treatment therapies cause a worsening of the symptoms (augmentation). We have mimicked this outcome in mice, and we found that blockade of excitatory (*Gs*-coupled) D1 receptor (D1R) function in such "augmented" animals restored the favourable effects of the prolonged D3R agonist treatment. Our data indicate that the mechanisms leading to augmentation in RLS patients after long-term use of the currently used dopamine receptor agonists may be related to a D3R-induced upregulation of the D1R system. As such, our model can be used to assess the interactions between D3R and D1R and unravel the mechanisms that lead to augmentation and serve as a platform for the development of new pharmacological strategies for the treatment of both RLS and augmentation.

Disclosure: Nothing to disclose.

171 | Hypoadenosinergic state as a driving force leading to hyperdopaminergic and hyperglutamatergic states in RLS

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Restless legs syndrome (RLS) is a common sensorimotor disorder, whose basic components include a sensory experience, akathisia,

and a sleep-related motor sign, periodic leg movements during sleep (PLMS), both associated with an enhancement of the individual's arousal state. The present review attempts to integrate the major clinical and experimental neurobiological findings into a heuristic pathogenetic model. The model also integrates the recent findings on RLS genetics indicating that RLS has aspects of a genetically-moderated neurodevelopmental disorder involving mainly the cortico-striatal-thalamic-cortical circuits. Brain iron deficiency (BID) remains the key initial pathobiological factor and relates to alterations of iron acquisition by the brain, also moderated by genetic factors. Experimental evidence indicates that BID leads to a hyperdopaminergic and hyperglutamatergic states that determine the dysfunction of cortico-striatal-thalamic-cortical circuits in genetically vulnerable individuals. However, the enhanced arousal mechanisms critical to RLS are better explained by functional changes of the ascending arousal systems. Recent experimental and clinical studies suggest that a *BID-induced hypoadenosinergic state*provides the link for a putative unified pathophysiological mechanism for sensorimotor signs of RLS and the enhanced arousal state. Downregulation of adenosine A1 receptors determines the hypoadenosinergic state, that can lead to the hyperglutamatergic and hyperdopaminergic states involved in PLMS and akathisia and the mechanism of activation of the arousal systems. In fact, we have previously shown that adenosine receptors localized in the cortico-striatal terminals play a very significant role in the modulation of striatal glutamate and indirectly dopamine release. Inhibitors of adenosine transporters, such as dipyridamole, counteract the hyperglutamatergic and hyperdopaminergic states and preliminary data indicate that they can provide a new therapeutic approach for RLS.

Disclosure: Nothing to disclose.

172 | The search for new therapeutic targets

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Although dopamine agonists are effective agents for the short-term treatment of restless legs syndrome//Willis-Ekbom disease (RLS/WED), their main long-term complication is augmentation of RLS symptoms, that is, an overall increase in symptom severity. If not stopped, augmentation can become a serious complication, as it will eventually progress and can lead to discontinuation of treatment. Studies show that after a treatment period of approximately 10 years, the prevalence of augmentation nears 50%. Furthermore, given that RLS is frequently a chronic disease it is likely that with protracted treatment, the risk of augmentation will increase even further. In light of this, there is a clinical need for treatment alternatives to dopaminergic drugs.

Brain iron deficiency (BID) is considered a main initial pathophysiological mechanism in the development of RLS. Recent studies have shown that BID in rodents is associated with a hypoadenosinergic state, with down-regulation of adenosine A_1receptors (A1R) in the striatum. Furthermore, down-regulation of A1R could explain the other two main alterations found in the pathophysiology of RLS, which are the presynaptic hyperdopaminergic and hyperglutamatergic states. So far, the main therapeutic alternative to dopaminergic medication have been alpha-2 delta ligands (gabapentin, pregabalina). These drugs probably exert their therapeutic effects by reduction of glutamatergic release. Furthermore, our group has shown that perampanel, an antagonist of glutamatergic AMPA receptors, also improves RLS symptoms.

Given the presumed A1R down-regulation in RLS patients, it could be hypothesized that an increase in adenosinergic function might help to alleviate symptoms. However, a direct targeting of A1R by means of A1R agonists does not seem a therapeutic option at present since they cause significant peripheral cardiovascular effects. On the other hand, equilibrative nucleoside transporters (ENT1) constitute an alternative therapeutic target, since, under normal conditions, they promote the uptake of adenosine from the extracellular space, thus keeping a relative low endogenous tone of adenosine. Hence dipyridamol, which blocks reuptake of extracellular adenosine by ENT, has shown promising therapeutic effects in a recent study.

In light of the existing interconnections between adenosine, glutamate and dopamine in corticostriatal pathways, we will discuss additional future therapeutic targets.

Disclosure: Dr. G-B has received research grants from MSD and Xenoport.

TRANSCUTANEOUS CARBON DIOXIDE DURING SLEEP IN SLEEP-DISORDERED BREATHING: THE REVERSE SIDE OF THE COIN

173 | Transcutaneous carbon dioxide during sleep-disordered breathing

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Primary stimulus for eupneic breathing during sleep comes from pCO2 while pO2 is relevant mainly during hypoxia. Development of obstructive sleep-disordered breathing is a gradual process, which usually begins with minor upper airway flow-limitation and later develops into full obstruction. Despite the fact that CO2 is major respiratory controller, the number of studies on sleep-disordered breathing (SDB) reporting pCO2 values is relatively limited. During sleep it is useful to determine the eupneic pCO2 level as that will be the target for ventilation. It is also common to determine the apneic threshold for pCO2 and pCO2 level that triggers arousal may also be found above eupneic levels. We were interested to see how the transcutaneous carbon dioxide (tcpCO2) measurement would

perform during different SDB types. In terms of inspiratory flow-limitation the tcpCO2 levels increase as the level of obstruction worsens. If the flow-limitation stabilizes, the tcpCO2 assumes level that is above eupneic pCO2. If so happens that inspiratory flow-limitation occurs below eupneic CO2 levels, these events are not characterized with increased efforts whereas flow-limitation occurring above the eupneic level is, along with the appearance of snoring due to increased efforts to keep the airway open. Central apneas are characterized with the loss of effort that comes from crossing the apneic threshold, whereas during the obstructive apnea and hypopnea the effort remains throughout the event. As expected, with tcpCO2 the central apneas are characterized with lowest values relative to wakefulness or eupneic breathing during sleep. Hypopnea and obstructive sleep apnea assume tcpCO2 values that are (on average) at eupneic levels or slightly below. Since the tcpCO2 measurement has an inherent delay, these results were calculated from a sequence of events. In conclusion, SDB events are characterized with different levels of tcpCO2, information which could be useful when different treatment options are considered. Elevated levels of pCO2 associated with inspiratory flow-limitation and increased effort are not currently detected as the disease severity is determined mainly with apnea-hypopnea-index (AHI) and oxygen desaturation index (ODI).

Disclosure: Nothing to disclose.

THE RELATIONSHIP BETWEEN BRAIN OSCILLATIONS DURING SLEEP, NEUROPLASTICITY AND STROKE

174 | Perilesional induction of sleep slow waves improves motor recovery after ischemic stroke

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Introduction: Sleep-wake disturbances are frequent after stroke and are associated with poorer rehabilitation and long-term outcomes. Clinical and experimental studies suggest a favourable effect of sleep on post-stroke neuroplasticity and functional recovery. Here, we investigate the role of sleep Slow Wave (SW)-like oscillations on motor recovery following ischemic stroke using optogenetic and *in vivo* electrophysiology techniques in mice.

Methods: Ischemic stroke was induced in wild type mice via middle cerebral artery occlusion (MCAO). Different optogenetic opsins were targeted to pyramidal neurons using local infusion of CamkII-ChR2-EYFP (ChR2) CamkII-ArchT-EYFP (ArchT) and CamkII-mCherry (control) adeno-associated viruses (AAV) within the peri-lesional primary somatosensory forelimb (S1FL) cortex. Optical stimulations were designed to mimic SW-like bistability during sleep during the recovery period. Optogenetic SW-like were delivered daily (2 hr/day, at ZT 09:00) starting on post-stroke day 5 until day 15. Behavioural tests were conducted on post-stroke days 4, 7, 10 and 15 to assess the effect of optogenetically-evoked SW on motor outcomes.

Results: We showed that MCAO induced an increased amount of NREM sleep ($n = 5$, t-test, $p < 0.05$) following ischemic stroke, where ipsilesional SW where longer in duration compared to control animals ($n = 5$, t-test, $p < 0.05$) We showed that both optogenetic activation (ChR2, $n = 7$) and silencing (ArchT, $n = 7$) of pyramidal neurons within the per-lesional S1FL cortex successfully induced SW-like bistability in ipsilesional and contralesional cortical electroencephalography (EEG) recordings. Next, we showed that chronic optogenetic induction of SW-like bistability, predominantly during NREM sleep, significantly improved the recovery of fine motor movements (two-way ANOVA, $p < 0.05$) as compared to control mice ($n = 7$). Interestingly, the induction of SW-like bistability post-stroke did not affect strength or symmetry of movements.

Conclusion: Our findings showed that optogenetically-induced SW-like bistability through manipulation of peri-lesional pyramidal neurons activity significantly improves functional outcomes after stroke. In line with the literature, our results suggest a positive role of sleep in motor recovery following ischemic stroke.

Disclosure: Nothing to disclose.

NARCOLEPSY

175 | Is cataplexy a dissociated state of paradoxical (REM) sleep? Role of glutamatergic neurons of the sublaterodorsal nucleus in a mouse model of narcolepsy type 1

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Narcolepsy type 1 is a chronic neurologic disorder characterized by an excessive daytime sleepiness and episodes of cataplexy. Cataplexy is characterized by a bilateral loss of muscle tone during wakefulness, and triggered by a strong and generally positive emotion, without loss of conciousness. This symptom has long been described as a REM sleep dissociated state because the muscle atonia phenotype observed during cataplexy resembles the characteristic muscle atonia of REM sleep. This supposes that a common neuronal network underlies REM sleep and cataplexy muscle atonia, however it has never been demonstrated.

To test this hypothesis, we abolished the glutamatergic transmission in the sublaterodorsal tegmentum nucleus (SLD) -responsible for REM Sleep atonia (Garcia Valencia et al, 2016)- in narcoleptic Orex-KO mice, using short-hairpin RNA method (shRNA) directed against the vesicular transporter 2 of glutamate. Mice were injected with

the experimental (shGlut; $n = 9$) or control (shCtrl; $n = 6$) AAV, locally in the SLD. After 8 weeks necessary for an efficient expression, mice underwent 48 hr of baseline recordings followed by a protocol of cataplexy induction with chocolate.

As expected, blockage of the SLD glutamate transmission induced episodes of REM sleep without atonia in shGlut mice. However, cataplexy was not reduced in its total amount or bouts number, in shGlut mice compare to shCtrl, and this during Baseline condition or after cataplexy-induced protocols (Mann Whitney, $p = 0.82$).

To conclude, these data altogether suggest that cataplexy does not rely on the activation of glutamate SLD neurons, and that cataplexy is not a dissociated state of REM sleep into wakefulness. Uncovering the neuronal network supporting cataplexy phenotype is thus of great importance for the development of future innovative treatments.

Disclosure: Nothing to disclose.

MOLECULAR AND CELLULAR MECHANISM OF SLEEP HOMEOSTASIS

176 | Ca2+-dependent hyperpolarization pathway in sleep homeostasis

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A primary goal of sleep research is to understand the molecular basis of sleep. To address this challenge, we combined mathematical analysis and comprehensive KO study. We constructed a simple computational model of an averaged neuron, which recapitulates the electrophysiological characteristics of the slow-wave sleep and awake states. Comprehensive bifurcation analysis of an ensemble of more than 1,000 models predicted that a Ca2+-dependent hyperpolarization pathway may play a role in slow-wave sleep and hence in sleep-time regulation. To experimentally validate the prediction, we performed a comprehensive KO study and succeeded in identifying eight genes playing a role in sleep-duration regulation (Kcnn2, Kcnn3, Atp2b3, Cacna1g, Cacna1h, Camk2a, Camk2b, and Nr3a), which suggests that the Ca2+-dependent hyperpolarization pathway may play a role in sleep-duration regulation. In addition, we further simplified our computational model and obtain a model with five channels and a pump. By combining a comprehensive bifurcation against this simplified model and KO study, we found that impairment of the leak K+ channel (Kcnk9) decreased sleep duration. Based on these results, we hypothesize that the Ca2+-dependent hyperpolarization pathway and leak K+ channels cooperatively regulate sleep duration in mammals.

Disclosure: Nothing to disclose.

177 | Long- and short-term molecular consequences of sleep loss in mice

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Numerous studies in a variety of species, including humans and mice, have investigated the effects of sleep loss on gene expression under a variety of experimental protocols. With few exceptions, the effects of this intervention on the transcriptome has been assessed immediately after a period of enforced wakefulness and were then contrasted to the matching time-of-day under undisturbed *ad lib* sleep conditions, precluding the assessment of the dynamic changes during the sleep deprivation (SD) and the longer term repercussions during recovery sleep and how these dynamics compare to those observed under undisturbed conditions. Here we present data on an extensive RNA-seq (gene expression) and ATAC-seq (chromatin accessibility) study in C57BL/6J male mice for which we sampled cortex and liver tissue over a 72 hr period during baseline (ZT0, −3, −6, −12, and −18), during a 6 hr SD deprivation (ZT0, 3-, and −6), during 48 hr recovery (ZT12, −18, −0, −6, −12, −18, −0, −6), and, finally, 2 time points 1 week after SD (ZT0 and −6; a total 18 time points, $n = 3$/time point). Transcriptome dynamics were classified according to 5 models including a strictly circadian model (with and without SD effect on amplitude), a strictly homeostatic model (sleep-wake driven; based on EEG data obtained in a separate cohort of mice), and 2 combinations thereof. The study confirmed the earlier reported immediate-early gene pathways being up-regulated immediately after SD which we show to quickly revert to basal levels. We also found evidence of pathways affected by SD with much slower dynamics outlasting the SD effects on sleep and the EEG. Moreover, the amplitude of several components of the core clock machine machinery were markedly blunted during recovery sleep. The ATAC-seq results revealed numerous genomic sites, mostly concerning intronic or intergenic regions, for which chromatin accessibility was changed immediately by SD; i.e., 3 and 6 hr into the SD, but these changes reverted to basal level within 12 hr of recovery. Analyses of the motives under the affected chromatin regions for transcription factor binding sites pointed to key transcription factors important for driving the expression of the rapidly induced transcripts.

Disclosure: Nothing to disclose.

178 | The gating of sleep by motivated behavior

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As humans, we often defy sleepiness and stay awake when attention is necessary, but also experience an inescapable desire to

sleep in boring situations. The brain mechanisms governing the regulation of sleep by cognitive and emotional factors are not well understood. We recently reported that a part of the brain that is associated with motivation and pleasure - the nucleus accumbens (NAc) - also can produce sleep (Oishi et al., Nat Commun, 2017). We used chemo-genetic and optical techniques to remotely control the activities of NAc neurons that express adenosine A_{2A}receptors (A_{2A}R), also known as indirect pathway neurons. As a result, we discovered that NAc A_{2A}R neurons projecting to the ventral pallidum have an extremely strong ability to induce sleep that is indistinguishable from the major component of natural sleep, known as slow-wave sleep, when activated. Inhibition of these neurons prevents the sleep induction but does not affect the homoeostatic sleep rebound. Interestingly, motivational stimuli inhibit the activity of ventral pallidum-projecting NAc A_{2A}R neurons and suppress sleep. Our findings may explain why we have the tendency to fall asleep in the absence of motivating stimuli, i.e., when bored. Caffeine, the most widely consumed psychostimulant in the world, produces its arousal effect also in the NAc by blocking A_{2A}R. Therefore, the classic somnogen adenosine is a strong candidate for evoking the sleep effect in the NAc.

Disclosure: Nothing to disclose.

SLEEP IN CHILDREN AND ADOLESCENTS

O179 | Sleep mediates the association between school pressure, physical activity, screen-time and psychological distress in adolescents

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Objectives/Instruction: This study examines the mediating role of sleep duration and sleep difficulties on the association between screen-time, school pressure, physical activity and psychological distress in adolescents.

Methods: Data were retrieved from 49,403 children (13.7 ± 1.6 years old, 48.1% boys) from 12 countries participating in the WHO 'Health Behaviour in School-aged Children' study conducted in 2013/2014. Psychological distress (feeling low, irritability or bad temper, feeling nervous), school pressure, physical activity (number of days/week 60 min moderate-to-vigorous), screen-time behaviors (TV, gaming, other purposes), sleep duration on week- and weekend days and sleep difficulties (perceived difficulties in getting asleep) were assessed using a validated self-reported questionnaire. Multilevel mediation analyses were conducted using the statistical program R.

Results: School pressure (ref. 'none'; 'some' B = 0.40, p = 0.01; 'a lot' B = 0.86, p = 0.01) and screen-time (B = 0.04, p = 0.001) were positively associated with psychological distress, while physical activity (B = −0.02, p = 0.002) was negatively associated. Except for sleep duration in the association between physical activity and psychological distress, all associations were significantly mediated by sleep duration on week- and weekend days and sleeping difficulties. Percentages mediated ranged from 2.84% to 21.16% for sleep duration on weekdays, from 0.66% to 4.49% for sleep duration on weekend days and from 24.60% to 34.13% for sleeping difficulties.

Conclusions: These results explain partly how school pressure, screen-time and physical activity is related to mental wellbeing. Future interventions improving adolescents' mental wellbeing could target schoolwork, physical activity and screen-time, as these behaviours are directly and indirectly (through sleep) related to psychological distress.

Disclosure: Nothing to disclose.

O180 | Tracking infant development: Links between sleep-wake behavior and gut bacteria beta-diversity

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Objectives/Instruction: In the first year of life infants' sleep regulation undergoes rapid maturation towards more consolidated, nocturnal sleep. Simultaneously, the community of gut bacteria (GB) inhabiting the digestive tract increases in diversity and complexity. Increasing evidence from animal and human adult research suggests a bi-directional relationship between sleep regulation and GB composition. However, little is known about this relationship in the developmental period of early human life.

Methods: Sleep behavior was assessed longitudinally in healthy infants using ankle actigraphy (Geneactiv) and 24-hr sleep-wake diaries (n = 83.3 months, n = 76.6 months, n = 36.12 months). *Total Sleep Duration* (per 24 hr), *Fragmentation* (of night time sleep/h), *Bedtime variability* and *% Night Sleep* (of total sleep duration) were quantified based on 7.0 ± 2.1 (M ± SD) days by adapting a previously published algorithm (Sadeh et al., 1995) and integrating 24-hr diaries. Fecal samples were collected from which total genomic DNA was extracted and subjected to high throughput 16S rRNA gene (V3 region) amplicon sequencing. Operational Taxonomic Units were constructed with UPARSE pipeline using the Greengenes (13.8) 16S rRNA gene collection as reference. Behavioral developmental status was quantified using the parent-reported Ages and Stages Questionnaire (composite score).

Results: Sleep and GB composition were not related at 3 mo, yet a significant relationship was found at 6 mo between *% Night Sleep* and GB beta-diversity ($p = 0.04$), partially explained by *Bifidobacterium* prevalence. At 12 months, *Fragmentation* was linked to GB beta-diversity ($p = 0.03$), revealing a positive association with *Bacteroides* and a negative association with Lachnospiraceae prevalence. Interestingly, at the same age, the sleep variable *Fragmentation* was also linked to behavioural developmental status ($r = -0.32$, $p = 0.06$). In addition, *Bedtime Variability* was associated with GB beta-diversity ($p = 0.02$) specifically showing a positive association with *Bifidobacterium longum* ($p < 0.001$), yet a negative association with other *Bifidobacterium* species ($p = 0.008$).

Conclusions: These findings uncover an interplay between infant sleep and GB, throughout the maturational period of the first year of life, specifically with the genera *Bifidobacterium* and *Bacteroides*. We propose a simultaneous maturation of sleep regulation and GB composition, but future studies should examine the directionality of this link.

Disclosure: Nothing to disclose.

O181 | Sleep in infancy and its relation to the symptoms of attention-deficit and hyperactivity disorder at age 5 years: a longitudinal study

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Objectives/Introduction: There are cross-sectional population-based studies and meta-analysis indicating that sleep difficulties are associated with cognitive and behavioral problems. It is not well studied, however, how the early sleep in infancy is related to later development. The aim of this study was to identify whether parent reported short sleep duration, night awakenings and sleeping difficulties during the first years are associated with ADHD-related symptoms at age 5.

Methods: The study is based on a longitudinal CHILD-SLEEP birth cohort comprising altogether >1,600 families from the Pirkanmaa area, Finland, with several measurement points. For this study, we used the information regarding maternal questionnaires during pregnancy and two sleep questionnaires, the Brief Infant Sleep Questionnaire (BISQ) and the Infant Sleep Questionnaire (ISQ) filled out by the parents when the child aged 3, 8, 24 months and 5 years. ADHD-related symptoms at age 5 were assessed using the Strengths and Difficulties Questionnaire (SDQ) and Five-to-Fifteen (Viivi) questionnaires. The final sample included 605 children with measurements at all time points.

Results: In order to examine the effects of sleep problems on ADHD-related symptoms, logistic regression analysis was conducted. Infant's age, gender, mother's educational level and number of children were included as covariates. Our main results showed that short sleep at 3 months of age predicted inattentiveness at age 5 ($p < 0.01$). Further, short sleep and sleep difficulties at age of 24 months increased the risk for having inattentive symptoms at age 5 ($p < 0.05$; and $p < 0.001$, respectively). Moreover, 5-year-old children with current sleep difficulties had increased risk for hyperactivity ($p < 0.001$) and inattentiveness ($p < 0.001$). Number of night awakenings were also associated with hyperactivity ($p < 0.01$) and inattentiveness ($p < 0.01$) at that age.

Conclusions: Sleep problems at early childhood were associated with later occurring ADHD-related problems. More specifically, short sleep at age 3 months was associated with inattentiveness at 5 years old. Short sleep and sleep difficulties at 24 months increased the risk for having inattentive symptoms at age 5 years. Our findings indicated that altered developmental pathway of sleep quality occurs early in infancy among the children who would later have ADHD-related difficulties.

Disclosure: Nothing to disclose.

O182 | Later school start times alleviate sleep deprivation and social jetlag in adolescent high school students

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Objectives/Introduction: School starts between 7 and 8 am in many countries. While this early start is in line with the normally early circadian phase of younger students, it clashes with the often late circadian phase and thus extremely late bedtimes of adolescent students. Consequently, adolescents accumulate a substantial amount of sleep loss over the school week and suffer from „social jetlag". This can impair their health, cognitive performance and career prospects. Nonetheless, early school start times for adolescents are largely maintained - for a scarce body of evidence that delaying them alleviates the problem.

Methods: We therefore monitored changes in sleep, circadian rhythms and grades, when in February 2016 a high school near Aachen (Germany) introduced "flexi time", allowing senior students to choose daily between an 8- or 9-am-start. Using actimetry and sleep diaries, we followed 93 students aged 15–19 for 3 weeks before and 6 weeks into the flexi-system, obtaining high-quality data from 39 and 65 students, respectively. In February 2017, we conducted a 1-year-follow-up in which 106 students aged 15–21 kept a sleep diary for 6 weeks (overlap with 2016: 41). 2016-data (presented below) were analysed using paired t-tests, Wilcoxon Signed-Rank Test and Cohen's d at a significance level of .05.

Results: In our 2016-study, nearly all participants benefited from a 9-am-start compared to an 8-am-start according to both subjective and objective sleep measures. Independent of chronotype, participants slept on average one hour longer on 9-am-days since sleep onset remained unchanged but sleep offset became significantly later. We also observed that students with short sleep duration at baseline benefited more compared to students with longer sleep duration. On 9-am-days, participants reported to use the alarm clock less often, to feel more concentrated and motivated, and to sleep and learn better. Social jetlag was significantly reduced in the flexible system because weekend sleep timing was advanced.

Preliminary results from our follow-up study corroborate these findings. A longitudinal analysis of grades will shed light on whether this translates to a change in academic performance.

Conclusions: Based on our findings and feedback from teachers and students we recommend later school start times for adolescents.

Disclosure: TR is founder of Chronsulting UGmbh, consultant to Condor Instruments LTDA, Consultant to Vanda Pharmaceuticals, Consultant to jetlite GmbH, consultant to HiPP-Werk Georg Hipp OHG, consultant to Reset Therapeutics, Inc.

O183 | Sleep-dependent memory consolidation in children with high-functioning autism spectrum disorder

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Objectives/Introduction: Sleep supports memory consolidation in both adults and children. Disturbed sleep during childhood may crucially alter cognitive development. Autism spectrum disorder (ASD) is accompanied by alterations in both cognition and sleep and preliminary evidence suggests that deficits in sleep-dependent memory consolidation due to sleep disturbances may underlie some of the cognitive deficits. Thus, the current study aimed to investigate if sleep is altered in children with ASD and if these alterations are linked to impairments in sleep-dependent memory consolidation.

Methods: In a counterbalanced within-subjects design we tested memory retention across a nocturnal sleep and a daytime wake interval in twenty-one children with ASD and twenty age (9–12 years) and IQ matched typically developing (TD) controls. Three different memory tasks were used that focus on abstraction of information: gist-based false memories, emotional memories, explicit knowledge of an implicitly learned serial reaction time task. Sleep was assessed using standard polysomnography.

Results: Contrary to our predictions, children with ASD did not show any specific impairment in sleep-dependent memory consolidation. They generally performed worse (independent of retention interval) than the TD children in the recognition of emotional memories (Group main effect: $p < 0.001$), the correct recall of words in the false memory task ($p = 0.014$), and trend wise in the explicit sequence knowledge in a serial reaction time task ($p = 0.080$). Interestingly, children with ASD showed a sleep-dependent benefit for recalling gist-based false memories that was not observed in the TD children (Group × Condition: $p = 0.012$). Although parents reported more sleep disturbances in children with ASD compared to children without ASD ($p < 0.001$) none of the objectively assessed sleep parameters differed significantly between groups.

Conclusions: Thus, even though, we confirmed a general deficit in memory performance in children with ASD, sleep-dependent memory consolidation and abstraction processes seem to be preserved. We propose that sleep might have a compensating function in children with ASD.

Disclosure: Nothing to disclose.

O185 | Sleep-dependent memory consolidation enhancement from childhood to adolescence is related to developmental changes in sleep spindles and slow oscillations

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Objectives/Introduction: The precise interplay between slow oscillations and sleep spindles is supposed to orchestrate sleep-dependent memory consolidation. This interplay during which sleep spindles are nested within the slow oscillations up-states deteriorates from young adulthood to old age. The period with the most rapid and drastic changes to sleep spindles and slow oscillations however, is during puberty. Here we investigated the development of sleep spindles and slow oscillations from childhood to adolescence and whether these changes benefit sleep-dependent memory consolidation.

Methods: Our longitudinal, within-subject design comprised four ambulatory full-night polysomnographies recorded in 36 healthy participants (24 female). We recorded the first two nights during childhood (age range 8–11 years) and the second two nights during adolescence (age range 14–18 years). At both times, participants had to recall previously learned word pairs before and after sleep. Slow oscillations and sleep spindles were automatically detected at central electrodes during non-rapid eye movement sleep.

Results: We found that both, slow oscillation up-state duration ($t(32) = -2.65$, $p = 0.012$, $d = -0.68$) and fast spindle density

(t (32) = −10.71, $p < 0.001$, d = −1.22) increased from childhood to adolescence. Furthermore, Spearman correlations (corrected for age difference) revealed that not only the developmental extension of the slow oscillation up-state (rs (30) = 0.40, $p = 0.022$), but also the developmental increase in fast spindle density (rs (30) = 0.55, $p = 0.001$) correlated positively with enhanced sleep-dependent memory consolidation.

Conclusions: Our results suggest that brain development from childhood to adolescence lead to prolonged slow oscillation up-states and increased fast spindle density. These developmental changes were found to be related to enhanced sleep-dependent declarative memory consolidation. The prolonged up-state could provide a wider timeframe in which memories can be potentiated by fast spindles during sleep. Not only do these results support the key role of slow oscillations and sleep spindles for memory consolidation from a developmental perspective, but they also hint at a qualitative change of slow oscillation-spindle-coupling during puberty, which we are currently investigating.

Disclosure: Nothing to disclose.

O186 | During day and night: childhood psychotic-like experiences and nightmares

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Objectives/Instruction: Psychotic-like experiences are auditory and visual perceptive phenomena, such as hearing or seeing things that are not there or delusional thoughts, in the absence of a psychotic disorder. Psychotic-like experiences commonly occur in the general pediatric population and predict the onset of severe mental illness. They have been associated with sleep problems, but studies with objective sleep measures are lacking. This study assessed whether psychotic-like experiences were associated with actigraphic sleep measures, symptoms of dyssomnia, nightmares, or other parasomnias.

Methods: This cross-sectional population-based study was embedded in the Generation R Study. Sleep was assessed using a tri-axial wrist accelerometer in $N = 814$ children, who wore the accelerometer for five consecutive school days. At age 10 years, psychotic-like experiences were assessed by self-report, dyssomnia and parasomnia symptoms were reported by both child and mother. The analyses were adjusted for age, sex, ethnicity, gestational age, maternal educational attainment and psychiatric problems, and additional for child's concurrent psychopathology.

Results: Self-reported psychotic-like experiences and hallucinatory phenomena were not associated with objective sleep duration, sleep efficiency, or arousal. However, psychotic-like experiences and hallucinatory phenomena were associated with self-reported dyssomnia (respectively, B = 1.22, 95% CI: 0.77–1.67, $p < 0.01$; B = 1.25, 95% CI: 0.61–1.89, $p < 0.01$) and mother-reported parasomnia, specifically nightmares (respectively, $OR_{adjusted} = 5.30$, 95% CI 2.91–9.66, $OR_{adjusted} = 2.99$, 95% CI 1.37–6.55).

Conclusions: Childhood psychotic-like experiences hallucinatory phenomena were not associated with objective sleep measures. In contrast, psychotic-like experiences were associated with nightmares, which are a known risk-indicator of psychopathology in preadolescence. More research is needed to shed light on the potential etiologic or diagnostic role of nightmares in the development of psychotic phenomena.

Disclosure: The funders had no role in the study design, data collection, analysis, interpretation of the data, or writing of the report. F.C.V. is the contributing editor of the Achenbach System of Empirically Based Assessment, from which he receives remuneration. For the other authors, no competing financial interest were reported.

O187 | Slow wave activity topography predicts development of brain myelin in children

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Objectives/Introduction: Sleep is an essential contributor to neurodevelopmental processes: insufficient sleep results in behavioral malfunction in cats, rodents and flies. While epidemiological research in humans reveals negative cognitive, emotional and psychosocial consequences of poor sleep in early life, pediatric longitudinal studies are lacking that quantify the physiological underpinning of these observations, i.e. sleep neurophysiology and structural brain maturation. We investigated correlational relationships between maturational markers in sleep EEG topography at preschool-age and brain myelin content 3.5 years later.

Methods: 9 healthy children underwent all-night sleep hdEEG at T1 (age 2.4–8.0 years, mean 4.7 years) and again at T2 (age 6.0–12.2 years, mean 8.8 years). The maturational status of slow wave activity topography was quantified as Frontal/Occipital (F/O) ratio of slow wave activity (1–4.5 Hz) in predefined clusters of 2*5 electrodes in the first 60 min of NREM sleep. mcDESPOT-MRI was obtained at T2 to quantify white matter myelin microstructure (myelin water fraction, MWF).

Results: F/O-ratio at T1 predicted whole-brain MWF at T2 ($R = 0.89$, $p = 0.001$, partial correlation with factor "age" $R = 0.75$,

p = 0.03). At T2, F/O-ratio was only linked to whole-brain MWF when corrected for age, showing a negative relationship (R = 0.18, p = ns, partial R = –0.84, p = 0.008). In other regions of interest, F/O-ratio was only a weak (at T1, Superior Longitudinal Fasciculus, R = 0.8, p = 0.1, partial R = 0.64, p = 0.08; at T2, p = ns, partial R = –0.86, p = 0.006) or else no correlative predictor for MWF (Corpus Callosum, Optic Radiation, p = ns).

Conclusions: The topographical distribution of slow wave activity (F/O ratio) in children is an early marker for whole brain myelin development. This preliminary finding supports the concept that sleep not only reflects, but also predicts brain myelin maturation. These findings make two important contributions, in (1) unraveling possible factors shaping the brain connectome, and (2) informing about longitudinal associations of sleep and myelin in childhood, which is relevant for translational avenues of mental health.

Disclosure: Nothing to disclose.

O188 | Beneficial effects of a lifestyle intervention program on C-reactive protein: impact of cardiorespiratory fitness in obese adolescents with sleep-related disorders

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Objectives/Introduction: Lifestyle modification is an adjunct therapy for obstructive sleep apnea (OSA) in obese youths but its effects on inflammation are not well understood. This study assessed the relationship between inflammation and OSA and whether the lifestyle program (LIP) effects on inflammatory markers are mediated by changes in anthropometric parameters, cardiorespiratory fitness, sleep duration and sleep-related breathing disorders in severe obese adolescents.

Methods: Participants were aged of 14.6 ± 1.2 years, with a body mass index (BMI) of 40.2 ± 6.5 kg/m^2. Sleep, investigated by ambulatory polysomnography, anthropometric parameters, glucose metabolism, inflammatory profile and cardiorespiratory fitness were assessed at admission and at the end of a 9-month LIP. $V\dot{O}_{2peak}$ was expressed relative to the body weight; $V\dot{O}_{2peakBW}$ (ml/min/kg), and to the fat-free mass; $V\dot{O}_{2peakFFM}$ (ml/min/kg$_{FFM}$). Associations between C-reactive protein (CRP) concentrations and BMI, sex, oxygen desaturation index (ODI), sleep fragmentation, total sleep time (TST) and $V\dot{O}_{2peak}$ were assessed via ANCOVA.

Results: Twenty-three subjects completed the study. OSA-subjects (n = 13) exhibited higher CRP concentrations and a trend for higher BMI than N-OSA (p = 0.09) at admission. Post-intervention, obstructive apnea-hypopnea index did not change but CRP and leptin levels significantly decreased while adiponectin concentrations increased in the OSA-group and overall population. OSA was normalized in 6 subjects (46%). At admission, BMI adjusted for sex, arousal index, ODI, TST and $V\dot{O}_{2peakBW}$ was associated with CRP levels (adjusted r^2 = 0.32, $p < 0.05$). Decrease in CRP concentrations post-intervention was explained by enhanced $V\dot{O}_{2peakFFM}$ adjusted for sex, weight loss and changed sleep parameters (adjusted r^2 = 0.75, $p < 0.05$).

Conclusions: Despite higher amounts of CRP in OSA-subjects, obesity overpasses the pro-inflammatory effects of sleep-related disorders and low cardiorespiratory fitness and explains systemic inflammation at admission of a LIP. Although the program did not normalize OSA in every subject, levels of CRP and adipokines were improved in overall population although these concentrations remain alarming. Finally, the decrease of inflammation is mediated by enhanced cardiorespiratory fitness related to fat-free mass, after controlling for sex, weight loss and changes in sleep parameters. In view of the long-term health implications of obesity and OSA, further studies are needed to better explore the relationship between fitness and inflammation in obese adolescents with sleep-related breathing disorders.

Disclosure: Nothing to disclose.

O188a | The impact of a teacher-led, classroombased, sleep education programme on adolescent sleep in UK schools: the Teensleep study

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Objectives/Instruction: Insufficient sleep during adolescence associates with poorer physical and emotional health. The National Sleep Foundation (NSF) recommend a healthy sleep duration of 8–10 hr yet weeknight sleep duration in adolescents around the world has shown a steady decline over the past century. Numerous movements are championing the delay of school start times to increase weekday sleep durations. However, UK schools start around 9 am, significantly later than other countries. Sleep education is a promising alternative mechanism for change. Therefore, the Oxford Teensleep project sought to evaluate if adolescent sleep could be improved through a teacher-led sleep education programme.

Methods: The Teensleep programme was taught to Year 10 (14–15 years) students in ten UK schools over one term. The 10-lesson programme consisted of teacher and student workbooks supported by PowerPoints. Teachers received a half-day training session on the

materials. Lessons were designed to be interactive and discursive covering sleep science, sleep hygiene, and stress management. Students were asked to complete the Sleep Condition Indicator (SCI; n = 694), Munich Chronotype Questionnaire (MCTQ; n = 347) and a sleep knowledge quiz (n = 779). A subgroup of students completed 2-weeks' sleep monitoring (actigraphy: n = 84; diary: n = 77). All measures were completed before and after the intervention.

Results: Sleep knowledge ($p < 0.001$) and sleep quality (SCI) ($p < 0.001$) improved. Students classified as having probable insomnia (SCI) at baseline (n = 113) showed a significant improvement in sleep quality ($p < 0.001$) with 52% moving out of this classification post-intervention. Subgroup weekday sleep duration did not significantly change following the intervention (diary = 7:51 hr, actigraphy = 7:02 hr) but survey sleep duration (MCTQ) improved (07:41 hr) (p = 0.026). Notably, sleep duration remained below NSF guidelines. Subgroup diary weekday sleep onset (p = 0.018) and wake after sleep onset (p = 0.018) significantly improved. There was no change in chronotype or degree of social jetlag.

Conclusions: This was the first sleep education study in the UK and the largest to use both pseudo-objective and subjective measures. This study highlights how teacher-led sleep education alone may be sufficient to improve sleep in those with insomnia symptoms. However, additional interventions to address the biological delay may be required to increase sleep duration to NSF recommendations for all students.

Disclosure: Nothing to disclose.

SLEEP IN AGING AND DEMENTIA

O189 | Association of circadian sleep-wake regulation and brain structure in older adults: a multi-modal approach

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Objectives/Introduction: The temporal organization of sleep and wakefulness evolves throughout the lifespan, leading to an increased sleep-wake fragmentation with ageing. However, how circadian aspects of sleep-wake regulation relate to brain structure during ageing is not known. We aimed at exploring whether grey matter volume and surface measures are associated to an electrophysiology-derived index of circadian sleep-wake regulation.

Methods: Eleven older participants (55–75 years; 7 men) underwent a 40-hr multiple nap protocol encompassing 10 nap periods. Nap sleep efficiency over the circadian cycle was obtained with polysomnography and used as an index of circadian sleep-wake promotion. The difference between the sleep ability during the night and day sleep, here called circadian sleep amplitude (CSA) was taken as an indicator of circadian integrity. T1-weighted brain scans were analysed with two complementary approaches: Voxel-Based Morphometry (VBM) to extract total grey matter volume, and Surface-Based Morphometry to extract total cortical thickness.

Results: Contrary to our hypothesis, a correlation analysis revealed that grey matter volume was negatively associated with CSA (r^2 = 0.385, p = 0.042), while cortical thickness was not significantly correlated. Remarkably, grey matter volume was also negatively associated with cortical thickness (r^2 = 0.454, p = 0.023). Since VBM fails to properly detect folding structures inside the brain, we calculated the local gyrification index for each participant using a surface-based morphometry approach. We observed that the mean of local gyrification indices across the brain showed a trend for a positive correlation with CSA (r^2 = 0.324, p = 0.067).

Conclusions: Despite the small sample size, our data suggest that a less folded brain has more "visible" grey matter detectable with the VBM approach, explaining the negative link between grey matter volume and cortical thickness but also with CSA. The results highlight the necessity of analysing surface indices in addition to volumetry. Within this context, our data suggest that a more "folded" brain, an index of brain fitness at older age, is associated with circadian integrity and should be considered in models linking sleep-wake regulation to brain ageing. Future region-based analyses of brain surface indices will be performed.

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O190 | Impact of intraocular cataract lens replacement on circadian rhythms and sleep in older adults

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Objectives/Introduction: Aging is associated with a progressive decline in light transmission due to the clouding and yellowing of the natural crystalline lens, particularly for shorter blue-light wavelength. The downstream effects of aging lens include reduced photic input to the circadian clock, with subsequent long-term disruption of the circadian system and sleep regulation. Importantly, these

age-related circadian and sleep effects are exacerbated in clinical ocular pathologies, particularly in cataract patients. Here, we investigated whether lens replacement (intra-ocular blue-blocking, BB, or UV-only blocking) in older cataract patients increases the effects of light on the circadian system and improves sleep.

Methods: Sixteen healthy older participants and thirteen post-cataract surgery patients (eight with BB lens, five with UV lens), matched by age and sex (55–75 years; 8 women per group), underwent a randomized within-subject crossover design with 3 in-laboratory protocols. Each protocol was 1-week apart, and comprised 1.5 hr of dim light, 1.5 hr of dark adaptation, followed by 2 hr of evening light exposure to polychromatic light at 6,500 K (blue-enriched) or 2,500 K or 3,000 K (both non-blue enriched).

Results: In comparison to healthy older individuals, cataract patients with lens replacement had significantly greater melatonin suppression during light exposure (BB and UV lens) and immediately after (UV lens), a hallmark of circadian photosensitivity (interaction "time" vs. "group": $F = 4.7$; $p < 0.001$). With respect to sleep regulation, UV patients had increased all-night non-rapid eye movement (NREM) slow-wave sleep ("group": $F = 4.5$; $p = 0.02$) and more NREM sleep slow-wave activity (SWA: 0.75–4.5 Hz) ("group": $F = 3.1$; $p = 0.03$) following light exposure. Furthermore, SWA dynamics, a functional index of homeostatic sleep pressure, was significantly higher during the first NREM-REM sleep cycle in UV patients as compared to BB patients and healthy older individuals (interaction "time" vs. "group": $F = 1.3$; $p = 0.02$).

Conclusions: Our data indicate that lens replacement, particularly UV-only blocking intra-ocular lens, in older cataract patients may increase the effects of light on the circadian system, with greater melatonin suppression, and improve sleep, as indexed by more SWS and NREM SWA. Ultimately, optimizing the spectral lens transmission of photic signals to the circadian clock and sleep regulatory mechanisms may minimize the adverse circadian and sleep effects associated with aging lens.

Disclosure: Nothing to disclose.

O191 | Pain, depression, dementia and their association with sleep in nursing home patients - a cross-sectional study

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Objectives/Introduction: Previous research suggests a positive association between pain, depression and sleep. In this study, we aim to investigate how sleep correlates with varying levels of pain, depression and dementia in nursing home (NH) patients.

Methods: Cross-sectional study based on sleep-related data (as measured with actigraphy for seven consecutive days), derived from two independent multicenter studies conducted in Norway; the COSMOS trial ($n = 83$) and DEP.PAIN.DEM trial ($n = 106$). The following inclusion criteria applied for the COSMOS trial: NH patients ≥65 years of age, with life expectancy >6 months, not diagnosed with schizophrenia. In short, the following inclusion criteria applied for the DEP.PAIN.DEM trial: dementia according to the *Mini Mental State Examination* (MMSE ≤ 20) and depression according to the *Cornell Scale for Depression in Dementia* (CSDD ≥ 8). In both studies, pain was measured with *Mobilization-Observation-Behavior-Intensity-Dementia-2 Pain Scale (MOBID-2)*, depression with *CSDD* and various levels of cognitive function with *MMSE*. We investigate the following sleep parameters: sleep onset latency (SOL), wake after sleep onset (WASO), early morning awakening (EMA), total sleep time (TST), sleep efficiency (SE), and daytime total sleep time (DTS).

Results: The linear regression predicting SE showed that being in pain was associated with increased SE ($p < 0.01$) Furthermore, being in pain and degree of dementia were both associated with reduced WASO ($p < 0.01$ and $p < 0.05$, respectively) and increased TST ($p < 0.01$ and $p < 0.05$, respectively). Severe dementia was associated with reduced TST ($p < 0.05$). Being in pain was associated with more DTS ($p < 0.01$). No statistical significant associations were found regarding depression and the measured sleep parameters.

Conclusions: We found that being in pain was associated with increased SE, TST and reduced WASO. Pain was also associated with increased DTS. Furthermore, our results showed that more severe dementia was associated with reduced TST. This implies that being in pain was associated with better sleep, as measured with actigraphy. This may be attributed to inactivity because of pain, which in turn may be registered as sleep with actigraphy. However, the underlying mechanisms remain unclear, and future research should explore this further.

Disclosure: Nothing to disclose.

O192 | Sleep, orexin and β-amyloid metabolism in obstructive sleep apnea syndrome and Alzheimer's disease

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Objectives/Introduction: Alzheimer's Disease (AD) is featured by cerebral β-amyloid plaques deposition; orexin has been demonstrated interfering with β-amyloid metabolism in AD pathology. Obstructive Sleep Apnea Syndrome (OSAS) is associated with pathological changes of cerebral β-amyloid dynamics. This study aimed at

investigating CSF β-amyloid and orexin levels in OSAS patients compared to AD patients and controls.

Methods: In this observational study, OSAS and AD patients were included and compared to a group of controls. All patients and controls underwent lumbar puncture for assessing CSF levels of β-amyloid$_{40}$ (Aβ_{40}) and β-amyloid$_{42}$ (Aβ_{42}), tau proteins and orexin, and polysomnography (PG) to evaluate nocturnal sleep architecture.

Results: We included 20 OSAS, 10 AD, and 10 controls. OSAS patients showed higher CSF orexin levels than AD and controls ($p < 0.05$), and AD patients showed higher CSF orexin levels than controls ($p < 0.05$). Moreover, OSAS patients showed lower CSF Aβ_{40} levels than AD and controls ($p < 0.05$), and AD patients showed lower CSF Aβ_{42} levels than OSAS ($p < 0.01$), who in turn showed lower CSF Aβ_{42} levels than controls ($p < 0.05$). Sleep macrostructure was similarly altered in OSAS and AD patients; in particular, the alteration of sleep quality, efficiency, and continuity was evident in both OSAS and AD patients compared to controls. Considering the correlation analysis, CSF β-amyloid levels correlated with apnea-hypopnea index in OSAS patients ($R = -0.46$, $p < 0.05$), while CSF orexin levels correlated with CSF AD biomarkers and sleep architecture changes in AD patients.

Conclusions: This study documented the alteration of CSF orexin levels and β-amyloid metabolism in OSAS patients. Sleep apneas correlated with the alteration of CSF β-amyloid metabolism in OSAS patients. We suppose that orexinergic system dysregulation and β-amyloid pathology may be present in OSAS patients and related to sleep dysregulation and intermittent hypoxia. This evidence further supports the current hypothesis that OSAS may possibly start AD neurodegeneration.

Disclosure: Nothing to disclose.

O193 | Arousals during sleep are associated with brain tau and amyloid-β burden in healthy older adults

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Objectives/Introduction: Arousal during sleep are deemed to reflect poorer sleep quality. Their impact on brain function and brain structure is however not established. In addition, accumulating evidence support a strong link between sleep-wake dysfunction and the pathogenesis of Alzheimer's disease (AD), including the abnormal accumulation of amyloid-β (Aβ) and tau protein in the brain. Here we investigated whether arousals during sleep are associated with Aβ and Tau burden in healthy aging. We also addressed whether these arousals are related to specific cognitive impairments.

Methods: Forty-one healthy and cognitively normal older individuals (aged 51–69; mean 59 ± 5; 30 females) were included in the protocol. We recorded their night time sleep in the laboratory under EEG and assessed Aβ and tau protein burden during two Positron Emission Tomography (PET) scans, respectively with 18F-flutemetamol and 18F-THK 5351 radiotracers. Validated automatic arousal detection was computed on all EEG recordings. All participants completed an extensive cognitive battery of neuropsychological tasks to assess memory, attentional, and executive functioning while well-rested.

Results: Generalized linear mixed models analyses revealed that the total number of arousals detected during sleep was significantly associated with whole-brain tau burden ($p = 0.018$), and with whole-brain Aβ burden ($p = 0.02$), even when correcting for age, sex and education. Further analyses showed that sleep macrostructure parameters such as sleep onset latency, wake after sleep onset, sleep efficiency or percentage of each stages were not significantly associated to whole-brain F18-THK 5351 or F18-flutemetamol intake values. Interestingly, memory performance showed a trend ($p = 0.07$) for an association with total number of arousals.

Conclusions: These findings suggest that arousals during sleep are strongly linked to whole-brain AD pathophysiology. They suggest that sleep arousals are key correlate of Tau and Aβ brain burden in healthy aging. Additionally, more arousals could be associated with lower memory performance, an essential feature of AD. The possibility will be verified after the inclusion of additional subjects. These results cast new light on the association between sleep and AD pathophysiology.

Disclosure: Support: FNRS,ULiège,ARC17/21-09,FEDER,WBI,Clerdent Foundation C. Berthomier, P. Berthomier and M. Brandewinder have ownership and directorship in Physip, and are employees of Physip.

O194 | Sleep efficiency and electroencephalographic patterns in midlife are associated with cognitive change over the adult life course

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Objectives/Introduction: Disrupted sleep is a contributing factor to cognitive aging, while also being associated with major neurodegenerative disorders. Little is known, however, about the relation of sleep and the gradual positive or negative cognitive changes over the adult life course. Patterns in the sleep electroencephalogram (EEG) are potential markers of the cognitive progress.

Methods: To test this hypothesis, we assessed the sleep architecture and sleep EEG of 167 men born in the Copenhagen Metropolitan Area in 1953, who – based on individual cognitive testing from early (~18 years) to late adulthood (~58 years) – were divided in 85 subjects with negative and 82 with positive cognitive change over their adult age span. As part of a Center for Healthy Aging (University of Copenhagen) study, participants underwent standard polysomnography including manual sleep scoring between 2009 and 2013. Features of sleep stage distribution were combined with a number of EEG features to distinguish between the two groups: EEG rhythmicity was assessed by spectral power analysis in frontal, central and occipital scalp sites. Functional connectivity was measured by inter-hemispheric EEG coherence. Group-differences were assessed by analysis of covariance ($p < 0.05$) including completed level of formal education as covariate. Significant features were combined in a machine learning approach to estimate their discriminative usability.

Results: Subjects with cognitive decline exhibited lower sleep efficiency, reduced inter-hemispheric functional connectivity during rapid eye movement (REM) sleep, and slower EEG rhythms during stage 2 non-REM sleep. While none of these measures passed as stand-alone features, the combined effects discriminated the two groups with an accuracy of 72% (sensitivity 75%, specificity 67%).

Conclusions: In conclusion, the study demonstrates the potential of combined sleep and electrophysiological measures as signs of cognitive changes. Ongoing medical screenings of the cohort are required to identify subjects progressing from cognitive decline to severe neurological disorders. These future investigations will need to confirm the demonstrated potential of sleep disruptions as strong indicators of a possible later development of a neurodegenerative disorder.

Disclosure: Nothing to disclose.

O195 | A polysomnographic sleep and resting state fMRI connectivity study in the general population

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Objectives/Introduction: With aging, sleep patterns change and sleep problems become more common in elderly persons. There is increasing evidence that impaired sleep is associated with structural brain characteristics, but less is known about the link with functional brain connectivity. We investigated the association of sleep with functional connectivity of the brain in an observational setting.

Methods: In 630 participants from the population-based Rotterdam Study we investigated cross-sectional associations of polysomnographic and subjective sleep aspects with resting-state functional connectivity during daytime. We investigated both resting-state correlations and BOLD-signal amplitude, on a global, network, and nodal level, defined by ICA. Analyses were adjusted for age, sex and other potential confounders.

Results: Longer total sleep time (TST) was associated with lower mean signal amplitude on a global brain level (Beta = –0.023, 95% CI –0.041; –0.004, $P_{FWE\text{-}corrected} = 0.01$). Regionally, this effect was driven by multiple resting-state networks and remained significant in the ventral attention network after correcting for multiple testing (Beta = –0.049, 95% CI –0.075; –0.023, $P_{FWE\text{-}corrected} = 0.001$). The effect of TST was mainly accounted for by shorter duration of rapid eye movement (REM) and N2 stages, but not stage N3. Moreover, this relation between longer TST and lower amplitude seemed particularly apparent in persons with good subjective sleep quality. We found no associations of sleep and resting-state correlations between and within networks, or between nodes.

Conclusions: In this cross-sectional, population-based study, longer TST was related to a lower amplitude of low-frequency fluctuations in BOLD-signal during daytime, in multiple resting-state networks. This relation is driven by stages N2 and REM, and extends beyond homeostatic, night-to-day effects. Sleep may facilitate the repertoire of low-frequency fluctuations during daytime, or, vice versa, daytime brain activity in the low-frequency range may influence (a need for) sleep.

Disclosure: Nothing to disclose.

O196 | Changes in slow waves density: a matter of aging and sex or an inaccurate detection?

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Objectives/Introduction: Starting at the age of 40, reduced slow wave density (number SW/min in NREM) and amplitude are commonly observed. Considering the amplitude criterion to detect SW (peak-to-peak amplitude [Ap] >75 μV; negative amplitude [An] >40 μV), the age-related decrease in SW density could be due to a reduction in SW amplitude and not to a decline in the capacity to generate SW per se. Moreover, women show higher SWS and delta power across age groups, but it remains a matter of debate whether the aging process differentially influences men and women. Therefore, we developed a data-driven approach to derive age- and sex-specific SW amplitude criteria, enabling more valid comparisons between age and sex groups.

Methods: Two-hundred seven healthy adults, young (N = 97, 52 women, 23.8 years old) and middle-aged (N = 110, 61 women, 57.5 years old), participated in one night of sleep recording. An algorithm was used to detect SW in central derivations (C3–C4) during NREMs sleep on artefact-free, filtered (−3 dB at 0.3 and 4.0 Hz) signal. SW were detected using very low criteria (Ap > 9 μV; An > 5 μV). From the young adults, a signal-to-noise ratio (SNR) was computed using the "signal" (SW with Ap > 75 μV and An > 40 μV) and "noise" (spurious SW with Ap < 75 μV or An < 40 μV) for men (SNR = 0.07) and women (SNR = 0.08). Combined to this SNR, a ratio between Ap and An (75:40) was used to determine the final criterion for middle-aged men (Ap = 61.5 μV; An = 32.5 μV) and women (Ap = 68.5 μV; An = 36.5 μV). ANOVAs were performed to assess age and sex effects with standard SW detection or SW SNR-detection.

Results: When applying the standard SW detection, middle-aged adults showed lower SW density compared to young adults (main age effect: $F_{(1,203)}$ = 70.851, $p < 0.0001$) and women had a higher SW density than men (main sex effect: $F_{(1,203)}$ = 13.836, $p < 0.0001$). Similar results were obtained with the SW SNR-detection, e.g., main age ($F_{(1,203)}$ = 15.216, $p < 0.0001$) and sex effects ($F_{(1,203)}$ = 5.831, p = 0.017).

Conclusions: Using a data driven SW detection, age- and sex-related differences remain despite a lower amplitude SW detection criterion in the middle-aged participants. Our results are in favor of age- and sex-related decline in SW generation capacity rather than an artefact of the detection amplitude criteria.

Disclosure: Nothing to disclose.

O197 | Change in sleep duration at retirement: a longitudinal study using objective assessments

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Objectives/Introduction: Retirement is an important life event, but relatively little is known about how sleep changes during the retirement transition. Previous studies have reported longer sleep duration following retirement, and gender differences in the change, but measure sleep duration using self-reports. In contrast, the current study uses day-to-day wrist actigraphy to investigate changes in sleep duration during the retirement transition, with a particular focus on week day and weekend sleep patterns.

Methods: In this ongoing study, 117 participants aged 60–70 years have been recruited from the Swedish Longitudinal Survey of Health (SLOSH) while still in paid work. During one week – approximately 6 months before their planned retirement date – the participants wore a wrist actigraph and filled out daily sleep and wake diaries. After 12 months, the participants were followed up for a second week using the same procedure. Using actigraphy, complemented by information from the sleep diaries, average total sleep duration per night, averaged over 7 days, was calculated. Sleep durations were also calculated for weekdays and at the weekend (nights prior to Saturday and Sunday) separately. Changes in sleep duration before and following retirement were calculated. Data from all participants who have so far completed both baseline and follow-up (n = 58) were analysed with regression analysis.

Results: Mean sleep duration per average night increased by 23 min ($p < 0.001$, 95% CI: 17–30). Following retirement, sleep duration during the week increased by 31 min ($p < 0.001$, 95% CI: 22–40), but the increase at the weekend was not significant at the 95% significance level (8 min, p = 0.121, 95% CI: −2 to 19). Differences between males and females were not significant at the 95% significance level.

Conclusions: This study suggests that after retiring from work, sleep duration increases, particularly on weekdays. To our knowledge, this study is the first to use a longitudinal design and apply actigraphy to measure changes in sleep duration before and after retirement. The findings support prior results using subjective sleep measures which show increased sleep duration after retirement.

Disclosure: Nothing to disclose.

O198 | Objectively measured sleep disturbances are associated with reduced microstructural integrity of white matter. A prospective cohort study in middle-aged and older persons

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Objectives/Introduction: Poor sleep affects cognition; moreover, sleep loss may destabilize axonal integrity and deteriorate white matter. In particular, older adults are at risk for both sleep problems and structural brain changes, but the temporal relation between these two processes is poorly understood. Previous neuroimaging studies of sleep have been small, cross-sectional, and mostly based on self-reported sleep. Therefore, we investigated the associations between actigraphically measured sleep and repeatedly measured white matter microstructural integrity.

Methods: We studied 1201 middle-aged and older adults (57.5 ± 6.8 years, 55% women) from a population-based prospective cohort study. Total sleep time (TST, hr), sleep onset latency (SOL, min), wake after sleep onset (WASO, min), and sleep efficiency (SE, %) were measured at baseline using a wrist-worn actigraph. White matter microstructural integrity was measured twice (average interval of 5.8 years (3.9–10.8)) with diffusion tensor magnetic resonance imaging to quantify global and tract-specific fractional anisotropy (FA) and mean diffusivity (MD). Longitudinal associations were explored with linear mixed models adjusted for mental and physical health parameters.

Results: Higher WASO was prospectively associated with decreased global FA (B_{min} = −0.003, 95% CI: −0.005, −0.001) and increased global MD (B_{min} = 0.002, 95% CI: 0.0004, 0.004). Correspondingly, higher SE was associated with increased global FA ($B_{\%}$ = 0.01, 95% CI: 0.002, 0.01) and decreased MD ($B_{\%}$ = −0.01, 95% CI: −0.01, −0.0004) values across follow-up. Longer TST was associated with increased global FA (B_{hr} = 0.06, 95% CI: 0.01, 0.12), but not with MD. SOL was not associated with white matter microstructural integrity. Global findings were driven by lower FA and/or higher MD in the cingulum, anterior forceps of corpus callosum, and several projection and association tracts.

Conclusions: This is the first study showing a temporal relation between objective sleep indices and white matter microstructure in middle-aged and older adults. Longer periods of wake after sleep onset and a corresponding lower sleep efficiency, are prospectively associated with reduced white matter microstructural integrity in middle-aged and older persons. Tracts projecting to the orbitofrontal cortex, cingulum, corticospinal, thalamocortical and interhemispheric connections seem most sensitive to sleep disturbances. Sleep disturbances may thus be a potentially modifiable risk factor for microstructural changes of white matter in the aging brain.

Disclosure: Nothing to disclose.

JOINT SYMPOSIUM ESRS – SSSSC

199 | Dreaming and consciousness

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Dreaming is a form of consciousness that occurs during sleep, while we are functionally disconnected from the environment. Traditionally, dreaming has been linked to REM sleep, a behavioral state characterized by fast, desynchronized electroencephalographic activity similar to wakefulness. In recent years however, it has become clear that dreaming can also occur in NREM sleep, in which EEG activity is dominated by slow waves and spindles. This has challenged the understanding of the neural correlates of conscious experiences in sleep. In the present talk I will present a series of studies in which we investigated the neural correlates of dreaming using a serial awakening paradigm and high-density EEG recordings. We found that dreaming, irrespective of sleep stage, is associated with a local reduction of low-frequencyactivity in posterior cortical régions in both REM and NREM sleep. By monitoring brain activity in these regions in real time, we were able to predict the presence or absence of dreaming in NREM sleep with a high accuracy. This local EEG correlate may thus account for the presence of conscious experiences in two behavioral states (REM and NREM sleep) with radically different global EEG signatures. In addition, we found that specific dream contents were associated with localized high-frequency increases within these posterior cortical areas. Finally, dream recall seems to be heralded by the presence of arousal-related EEG changes. Taken together, these results provide noninvasive measures that could represent a useful tool to infer the state of consciousness during sleep.

Disclosure: Nothing to disclose.

200 | Sleep biomarkers in insomnia and depression

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Objectives: Sleep may serve as a window to brain functions and as a source of biomarkers for mental disorders. Accordingly, heart rate variability (HRV) correlates very well with sleep EEG stages and may indicate nocturnal brain activity.

Aims: To examine biomarker properties of sleep EEG related HRV concerning (1) insomnia, (2) major depressive disorder (MDD) independently from antidepressant (AD) effects, and (3) treatment response in MDD.

Methods: We examined two controlled clinical samples by polysomnography: (1) Ten women (mean age: 50 ± 8 years) with primary insomnia without any other physical or mental illness. (2) Thirty-four out-patients with MDD without AD treatment (age: 32 ± 11 years; 52.9% females) and again one week under AD treatment. HRV frequency domain measures (i.e. very low frequency power (VLF), low frequency power (LF) and high frequency power (HF)) of REM, N2 and N3 sleep were compared between patients vs. controls and responders vs. non-responders. Response was defined as ≥50% reduction of baseline Hamilton depression rating score at week 4.

Results: (1) In contrast to conventional sleep-EEG variables suppressed sleep-EEG related HRV discriminated primary insomnia from normal sleep with large effect sizes (Cohen′s d > 1.3). In REM sleep there was a specific difference of less relative HF-power and increased VLF-power ($p < 0.05$). (2) In antidepressant-free MDD patients the pattern of HRV results was similar. (3) After one week of treatment, AD had exerted an additional suppressing effect on HRV, most prominently on absolute VLF- and LF-power in REM-sleep (Cohen′s d = 1.90 and 1.01). The AD related change of REM sleep related relative VLF-power at week 1 separated between responders and non-responders at week 4 again with large effect size ($F(1, 32) = 6.42$, $p = 0.016$, $\eta^2 = 0.167$).

Conclusions: Our findings of suppressed HRV measures in insomnia support the hypothesis of hyperarousal. Concerning MDD, sleep-EEG stage related HRV seems to be a reliable, AD independent marker of depression at baseline. Under treatment, the dynamic of REM sleep related HRV shows early changes during the first week and may provide a promising biomarker of treatment outcome.

Disclosure: Nothing to disclose.

POSTER SESSION 1

CELLULAR, MOLECULAR BIOLOGY & GENETICS

P001 | Insulin resistance and leptin levels in patients with obstructive sleep apnea

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Objectives/Instruction: Obstructive sleep apnea (OSA) has been associated with metabolic syndrome, diabetes mellitus and cardiovascular disease. Insulin resistance and increased leptin levels could explain the impaired metabolic condition in patients with OSA. This study aimed to assess the association of OSA severity with insulin resistance and leptin levels in a cohort of subjects referred to sleep disorders clinic.

Methods: Ninety-one patients with OSA and 17controlswere included in this study. All subjects underwent full night polysomnography (PSG) and blood samples were collected in the morning after PSG. The insulin resistance index was estimated by homeostasis model assessment (HOMA).

Results: HOMA values were not significantly different between groups. Significant difference in leptin level was found between patients with severe OSA and mild OSA. Leptin level was significantly correlated with age ($r = 33$, $p = 0.02$), apnea-hypopnea index ($r = 0.41$, $p = 0.004$), and oxygen desaturation index ($r = 46$, $p = 0.03$). HOMA were in significant positive correlation only with TG level ($p = 0.01$). Stepwise multiple regression analysis showed that apnea-hypopnea index, body mass index and gender were determinant factors for leptin levels but no determinant variable was found for predicting HOMA.

Conclusions: Our findings suggest that leptin levels might be independently associated with severity of OSA. Other factors except insulin resistance should be considered for increasing vascular diseases in OSA patients.

Disclosure: Nothing to disclose.

P002 | Genetic risk factors for schizophrenia associate with sleep spindle activity in healthy adolescents

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Objectives/Instruction: Schizophrenia has been associated with disturbed sleep, even before the onset of the disorder, and also in

non-schizophrenic first-order relatives. This may point to an underlying genetic influence. Here we examine whether weighted polygenic risk scores (PRS) for schizophrenia are associated with sleep spindle activity in healthy adolescents.

Methods: Our sample comes from a community-based cohort of 157 non-schizophrenic adolescents (57% girls) having both genetic data and an overnight sleep EEG measurement available. Based on a recent genome-wide association study, we calculated PRS for schizophrenia across whole genome. We also calculated PRS for *CACNA1I* gene region, which has been associated with both schizophrenia and sleep spindle formation. We performed an overnight sleep EEG at the homes of the participants. Stage 2 sleep spindles were detected using an automated algorithm. Sleep spindle amplitude, duration, intensity and density were measured separately for central and frontal derivations and for fast (13–16 Hz) and slow (10–13 Hz) spindles.

Results: PRS for schizophrenia associated with higher fast spindle amplitude (p = 0.04), density (p = 0.006) and intensity (p = 0.04) at central derivation, and PRS in *CACNA1I* region associated with higher slow spindle amplitude (p = 0.01), duration (p = 0.03) and intensity (p = 0.002) at central derivation.

Conclusions: A positive association between genetic variants for schizophrenia and sleep spindle activity among healthy adolescents support a view that sleep spindles and schizophrenia share similar genetic pathways. This study suggests that altered sleep spindle activity might serve as an endophenotype of schizophrenia.

Disclosure: Nothing to disclose.

P003 | Neuron-specific interleukin-1 receptor accessory protein is required for the maturation of small network emergent sleep-like electrophysiological properties

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Objectives/Instruction: Small neuronal/glial networks oscillate between sleep- and wake-like states *in vivo*, e.g. cortical columns (Brain Res. 1047:45), and *in vitro*, e.g. co-cultured neurons and glia (Eur. J. Neurosci. 42:2078). Sleep regulatory substance interleukin-1β (IL1) signals via its type I receptor and a receptor associated protein (AcP). AcP has an isoform that is neuron-specific called AcPb. Mice lacking AcPb lack sleep rebound after sleep deprivation (Brain Behav. Immunity 47:35). Herein we determined whether AcP and AcPb alter network emergent properties in cultured neurons/glia.

Methods: AcP knockout (KO), AcPbKO, and wild type (WT) mice were obtained from Amgen Inc. Cortical cells from 1-day-old pups from each strain were cultured separately on multi-electrode arrays. Recordings were taken from days *in vitro* (DIV) 4–14 for 1 hr each day. Synchrony (SYN) and delta wave power (DWP) were calculated from filtered recordings and fast Fourier analyses. A total of 4 independent preparations from each strain were used and recordings from 297 electrodes (WT and AcPKO cells) and 162 electrodes (AcPbKO cells) were analyzed. Two-way analyses of variance were used.

Results: Both SYN and DWP exhibited main time and strain effects (SYN: genotype x time $F_{(20,15979)} = 37.77$, $p < 0.001$; DWP: genotype × time $F_{(20,6873)} = 26.12$, $p < 0.001$). Post-hoc Student's t-tests indicated that SYN was higher in AcPKO cells from DIV 5–14 compared to WT and AcPbKO cells. WT SYN was greater than SYN in AcPbKO cells from DIV 6–14. Compared to SYN emergence, the development of DWP was slower in onset in AcPKO and WT cells. In contrast, DWP in AcPbKO cells was first significantly above their baseline values on DIV 11 whereas SYN was not until DIV 13. From DIV 9–14 DWP was highest in AcPKO cells, followed by WT cells, and lowest in AcPbKO cells.

Conclusions: The lack of AcP accelerates the maturation of network properties compared to those occurring in WT cells. In contrast, the lack of AcPb delays network emergence of sleep-linked electrophysiological properties. IL1 signaling has a critical role in emergent sleep-linked network behavior.

Disclosure: Nothing to disclose.

P004 | Effect of cyclical intermittent hypoxia on mouse model of Ad5CMVCre induced solitary lung cancer progression and spontaneous metastases in $Kras^{G12D+}$; $p53^{fl/fl}$; myristolated $p110^{fl/fl}$ ROSA-gfp

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Objectives/Instruction: Epidemiological data suggests that obstructive sleep apnea is associated with increased cancer incidence and mortality. Here we investigate the effects of cyclical intermittent hypoxia (CIH), akin to the underlying pathophysiology of obstructive sleep apnea, on lung cancer progression and metastatic profile in a genetically engineered mouse (GEM) $Kras^{G12D+/-}$; $p53^{fl/fl}$; myristolated-$p110\alpha^{fl/fl}$-ROSA-gfp activated by intrathoracic injection of Ad5CMVCre virus.

Methods: With the goal to develop a translatable pre-clinical model, we combine several techniques into one model: (1) intrathoracic injection of Ad5CMVCre virus to produce a solitary lung carcinoma with validation of injection technique; (2) serial micro CT scans

with respiratory gating (no contrast) and freely available software (ITK-SNAP) to manually segment lung tumors on consecutive slices; (3) use of RT-PCR to detect spontaneous metastases in distant organs with validation using H&E stain and flow cytometry; (4) effect of CIH on mice with intrathoracic injection of Ad5CMVCre to induce lung tumors.

Results: This mouse model of lung cancer consistently provides a solitary lung cancer that spontaneously metastasizes. (1) 3.12×10^7/3 μL of Ad5CMVCre virus was injected into the left lung and a TaqMan real-time PCR assay targeting the CMV promoter region revealed a recovery rate of 88% of the injected virus from the dissected lung tissue and a CV of 8.4%; (2) Serial micro CT demonstrates that male mice exposed to CIH have a significant increase in tumor volume compared to control (room air) on Day 19 (p = 0.02), 26 (p = 0.008) and 33 (p = 0.02) post injection; (3) Tumor volume variability measured using interquartile range (IQR) increases as tumor progress and CIH increases IQR by 2 to 4-fold between Day19 to Day40 post injection; (4) RT-PCR using 3 different probes-*gfp*, *SPC* and *CC10*, positively detects metastases most frequently in diaphragm (100%), right lung (86%), mediastinal lymph nodes (59%), ribs (46%) and axillary lymph nodes (40%).

Conclusions: We describe a new model of using intrathoracic injections of Ad5CMVCre virus into the GEM $Kras^{G12D+/-}$; $p53^{fl/fl}$; myristolated-$p110\alpha^{fl/fl}$-ROSA-gfp that spontaneously metastasizes to distal organs within 40 days. We also report that male mice with solitary lung cancer have increase variability and tumor growth when exposed to cyclical intermittent hypoxia.

Disclosure: JCG: External Advisory Boards: KSQ Therapeutics, ITUS, Compass Therapeutics; Sponsored research: Compass Therapeutics, ITUS.

P005 | Key elements in biology and physiology of Hcrt and Mch cells affecting normal sleep

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Objectives/Instruction: Hcrt/Orexin and mlenain concentrating hormone (Mch) neurons are located in the lateral hypothalamus. They have established roles in the regulation of normal vigilance states and also feeding behavior, addiction, reward and stress. The expression of Hcrt is dysregulated in the brain of narcoleptic patients, which results in the loss of these cells causing excessive daytime sleepiness and cataplexy. How these neurons are involved in multiple functions and how they act as physiological integrators remain unknown.

Methods: The hypothalami of E18 pups were dissected and FACS sorted by a method developed in the lab which amplifies the reporter mCherry only in the Hcrt cells and EGFP in Mch cells. RNA sequencing was performed to compare the transcriptome of Hcrt cells with the rest of the hypothalamus. Immunostaining, in situ hybridization and qPCR were used for data validation and in depth analysis.

Results: We have identified 340 genes significantly differentially expressed in Hcrt cells and more than 2000 genes in Mch cells compared to the rest of hypothalamic cells with fold changes from 2 to 100. We identified two gene sets distinguishing these neuronal cell types from each other and other cell types of the hypothalamus. We identified transcription factors enriched in both cell types. Knockdown of them in zebrafish identified critical ones for the expression of Hcrt and Mch. Knocked down of a paternally expressed gene by morpholinos totally abolished the expression of Hcrt and Mch indicating a critical role of this gene in the physiology of these neuropeptides. Morphant larvae exhibited significantly less locomotor activity mainly during daytime (wt = 42.6 vs. morphants = 21.1; $p < 0.01$), which is the active period of zebrafish larvae. This reduction in activity is accompanied with increased sleep time during the day (wt = 24.2 vs. morphants = 45.2; $p < 0.0001$, t-test).

Conclusions: We, for the first time, purified intact Hcrt and Mch cells and performed RNA sequencing. This led to the identification of molecules involved in the biology and physiology of Hcrt and Mch cells and also sleep and wakefulness.

Disclosure: Nothing to disclose.

P006 | Oxidative stress in Caucasian and Asian menopausal women with sleep disorders

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Objectives/Introduction: 35–60% of menopausal women complain about certain problems with sleep. It is well known, that sleep loss may cause oxidative stress. The aim of this work was assessment of the lipid peroxidation and antioxidant protection system parameters in Caucasian and Asian menopausal women with sleep disorders.

Methods: 255 menopausal women divided into Caucasian (n = 123) and Asian (n = 132) groups were examined. All women underwent clinico-anamnestic examination. Polysomnography and specialized questionnaires for the assessment of sleep disorders were used. Each ethnic group was divided into control (without sleep disorders) and main groups (insomnia and insomnia with obstructive sleep apnea syndrome (OSAS)). Lipid peroxidation and antioxidant system parameters (conjugated dienes (CDs), malonyl dialdehyde (MDA), α-tocopherol, retinol, superoxide dismutase activity, reduced and oxidized glutathione, total antioxidant activity) by spectrophotometric and fluorometric methods were determined. Statistical analysis was performed by non-parametric tests. A study was supported by a grant MK-3615.2017.4.

Results: In Caucasian patients compared to control was observed accumulation of lipid peroxidation products both in perimenopause with insomnia (CDs by 25% ($p < 0.05$)) and in postmenopause with insomnia (CDs, MDA by 42% and 21% respectively ($p < 0.05$)) and insomnia with OSAS (MDA by 25% ($p < 0.05$)). Total antioxidant activity level decreased by 20% ($p < 0.05$) in Caucasian women with insomnia and OSAS. In Asian patients both in insomnia and insomnia with OSAS revealed a higher content of CDs in perimenopause (by 37% and 63% respectively ($p < 0.05$)) and MDA in postmenopause (by 51% and 28% respectively ($p < 0.05$)) compared to control. The decreasing of α-tocopherol level by 19% ($p < 0.05$) was observed in Asian perimenopausal women with insomnia and superoxide dismutase activity by 9% ($p < 0.05$) both insomnia and insomnia with OSAS compared to control. Also, the decreasing of the total antioxidant activity level by 21% ($p < 0.05$) in Asian postmenopausal women with insomnia and OSAS and the increasing of reduced glutathione level by 18% and 17% respectively ($p < 0.05$) in patients with insomnia and insomnia with OSAS was found.

Conclusions: Our results demonstrate the development of oxidative stress in patients with insomnia and insomnia with OSAS in both Caucasian and Asian menopausal women.

Disclosure: Nothing to disclose.

P007 | Melatonin receptor type 1A gene linked to intolerance to shift work and Alzheimer's disease in old age

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Objectives/Introduction: Disruption of the circadian rhythms is a well-known consequence of shift work and a frequent preclinical and clinical manifestation of Alzheimer's disease. In a recent study, we demonstrated association of the variant rs12506228 near melatonin receptor 1A gene (*MTNR1A*) with shift work intolerance (Sulkava et al. Sleep 2016, PMID 28364478). Here, we tested association of the same variant with clinical and pathological Alzheimer's disease.

Methods: We genotyped the variant in two Finnish population-based cohorts of very elderly individuals, Vantaa 85+ and Kuopio 75+, and in a younger Finnish case-control sample. Vantaa 85+ included post-mortem neuropathological examination for half of the cohort. We studied also the effects of RNAi-mediated silencing or overexpression of *MTNR1A* on amyloid precursor protein (APP) processing using APP-overexpressing N2A cell line *in vitro*.

Results: The risk variant of intolerance to shift work was associated with clinical Alzheimer's disease in Vantaa 85+ ($p < 0.0001$, OR=2.1, n = 357) and the association was replicated in Kuopio 75+ ($p < 0.05$, OR=1.5, n = 490) but not in the younger case-control sample (n = 651 + 669). The risk variant also associated with higher amounts of neurofibrillary tangles and amyloid plaques ($p < 0.005$), the neuropathological hallmarks of Alzheimer's disease, in the Vantaa 85+ cohort. Lower level of *MTNR1A* gene expression in the brain was detected in the carriers of risk variant according to NIAGADS database. *In vitro*, Silencing of *MTNR1A* increased, and overexpression decreased amyloidogenic processing of APP. (Sulkava et al. Sleep, *in press*).

Conclusions: We suggest the *MTNR1A* variant as a common genetic risk factor for shift work intolerance and Alzheimer's disease among the very elderly. Differences in *MTNR1A* expression which modulate APP metabolism, are likely to mediate the association with Alzheimer's disease.

Disclosure: SS has an immediate family member who is an employee and shareholder of Amialife Ltd, which is not related to this study. RS is an employee and shareholder of Amialife Ltd, which is not related to this study. HMO is consulting for Jazz Pharmaceuticals Plc on topics unrelated to the work described in this manuscript. HJH is an employee and shareholder of Herantis Pharma Plc, which is not related to this study. The other authors report no conflicts of interest.

P008 | The impact of insufficient sleep on microglia morphology

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Objectives/Introduction: Sleep deficient in duration and quality is a common problem in the modern society. Studies have shown that sleep is beneficial for the retention of the brain homeostasis and that chronic insufficient sleep leads to low grade inflammation. However only little is known about the effects of insufficient sleep on microglia, the brain resident macrophages.

Our main hypothesis is that sleep is crucial for microglial functions. If sleep is restricted, microglial physiological functions are impaired. As microglial morphology changes with their functional state, the impact of acute sleep deprivation (SD) and chronic sleep fragmentation (SF) was studied via the characterization of microglia morphology by confocal microscopy.

Methods: SD (9 h; gentle handling) and SF (14d; Sleep Fragmentation Chamber (Lafayette, USA)) were performed in mice. After the treatments the animals were sacrificed and perfused. The brain tissue was sliced, immunostained for microglia (anti-IBA1 and Alexafluor 568, Synaptic Systems) and imaged with a confocal microscope (Leica TCS SPX, Germany). Morphometric analysis of the

fluorescent images (Z-stacks: 55–85 × 0.2 μm) from the somatosensory cortex was accomplished using Fiji (ImageJ, NIH) Simple Neurite Tracer.

Results: A statistically significant (N_{cells}=40; N_{mice}=8; $p \leq 0.01$) increase in the average branch length and decrease in the number of branches was found between SF and the control group in the somatosensory cortex. This response was significantly different compared to the LPS induced microglial activation (N_{cells}=20; N_{mice}=4; $p \leq 0.01$).

Conclusions: Microglial morphology is affected by insufficient sleep. But interestingly microglial reactivity after SF was not identical to LPS induced activation.

Disclosure: Nothing to disclose.

P009 | Epigenetic age and sleep quality in adolescence

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Objectives/Introduction: Sleep problems and insomnia are commonly associated with health-related symptoms and several detrimental outcomes. One of the most recent biomarkers of aging are those based on DNA methylation (DNAm). Epigenetic age acceleration, or a DNAm age which is higher than chronological age, has been associated with an increased risk of all-cause mortality. However, no previous study has addressed the association between sleep and epigenetic age in adolescence, even though risks related to accelerated aging are likely to accumulate over several decades. We studied adolescent sleep behaviour and problems in order to investigate whether the risks of accelerated aging are already present at a young age.

Methods: The participants came from a healthy birth cohort. We calculated a total sleep problem score at age 12.3 years (SD=0.5) (n = 223; 119 girls) from The Sleep Disturbance Scale for Children, and derived sleep duration and latency from actigraphy (Actiwatch 7). The Pittsburgh Sleep Quality Index was administered at age 17 (n = 105; 65 girls), resulting in a total sum score. We used the Horvath method to calculate the DNAm predicted age, and used linear regressions to study the associations between sleep and DNAm age. We adjusted all analyses for sex and pubertal development scores derived from the Pubertal Development Scale.

Results: Sleep duration and latency at age 12 years were not significantly associated with DNAm age ($p > 0.2$). Higher total sleep problem score at age 12 years was associated with accelerated age ($p = 0.005$). Similarly, at age 17 years, poorer sleep quality as measured by the Pittsburgh Sleep Quality Index score was associated with higher DNAm age ($p = 0.015$).

Conclusions: As epigenetic aging is likely to be a longitudinal process, it is expected that persistent insomnia symptoms from an earlier age are associated with accelerated aging. Our study is the first to detect this association already in early adolescence.

Disclosure: Nothing to disclose.

P011 | $GABA_A$ receptors of the thalamic reticular nucleus regulate NREM delta oscillations: an in vivo investigation by CRISPR-Cas9 genetic abscission

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Objectives/Introduction: Understanding the cellular/molecular mechanisms which regulate non-rapid-eye-movement sleep (NREM) delta oscillations (1–4 Hz) is of considerable importance due to their association with synaptic homeostasis, cellular energy regulation and clearance of toxic metabolites. Cortical delta-oscillations are generated by intrinsic delta-frequency burst discharge of thalamocortical (TC) neurons whose main inhibitory input is from GABAergic thalamic reticular nucleus (TRN) neurons, the majority of which contain the calcium-binding protein, parvalbumin (PV). TRN-neurons themselves are regulated by extrinsic GABAergic inputs from wake-active neurons acting on alpha3-subunit containing $GABA_A$ receptors ($GABA_AR$). Based on this model, and findings that tonic optogenetic stimulation of TRN-neurons promotes delta-power, we hypothesize that knock-down of alpha3-$GABA_AR$ on TRN-neurons increases NREM-delta.

Methods: We used clustered-regularly-interspersed-short-palindromic-repeats (CRISPR) gene-editing to selectively knock-down (KD) alpha-3 $GABA_ARs$ in a region-specific (TRN) and cell-type specific (GABA-PV) manner *in vivo*. An adeno-associated viral (AAV) vector encoding three single-guide-RNAs targeting the alpha-3 subunit was injected into TRN of PV-Cre/Cas9 transgenic mice, to disrupt local expression of synaptic $GABA_ARs$, in TRN-PV neurons. We measured electroencephalography (EEG) and electromyography to determine NREM, REM and wakefulness in freely moving mice before and after AAV induced CRISPR-Cas9 mediated KD of alpha-3 subunits locally in TRN. We validated the effectiveness of the KD by *in vitro* recordings of inhibitory post synaptic currents.

Results: During the light period, NREM time was increased (9.9 ± 1.7%, $p = 0.001$) with longer bout durations (22%±8.7, $p = 0.02$) in mice (N = 5) after alpha-3 KD in TRN-PV neurons. Normalized delta-power was higher (light-period:43.9 ± 31.01%, $p = 0.05$, dark-period:38.7 ± 17, $p = 0.02$) after alpha-3 KD in TRN-PV neurons. sIPSCs frequency was reduced in alpha-3 KD TRN-PV-neurons (1.01 ± 0.53, N = 5) vs. control PV-tdTomato-neurons (3.47 ± 0.75, N = 6, $p = 0.03$).

Conclusions: This is the first use of cell-type and brain-region localized CRISPR-Cas9 technology to study sleep or EEG *in vivo*. Our data suggests that in the absence of alpha-3-$GABA_ARs$ the TRN-PV

neuronal activity is upregulated, leading to the potentiation of NREM sleep and delta activity. This might explain how hypnotics which potentiate alpha-3-$GABA_A$Rs suppress delta-oscillations while promoting sleep.

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P012 | CLOCK gene polymorphism (rs1801260) in menopausal women of two ethnic groups with insomnia

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Objectives/Introduction: One of the genes that determine circadian rhythms is the *Clock* gene. The relationship of pathological states with *Clock* gene polymorphisms depends on the population under study. The aim of study is to determine an association of *Clock* gene polymorphism (*rs1801260*) and insomnia in Caucasian and Asian menopausal women.

Methods: 403 menopausal women aged 45–60 years divided into Caucasian (without insomnia (n = 68) and with insomnia (n = 146)) and Asian (without insomnia (n = 61) and with insomnia (n = 128)) groups were examined. The program of the study included the following methods: clinical-anamnestic (specialized questionnaires for the assessment of sleep disorders, polysomnographic monitoring, gynecological examination) and statistical. Genotyping by *Clock* gene polymorphic marker *rs1801260* was carried out in women.

Results: Both in Caucasian and Asian women, the *T*-allele and the *TT*-genotype was more prevalent (*T* - 0.70, *TT* - 51.4%, *TC* - 36.4%, *CC* - 12.2% and *T* - 0.81, *TT* - 69.3%, *TC* - 22.8%, *CC* - 7.9%, respectively ($p < 0.05$)). The frequency of the *TC*-genotype was significantly larger in Caucasian women ($p < 0.05$) and the frequency of *TT*-genotype was less ($p < 0.05$). The C-allele was more frequent in Caucasian women (30.4% vs. 19.3%, $p < 0.05$). The distribution of the genotypes in ethnic groups with/without insomnia corresponded to the Hardy-Weinberg distribution law ($p > 0.05$). Differences in the distribution of the *Clock* gene polymorphism genotypes were found only between groups of the Caucasian women. *TT*-genotype is more incident in women with insomnia compared to control (55.5% and 42.6%, respectively ($p < 0.05$)). *T*-allele was fairly more frequent in group with insomnia compared to control (73.6% and 61%, respectively ($p < 0.05$)). The odds ratio for the risk of insomnia realization in Caucasian women was 1.78 (95% CI: 1.16–2.75).

Conclusions: *T*-allele of *rs1801260 Clock* gene polymorphism is prognostic sign for the formation of insomnia only in Caucasian women.

Disclosure: Nothing to disclose.

P013 | The role of melanin concentrating hormone and orexin/hypocretin neurons in the Prader-Willi syndrome

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Objectives/Introduction: Prader-Willi syndrome (PWS) is paternally imprinted disorderthat leads to sleep and feeding alterations. It is characterized by hypothalamic dysfunction. Melanin concentrating hormone (MCH) and orexin/hypocretin (OX) neurons, located in the lateral hypothalamus (LH), are strongly implicated in the regulation of sleep-wake cycle and feeding behavior. To this, we postulate that MCH and OX may represent a key component in the pathophysiology of PWS.

Methods: Two groups of mice were used: a) PWS mice with paternally inherited Snord116 deletions (PWS mice) b) wild type littermate control (WT mice). The gene expression of MCH (Precursor of MCH (Pmch) and its receptor MCH receptor 1 (MchR1)) and OX (prepro-Orexin (Ppox) and receptors OX receptor 1 (OxR1) and OX receptor 2 (OxR2)) systems were performed by qRT-PCR at three time points: at the baseline (T0), after a sleep deprivation (T1) and after 2 hr of sleep deprivation (T2) in different brain regions: hypothalamus (Hy); parietal cortex (PC) and frontal cortex (FC). The neuronal activity of the LH was recorded by using tetrode-based in vivo recording technique, during $BL_{sua}$and during the last hour of SD ($T1_{sua}$)and the following first hour after SD ($T2_{sua}$). Simultaneously, EEG/EMG electrodes were implanted to assess sleep-wake cycle.

Results: Gene expression: MCH system, both the neuropeptide and its receptor, was found increased only at T2 in PWS mice in the Hy ($p = 0.012$). OX system was increased at T0($p = 0.04$) and at T2 ($p = 0.045$) in the Hy, FC and PC, in *PWS mice*relative to *WT mice*. Using tetrode-based in vivo recording technique, we identified various firing patterns of the LH that accurately respond to specific sleep-wake stages across conditions (i.e. BL_{sua}, $T1_{sua}$, $T1_{sua}$).

Conclusions: These preliminary results suggest that MCH and OX systems are altered in PWS. Furthermore, a different neuronal activity in the LH coordinated with sleep-wake stages was observed. Although these are very preliminary results we can conclude that MCH and OX neurons may be involved in the pathophysiology of PWS representing new treatment options for PWS.

Disclosure: Nothing to disclose.

P014 | Characterization of sleep architecture and oscillations in a mouse model with reticular thalamic nuclear dysfunction

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Objectives/Introduction: In mammals, during non-rapid eye movement (NREM) sleep, the electroencephalogram (EEG) activity shows typical signs of brain activity that include a predominant slow wave (< 1 Hz) associated with delta (1–4 Hz) and spindles (9–16 Hz) macroscopic oscillatory events. These oscillations are modulated by subcortical inputs to the thalamus network. We had previously demonstrated that TRN cells integrate subcortical arousal inputs selectively during NREM sleep and may participate in sleep intensity and consciousness (Herrera CG, et al. Nat. Neurosci., 2016). Interestingly, recent investigations have suggested alterations in the thalamo-cortical system in patients with schizophrenia (SZ) bipolar disorders (BD), where TRN neuroanatomy and functionality is significantly altered.

Methods: We use LFP/EEEG/EMG electrodes to characterised sleep architecture and oscillations in a mouse model of schizophrenia (Gclm KO) (Steullet et al. Molecular Psychiatry 2018). We recorded knock out (KO) and wild type litter mates (WT) for 24 h. Sleep homeostatic processes were induced by 4 hr sleep deprivation starting at the onset of the light period and followed by recordings of the recovery sleep (RS) for 6 h.

Results: We found that KO vs. WT sleep-wake cycles were not significantly different. However, KO mice show no increase of NREM duration (61±6.9 WT, 38±5.1 KO) and delta power (O.07 ± 9 $e10^{-4}$ WT, 2 e $^{10-3}$ ± 1.01 $e10^{-6}$ KO) during SR, characteristic of homeostatic sleep regulation. Finally, the rate of spindles during NREM were decreased ~26% in baseline sleep in KO when compared to WT mice; however, during sleep recovery spindle rate increased only in KO ~36%, resulting in values comparable to baseline NREM sleep spindle rate in WT. Data are presented as mean +/SEM. $p < 0.005$, 2way ANOVA.

Conclusions: The combination of sleep, spindles disruption and attention deficits have been shown in SZ as well in BD and autistic patients, and it has been proposed that the TRN deficits may be a common mechanism. In agreement, our findings provide a functional insight underlying network dysfunction relevant for schizophrenia; and it renders the possibility of a combinatorial approach that will be indeed invaluable to determine the extent of TRN involvement in these disorders.

Disclosure: Nothing to disclose.

P015 | CDK5-mediated phosphorylation of PER2 regulates circadian clock

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Objectives/Introduction: Defects in circadian rhythmicity influences sleep, mood, and neurodegenerative disorders. The Cyclin-dependent Kinase 5 (CDK5) is a proline-directed serine/threonine kinase related to the Cdc2/Cdk1 family, which has been shown to be directly involved in some of the above-mentioned disorders. The clock component Per2 has also been shown to be involved in these disorders and its protein is highly phosphorylated by various kinases.

Methods: We used protein analyis methods, shRNA techiques, cell culture experiments and in vivo mouse behavior analysis to investigate CDK5 influence on the clock component PER2.

Results: We find that CDK5 phosphorylates PER2 protein at a unique highly conserved Serine residue, not yet characterized. In the Suprachiasmatic nuclei (SCN), CDK5 kinase activity *per se* is circadian and the protein itself undergoes rhythmic interaction with PER2 around the clock. PER2 phosphorylation at S392 facilitates the interaction with CRY and allows the PER2: CRY complex to enter the nucleus. When PER2 is not phosphorylated it is quickly degraded via the proteosome, and the leftover protein is located only in the cytoplasm. CDK5 down regulation lengthens circadian period, because Cry stays longer is the cytoplasm due to reduced presence of phosphorylated PER2. This leads to a delayed arrival of CRY in the nucleus to act as suppressor of the BMAL1/CLOCK complex.

Conclusions: CDK5 is a novel circadian kinase that phosphorylates PER2. This phosphorylation is critical for the period of the molecular circadian cycle. Our results close the gap of knowledge, on the question which kinase drives the nuclear entry of PER2.

Disclosure: Nothing to disclose.

P016 | Sleep-wake and thermoregulatory changes in Panx1$^{-/-}$ mice

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Objectives/Introduction: Recently a 17-years old female patient has been described carrying out a homozygous point mutation in the Panx1 gene (an exchange of guanine to adenine at the position 650) which leads to the substitute of Arg for His at the position 217 in the expressed protein. This patient demonstrates

multisystem disfunction including intellectual disability, sensorineural hearing loss, skeletal defects, and primary ovarian failure [*Shao et al., J. Biol. Chem. 2016, 291(24):12432–43*]. It was proposed that the primary origin of this global pathology is a disfunction of the Panx1 protein discovered in 2000 [*Panchin et al., Curr. Biol. 10: R473–4*]. The ability to form ATP permeable membrane channels is regarded as one of the main functions of this protein. ATP molecules can exit the cell cytoplasm and enter the interstitial space through these channels and take part in the paracrine regulation [*Esseltine, Laird, Trends Cell Biol. 2016, 26(12):944–55*]. Extracellular ATP, in its turn, is the source of adenosine, the main regulator of the sleep-wake cycle [*Holst, Landolt, Curr. Sleep Med. Rep. 2015, 1 (1):27–37*]. So we proposed that the *Panx1* gene mutation could also play an important role in sleep-wake disorders [*Shestopalov et al., Front. Cell. Neurosci. 2017, 11:210*].

Methods: Continuous EEG recordings plus implanted thermoprobes. in mice.

Results: Our experiments in $Panx^{-/-}$ mice demonstrated an increase in motor activity and wake percentage and correspondent decrease in SWS especially expressed during the dark (active) period as compared to WT animals [*Kovalzon et al., Behav. Brain Res. 2017, 318:24–27*]. The following studies revealed a decreased level of the basal body temperature and decreased response to pyrogene administration as well as an increased tendency to spontaneous falling into torpor within the room temperature in $Panx^{-/-}$ vs. WT mice ($p < 0.05$; $N = 8$; *U-test*).

Conclusions: Thus, both clinical and experimental data are in favor of the important role of Panx1 in the regulation of various physiological functions including the sleep-wake cycle and thermoregulatory processes. *Supported by the Russian Science Foundation №17-15-01433.*

Disclosure: Nothing to disclose.

DREAMING

P017 | The degree of lucidity experienced in dreaming could reflect the capacity of conflict resolution in cognitive control

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Objectives/Instruction: A lucid dream refers to the condition that a dreaming individual is aware that he or she is dreaming. Some previous studies found that the dorsal lateral prefrontal cortex, which has been linked to executive functions, yielded greater activations during lucid dreams than non-lucid ones. It has also been suggested that the tendency of an individual to experience lucid dreams is related to the performance of executive functions. However, it is far from clear how and why lucid dreaming is related to the various components of executive functions.

Methods: To address this issue, the current study recruited 77 participants to record the degree of lucidity of the dreams they experienced for 7 consecutive days. These participants then visited our lab twice to complete a various kinds of executive function tasks, including task switching, attentional network (ANT), operation-span, and the majority function task.

Results: Our data shows that there is a significant correlation ($p = 0.012$) between trait lucidity and the conflict score obtained in the ANT task while the alerting effect is positive.

Conclusions: This result suggesting that people who are more "lucid" in their dreams tend to have better capacity for conflict resolution in cognitive control.

Disclosure: Nothing to disclose.

P018 | A technique for inducing high levels of signal-verified lucid dreams in a laboratory morning nap

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Objectives/Introduction: Lucid dreams occur when the sleeper is aware that they are dreaming while asleep. We attempted to induce lucid dreams in a laboratory setting using pre-sleep training and audio/visual cues during sleep.

Methods: Participants underwent 25 min of training in bed in the sleep lab. First, participants practiced how to signal a lucid dream with eye movements (look left-right 4 times). Then, we played audio and visual cues (beeping or flashing LED lights) at approximate 1-min intervals and instructed participants to become lucid (i.e. self-aware, mindful) each time they observed a cue. Participants then had a 90-min sleep period with PSG recording.

38 participants were randomly assigned to one of 3 conditions: 7:30 am nap with cues (n = 14, age=20.86 ± 2.71), 11:00 am nap with cues (n = 13, age=21.77 ± 4.38), 11:00 am nap without cues (n = 11, age=24.64 ± 6.27). The audio/visual cues were presented during REM sleep. Participants were awakened to report dreams and complete the LuCiD Scale, which measures dream insight, control, memory, among others.

Results: In the 7:30 am cued condition, 9 participants reported a lucid dream, 7 were signal-verified. In the 11:00 am cued condition, 8 participants reported a lucid dream (7 signal-verified). The two cued conditions did not differ in signal-verified lucid dream count (χ^2 $p = 0.84$). Within the 7:30 am cued condition, lucid dream reporters had longer sleep duration the previous night (4.1 vs. 6.0 h, $p = 0.03$) than non-lucid dream reporters.

In the 11:00 am non-cued condition, 4 participants reported a lucid dream (2 signal-verified); the 11:00 am cued condition had marginally more signal-verified lucid dreams (χ^2 $p = 0.07$), higher insight ($p = 0.004$) and memory ($p = 0.02$) scores than the non-cued condition.

Importantly, in the cued conditions, signal-verified lucid dreams occurred in 4 of 6 participants who had never before experienced a lucid dream. Of methodological interest, 2 participants did eye signals but did not report lucid dreams.

Conclusions: Overall, findings suggest that lucid dreams can be efficiently elicited by a combination of training and audio/visual cues during sleep, and elicited even in previous non-lucid dreamers. That 2 non-lucid dream reporters did eye movement signals highlights the potential to influence dream content through training even without intervening lucidity.

Disclosure: MCarr, Funding Source: Dream Science Foundation/ International Association for the Study of Dreams Research Grant. KKonkoly, nothing to disclose. RMallett, nothing to disclose. CEdwards, nothing to disclose. KAppel, nothing to disclose. MBlagrove, nothing to disclose.

P019 | Electrophysiological response to emotional voices during sleep and wakefulness as a function of stimulus-reactivity

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Objectives/Introduction: As compared to neutral sounds, emotional sounds elicit enhanced cortical responses during wakefulness. Whether this effect is similarly present during sleep remains unresolved. On one hand, evidence shows that the sleeping brain is not fully disconnected from its acoustic environment. On the other hand, compared to wakefulness, sleep is characterized by an over-activation of limbic regions related to emotion processing. Moreover, a recent study suggested that individual differences in brain reactivity associated to dream recall frequency determine brain responses to external stimuli during sleep (Vallat et al., 2017). Here we hypothesized that elevated emotional arousal during sleep enhances brain reactivity to affectively-loaded information.

Methods: We examined event-related potential (ERP) responses to angry and neutral voices (Grandjean et al., 2005) in 13 healthy participants (age: 21.69 ± 1.6) both during wakefulness and sleep. We also included an extra set of control stimuli, with the same envelope as the experimental angry and neutral voices, but filled with white noise. Stimuli were 750 ms binaural meaningless word-like vocal utterances pronounced with either angry or neutral prosody, delivered every 8 (±3) seconds. During sleep, the stimulation started during the first stable N3 sleep episode.

Results: We observed enhanced auditory responses to angry compared to neutral voices, both during wakefulness and NREM sleep. The effect observed during NREM sleep predominated in high dream recallers (n = 5), characterized by high reactivity to external stimuli, and was not significant when only considering low dream recallers (n = 8). Moreover, the number of arousals during NREM sleep after presentation of angry voices was greater than for neutral voices, an effect that, again, only occurred in high dream recallers. Importantly, the control stimuli did not elicit differential responses to angry- or neutral-related stimuli, thus confirming that the emotional effects observed with the original voices were driven by affective stimulus attributes.

Conclusions: We show that emotion encoding of external stimuli may be preserved even in conditions of deep sleep, and that this effect depends on individual brain reactivity during NREM.

Disclosure: Nothing to disclose.

P021 | Relationship between EEG frontal alpha asymmetry and dream affect

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Objectives/Introduction: Establishing the neurophysiological correlates of dream phenomenology, including dream affect, has remained challenging. Frontal alpha asymmetry (FAA) is considered a marker of affective and motivational states and traits as well as affect regulation in the waking state. Our aim was to explore whether FAA during rapid eye movement (REM) sleep is associated with corresponding dream affect, and whether FAA during evening resting wakefulness predicts dream affect in REM sleep dreams.

Methods: Electroencephalography (EEG) recordings were obtained from seventeen (7 male, 10 female) young adults (mean age = 25.76 ± 4.93) who spent two non-consecutive nights in the sleep laboratory. Participants were awakened 5 min after the onset of every REM stage, after which they gave an oral dream report ($N = 115$, $M = 6.76 \pm 3.05$) and rated their dream affect using the modified Differential Emotions Scale. Two-minute EEG samples from each REM sleep stage that resulted in a dream report were analysed. Additionally, 8 min of evening pre-sleep and morning post-sleep EEG was recorded during resting wakefulness. Mean spectral power in the alpha frequency band (8–13 Hz) and corresponding FAA was calculated over the mid-frontal (F4/3 electrodes) and subsequently over all the other homologous electrode pairs.

Results: Linear regression analyses showed that FAA over mid-frontal regions (F4/3) during REM sleep ($N = 17$, $\beta = 0.690$, $p = 0.002$), as well as during evening resting wakefulness ($N = 17$, $\beta = 0.728$, $p = 0.001$), predicted ratings of dream anger. Moreover,

Pearson correlations showed that FAA over the F4/3 electrode pair was positively correlated across different states of consciousness (evening wakefulness, REM sleep, and morning wakefulness) (N = 17, r = 0.637 — 0.720, $p < 0.01$).

Conclusions: These results suggest that FAA may serve as a neural correlate of state and trait affect regulation (i.e., inhibitory control of affective processing) not only in the waking but also in the sleeping state.

Disclosure: Nothing to disclose.

P022 | Increase of both bottom-up and top-down attentional processes in high dream recallers

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Objectives/Instruction: Evoked potentials associated with the automatic orientation of attention towards an unexpected sound (bottom-up processes) are of larger amplitude in high dream recallers (HR) than in low dream recallers (LR) (Eichenlaub et al. 2014a). Such result suggests different attentional processes or strategies in the two groups.

Methods: To further investigate this issue, we measured bottom-up and top-down attentional performance and their cerebral correlates with EEG in HR and LR using a paradigm in the auditory modality (Bidet-Caulet et al. 2014). EEG was recorded in 18 HR (7 men, age = 22.7 ± 4.1 years, dream recall frequency = 5.3 ± 1.3 days with a dream recall per week) and 19 LR (9 men, age = 22.3, DRF = 0.2 ± 0.2) while they had to detect a target sound (played either in the right or the left ear) preceded either by an uninformative or informative visual cue (indicating the ear in which the sound will be played). In 25% of the trials a distracting sound was presented between the cue and the target.

Results: Significant between group differences were found in event related potentials (ERPs to cue, target and distractor) but not in behavioral responses. The results confirm that HR present a larger P2/earlyP3a complex to distracting sounds than LR, suggesting enhanced bottom-up attentional processes in HR. HR also presented a greater contingent negative variation (CNV) during target expectancy and a larger P3b response to the target sound than LR, speaking for an enhanced top-down control of attention in HR. These results demonstrate that both bottom-up and top-down attentional related mechanisms are exacerbated in HR compared to LR.

Conclusions: This general increase leads to a apparently preserved balance between bottom-up and top-down processes since similar performance were observed in the two groups. These results show that different neurophysiological profiles allow to achieve similar cognitive performance, with some profiles possibly more costly in term of resource/energy consumption.

Disclosure: Nothing to disclose.

P023 | PTSD-like symptoms, morning affect and intrusive memories in nightmare disorder

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Objectives/Introduction: Nightmare disorder is characterized by frequent, intense and highly unpleasant mental experiences (nightmares), usually appearing during late-night Rapid Eye Movement (REM) sleep. Frequent nightmares are related to impaired subjective sleep quality, altered sleep architecture and sleep fragmentation. According to Levin and Nielsen's (2007) model, nightmare disorder is characterized by impaired emotional regulation during sleep. The aim of the following experiment was to investigate the relationship between emotional information processing, sleep and affect in a group of nightmare sufferers and healthy controls.

Methods: 22 Nightmare sufferers, and 22 age and gender matched controls participated in our experiment. Participants spent two nights of sleep in the sleep laboratory ("habituation" night, "experimental" night) monitored by electroencephalography (EEG). During the experimental night IAPS ($N_{neutral}$ = 20, $N_{negative}$ = 20) pictures were presented. The same picture set was presented in the next morning. Upon awakening, participants completed a dream questionnaire. Affective states were monitored during the experiment by standardized scales (PANAS). In addition, they were asked to keep a "Flashback diary" for the following week about their intrusive, image-like memories concerning the presented IAPS pictures.

Results: Preliminary analyses showed significant Group (Nightmare, Control) x Time ($PANAS_{pre\text{-}test}$, $PANAS_{post\text{-}test}$, $PANAS_{morning}$) interaction ($F_{2,42}$ = 3.7, p = 0.027), mainly due to increased negative affect in the nightmare group in the morning (p = 0.005). Questionnaire based measures significantly differed between the two groups (PTSD-like symptoms: $t_{(34.79)} = -3.56$, p = 0.003; Insomniac complaints: $t_{(27.749)} = -3.806$; $p < 0.001$). The Nightmare group experienced significantly more intrusive images (p = 0.022), and these images were more negative (p = 0.043) compared to the Control group. Furthermore, Nightmare group participants reported higher rate of negative emotions in their dreams (p = 0.004) compared to the Control group. Negative dream affect was significantly correlated with PTSD scores in both groups (rho_{NM} = 0.459, p = 0.036; rho_{CTL} = 0.509, p = 0.006).

Conclusions: Idiopathic nightmare sufferers seem to show increased PTSD-like symptomatology and insomniac complaints, that might affect their everyday mood, emotional reactivity, and dream affect. Negative affect in the morning might reflect the impairment of the mood regulatory function of sleep.

Disclosure: Nothing to disclose.

P024 | Testing the empathy theory of dreaming: the relationship between trait empathy and positive attitude towards dreams and the frequencies of listening to and telling dreams

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Objectives/Introduction: In the empathy theory of dreaming the sharing of dreams is proposed to have an empathic effect on the dreamer and on significant others who hear and engage with the telling of the dream. In this theory, dreaming is a simulation of waking life (Revonsuo et al., 2015), and with a mixture of characters, motivations, scenarios, positive and negative emotions, and almost entirely fictional plot, is proposed to have been selected for in evolution, and in particular in sexual selection, as part of the selection for emotional intelligence and empathy (cf Smith et al., 2017). This study tests three correlations that are predicted by the theory, that trait empathy will be correlated with dream telling frequency, frequency of listening to others' dreams, and with positive attitude towards dreams.

Methods: 160 participants (120 females, 40 males; mean age = 21.30, SD = 4.70) completed the Toronto Empathy Questionnaire and the Mannheim Dream Questionnaire online.

Results: Pearson partial correlations were conducted, with age and sex partialled out, dfs = 156, and with one-tailed ps. Trait empathy was found to be significantly associated with frequency of listening to the dreams of others (r = 0.14, $p = 0.045$), frequency of telling one's own dreams to others (r = 0.32, $p < 0.001$), and positive attitude towards dreams (r = 0.29, $p < 0.001$).

Conclusions: The hypotheses were confirmed. A proposed mechanism is that the dream acts as a piece of fiction, that is explored by the dreamer and others and that, like literary fiction (Matthijs Bal & Veltkamp, 2013), can induce empathy about the life circumstances of the dreamer. Future studies should investigate the effect on state empathy of experimental alterations in frequency of telling and listening to dreams.

References:

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Disclosure: Nothing to disclose.

P025 | Emotions in dreams correlate with coping style

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Objectives/Introduction: Modern dream research has shown interesting relationships between some cognitive-behavioural trait variables and dream content (Malinowski, 2015). Aim of this study is to analyse the role played by behavioural activation systems and coping strategies in determining interindividual differences in dream emotional content. Specifically, continuity between waking cognitive/emotional strategies and dream emotions was expected.

Methods: Ten adult subjects were administered: a) the Behavioural Inhibition and Activation Scale (BIS/BAS Scale, Italian version, Leone et al., 2002), addressing interindividual differences in inhibition/activation through the following subscales: "Behavioural Inhibition System", "Reward Responsiveness", "Drive", "Fun Seeking", "Behavioural Activation System"; b) the Coping Orientation to Problems Experienced - New Italian Version (COPE-NVI, Sica et al., 2008), evaluating the frequency of different coping strategies through the subscales: "Social Support", "Avoidance", "Positive Attitude", "Problem-focused Coping", "Religious Coping". Dream reports were collected for 38 consecutive days. The central 8 days were analysed for the following dream features: number of dreams, dream length (in temporal units), number of total emotions, number of positive emotions, number of negative emotions, number of somatic sensations, dream bizarreness (subjectively reported on a 5-point scale). These variables were then correlated to all BIS/BAS and COPE-NVI subscales.

Results: Significant Spearman correlations were found between emotion type and two types of coping strategies: the number of positive emotions positively correlates with "Problem-focused Coping" (rho = 0.247, $p \leq 0.01$) and negatively correlates with "Avoidance" (rho = 0.300, $p \leq 0.05$). No significant associations emerged with BIS/BAS subscales.

Pearson analysis of correlation between BIS/BAS and COPE-NVI ratings on one hand and number of words, number of dreams and dream bizarreness on the other hand, showed no significant results.

Conclusions: Our results point to a continuity of emotional processing from waking to the sleep state. The positive correlation between positive emotionality in dreams and active coping is consistent with existent data on waking emotional processing reporting associations between positive affect and active coping strategies (Khosla & Hangal, 2004) Similarly, the negative correlation of dream positive emotions with avoidance coping frequency confirms previous literature on the waking state (Piira et al., 2002). Future research should address the direction of this association.

Disclosure: Nothing to disclose.

P026 | Dreams of children with neurodevelopmental disorders: autism spectrum and attention deficit/hyperactivity

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Objectives/Introduction: The Autism Spectrum disorder (ASD) and the Attention Deficit/Hyperactivity (ADHD) disorder are two highly comorbid neurodevelopmental disorders (NDDs) with atypical cognitive functioning, including emotional processing. The study of dreams in these two groups of children could constitute an opportunity to better understand the physiopathology of NDDs.

Methods: 18 children diagnosed with ASD (11.7 ± 3.7 years) and 18 children diagnosed with ADHD (11.8 ± 3.3 years) filled a dream content self-report. Groups were compared on easiness to recall content (1 = never, 5 = easy), cloudiness of recall (1 = vivid, 5 = very cloudy) and the frequency of four emotions in their dreams (joy, fear, sadness and anger; 1 = never, 5 = always). Results were compared with t-tests. We expected that recall, clarity and emotions would be decreased in the ASD group.

Results: The ASD group recalled less their dreams than the ADD group (means ± s.d.: 2.0 ± 1.0 vs. 2.7 ± 0.9; $t(29)=2.04$, $p < 0.05$), the content was more cloudy (3,9 ± 1,1 vs. 3.0 ± 1.4; $t(29)=2.02$, $p < 0.05$) but there were no differences on the frequency of emotional items, both groups reporting rarely or seldom joy, fear, sadness or anger.

Conclusions: Dream recall is less easy and less clear in children with an ASD compared to ADHD but groups did not differ on the frequency of emotional items. Comparable results on recall were published in ASD adults compared to a group of neurotypical individuals (Daoust et al., 2008). The two groups of children do not differ on the frequency of emotional items, both displaying low scores. This possibly reflects an altered processing of emotional load in dreams of children with NDDs.

Disclosure: Nothing to disclose.

P027 | Efficacy of cognitive behavioral therapy for insomnia on nightmares in veterans with PTSD

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Objectives/Introduction: Insomnia and nightmares are two of the diagnostic criteria for Posttraumatic Stress Disorder (PTSD). Cognitive behavioral therapy for insomnia (CBT-I) is considered the gold standard in treatment for insomnia however little is known about impact CBT-I has on the frequency of nightmares in a Veteran population. Here we report results of a randomized trial in Veterans with PTSD and chronic insomnia comparing delivery of CBT-I by video teleconference vs. in-person delivery.

Methods: Veterans with current PTSD on the Clinician Administered PTSD Scale and Insomnia Severity Index (ISI) score ≥ 15 were randomized to receive CBT-I in person or via video telehealth equipment. Nightmares were assessed using the Nightmare Frequency Questionnaire (NFQ), and Nightmare Distress Questionnaire (NDQ). Relationships were examined using paired t-tests comparing baseline and 3-month follow-up measures within each group.

Results: Subjects who received CBT-I in person (n = 46) reported experiencing a total of 2.2 nightmares on 2.1 days a week while Veterans who received CBT-I via telemedicine (n = 49) reported a number of 2.3 nightmares on an average of 2.2 days a week. At the 3-month follow-up Veterans in the in-person CBT-I group averaged 2.5 nightmares on 2.5 days a week and those in the telemedicine group reported 3.2 nightmares on 3.1 days per week. On the NDQ, subjects who received in-person CBT-I scored a 26.82 ± 8.08 prior to treatment and a 28.81 ± 7.70 at the 3-month follow-up while Veterans who received CBT-I via telemedicine scored a 26.73 ± 7.74 at baseline and 25.46 ± 7.95. These improvements were not statistically significant. Baseline ISI scores significantly improved when compared to scores at the 3-month follow-up ($p < 0.01$).

Conclusions: Nightmares continue to be a staple symptom in Veterans with PTSD. Overall, sleep improved in both groups however the frequency of nightmares was not found to be significantly impacted from treatment. This could be an indication that CBT-I alone does not aid in the improvement of nightmares in Veterans with PTSD. Further research is needed in this area to determine the factors driving nightmares in this population.

Disclosure: Nothing to disclose.

P028 | Emotions in REM dream reports in healthy women

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Objectives/Introduction: To evaluate and compare two methods of analysing the emotional content of REM dreams′ recall: self-rating and with the Hall and Van Castle scale/

Emotions are an important aspect of dreams. Negative emotions (NE) tend to predominate in the case of explicitly mentioned emotions, whereas in the case of self-ratings, the affective tone is balanced. (Schredl et al., 1998).

Methods: 20 adult healthy women were recorded for 2 PSG consecutive nights. REM awakenings dreams were collected after 10 continuous minutes of REM.

Dream emotional content analysis was measure with:

(1) A scale for dreamers' self-ratings their dreams' reports: six emotion categories (1-fear/anxiety, 2-anger, 3-sadness, 4-shame, 5-joy/elation, 6-affection/erotic) on a scale of 1–5 (5 = highest intensity).

(2) Evaluated by the Hall and Van de Castle method; this system scores all explicitly mentioned emotions in five categories: anger, apprehension, happiness, sadness, and confusion. A dream report was considered

(a) positive, when the number of PE were predominant;

(b) negative, when the number of NE exceeded that of PE;

(c) balanced (BT), when the number of PE and NE was equal and

(d) with no emotions (NE), when no emotions were explicitly mentioned.

Results: 20 women were admitted in our study with mean age of 27,7 (min 20; max 36).

127 REM awakenings were performed (mean= 4,86; SD= 2,74), with 82,9% recall rate; 105 dreams were evaluated (5.25 per subject, min 2; max 9; mean=1,38; SD= 1,90).

With the self-rating analysis we obtain 35 with NE (33.3%), 61 with PE (58.1%), 1 with BT (1%) and 8 with NE (7,6%) and with the Hall and Van Castle evaluation, 27 with NE (25,8%), 8 with PE (7,6%), 2 with BT (1,9%) and 68 with NE (64,8%).

With the two methods the resulting difference between PE and NE was not significant (ANOVA with Bonferroni correction $p < 0,05$.) The two content analysis were different: Self-rating analysis 1.83 ± 0.790 and Hall and Van Castle 3.06 ± 1.329, (Mann-Whitney test Z = −7,189 $p < 0,001$).

Conclusions: PE and NE were similar in the two evaluations.The two analyses were different, probably associated with the low rate of explicitly mentioned emotions in the dreams reports.

Disclosure: Nothing to disclose.

P029 | Sleep inertia and functional connectivity between brain regions at awakening in high and low dream recallers: an EEG-fMRI study

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Objectives/Introduction: Sleep inertia is a transitional state of lowered arousal occurring immediately after awakening from sleep and producing a temporary (typically 30 min) decrement in subsequent performances in various kind of tasks. Designing this study, our aims were to test a possible role for sleep inertia in dream recall frequency variations measuring its behavioral effects and cerebral correlates at awakening in high and low dream recallers (HR, LR). Our hypothesis was that a stronger sleep inertia in LR than in HR may prevent the short-term memory trace of the dream from surviving the sleep-wakefulness transition.

Methods: Participants (n = 55, 28 males, age=22.5 ± 2.4) were selected as either high (HR, n = 28, DRF=6.6 ± 0.7 days per week with a dream recall) and low dream recallers (LR, n = 27, DRF=0.2 ± 0.1). After a partial sleep deprivation (sleep slot : from 5 to 8 am), participants were equipped with fMRI compatible EEG and installed in the scanner at approximately 1 pm. After reference measures, they were instructed that they could sleep (max 45 min). They were awakened in NREM sleep and asked about their dreams. Measures of sleep inertia (2 min of the descending subtraction task) and functional connectivity (eyes open resting state scans) were done before the nap, 1–2 min and 25 min after awakening.

Results:

(1) replicated previous ones showing an alteration of the DST performance 5 min after awakening,

(2) showed that this effect tended to be stronger in LR than in HR, and

(3) that it was associated with a significant decrement of the functional connectivity of the DMN in LR as compared to HR.

Between-group contrasts of the functional connectivity at 5 min post-awakening revealed a pattern of enhanced connectivity in HR vs. LR within the default mode network and regions involved in memory retrieval (i.e. medial prefrontal cortex, precuneus, left medial temporal lobe, left dorsolateral prefrontal cortex).

Conclusions: These results show that

(1) HR and LR cerebral functioning is different,

(2) designate sleep inertia as a good candidate to explain some of the dream recall frequency variations, and

(3) provide some cerebral correlates of the functional state favoring dream recall at awakening.

Disclosure: Nothing to disclose.

SLEEP PHYSIOLOGY 1

P030 | Sleep EEG topography as an endophenotype: insights from an adolescent twin study

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Objectives/Instruction: Twin studies can disentangle the genetic and environmental contributors to a given phenotype. These studies are based on the assumption that greater similarity between MZ twins as compared to DZ twins can be attributed to the larger

proportion of shared genes. Low-density EEG studies in adult twins showed that the spectral composition of the sleep EEG is genetically determined. This study examined the degree to which genes contribute to sleep EEG topography during adolescence, a period of rapid changes in brain structure and organization.

Methods: High-density (58 derivations) sleep EEG was recorded in 14 monozygotic (MZ) and 12 dizygotic (DZ) adolescent twin pairs (mean age = 13.2; SD = 1.1; 20 females). The topographic distribution of power was examined for delta (1–4.6 Hz), theta (4.8–7.8 Hz), alpha (8–10.8 Hz), sigma (11–16 Hz), beta 1 (16.2–20 Hz), beta 2 (20.2–24 Hz), gamma 1 (24.2–34 Hz) and gamma 2 (34.2–44 Hz) bands during rapid eye movement (REM) and non-REM (NREM) sleep. Because we were interested in the spatial distribution of power across the scalp, absolute power at each derivation was normalized with mean power across derivations resulting in a vector of 58 values per individual. This vector was then correlated within a twin pair, resulting in one correlation coefficient (r) per twin pair. An ANOVA was used to evaluate the differences in the correlation coefficients between MZ (r_{MZ}) and DZ (r_{DZ}) twins. Furthermore, a heritability coefficient, h^2, defined as $2(r_{MZ}-r_{DZ})$ was calculated.

Results: The observed correlation coefficients were significantly higher in MZ as compared to DZ twin pairs for NREM sleep across all bands except theta and gamma 2. For REM sleep r_{MZ} was significantly higher than r_{DZ} in the beta 1 to gamma 1 bands. We found highest heritability in the beta bands ($0.44 \leq h^2 \leq 0.57$), while heritability was modest in the delta to sigma bands ($0.01 \leq h^2 \leq 0.26$).

Conclusions: EEG topography is not only a representation of brain anatomy, but also reflects functional networks. Our results indicate that sleep EEG topography at higher frequencies is highly heritable suggesting that such topography may be a rich metric of brain function and a potential endophenotype for psychiatric disorders.

Disclosure: Nothing to disclose.

P031 | Event-related analysis of awakenings due to road traffic noise at night: a polysomnographic field study

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Objectives/Instruction: Nocturnal traffic noise causes sleep disturbances in residents. Thus, knowledge about noise effects is important to help protect residents' sleep and maintain health, well-being, and performance. In recent years, DLR has established exposure-response curves regarding the effects of aircraft and railway noise on the awakening probability of residents. However, such a curve has not yet been established for road traffic noise.

Methods: We conducted a field study in residential areas where road traffic was the dominant noise source and noises were attributable to separate events. Forty healthy participants (mean age = 29.1, SD = 11.7; 26 females) that were free of sleep disorders were polysomnographically examined for five consecutive nights. Acoustic measurements were undertaken at the sleepers' ear. The synchronous collection of electrophysiological and acoustic data allowed for an event-related analysis of noise events and associated awakenings.

Results: The present analysis included 152 nocturnal recordings with a total of 11265 road traffic noise events within the participants' sleep period. Participants were exposed to a median of 107 road traffic noise events per night. A random effects logistic regression model, including acoustic, sleep-related and participant-related (e.g. age) variables, revealed a significant increase in the awakening probability with increasing maximum sound pressure level of a noise event ($p < 0.001$). When holding all confounding variables constant at their respective sample median, the awakening probability per single noise event ranged from 0.5% at 24.2 dB(A) to 3.8% at 70 dB(A) maximum sound pressure level. Assuming an exposure of 107 noise events per night with maximum sound pressure level of 39.4 dB(A) (median) the model estimates on average one noise-induced awakening per night.

Conclusions: The present study is of high ecological validity and provides for the first time an exposure-response curve regarding the effect of separate road traffic noise events on the awakening probability. Our study focussed on residential areas with moderate traffic density at night. Further investigations of urban areas with dense traffic are still needed, which, however, will require a novel methodological approach as an event-related analysis is no longer feasible. The ultimate goal will be to establish physiologically based noise protection measures.

Disclosure: Nothing to disclose.

P032 | Light-induced sleep is homeostatically regulated in mice

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Objectives/Instruction: Prolonged wakefulness leads to longer and more intense sleep. Light exposure during the dark period reliably triggers sleep in mice, but it is unknown whether sleep-wake history affects light-induced sleep, and, conversely, whether light-induced sleep contributes to sleep pressure dissipation. The aim of this study was to determine whether light-induced sleep is homeostatically regulated in mice.

Methods: EEG recordings from the frontal and occipital cortex were performed in adult male C57BL/6J mice (n = 11) during spontaneous and light-induced sleep. Mice were subjected to one-hour

white light pulses (~150 lux) either two (ZT14) or six (ZT18) hours after dark onset.

Results: At ZT14, the light pulse induced NREM sleep within minutes (2.1 ± 0.6 min), and the total amount of NREM sleep during the 1-h light pulse was higher than during the corresponding interval of baseline (41.5 ± 2.2 vs. 15.3 ± 3.5 min, $p < 0.01$). The light pulse induced more NREM sleep at ZT14 as compared to ZT18, when only 25.9 ± 6.2 of NREM sleep occurred during the light exposure ($p < 0.05$). The total 12-h amount of NREM sleep only was not different between baseline and the night when the light pulse was delivered. The amount of NREM during the light pulse at ZT14 and ZT18 was negatively correlated with the amount of NREM during the 2-h intervals prior to the light pulse ($p < 0.0001$). Furthermore, the amount of sleep during the 2-h interval following the light exposure was negatively correlated with the amount of sleep during the light pulse ($p = 0.0101$). Finally, the light-induced sleep was characterised by elevated EEG power density in slow frequencies, which significantly exceeded baseline values by 70% in the frontal derivation between 0.5 and 1 Hz at ZT18, and by 43.1% in the fronto-occipital derivation between 0.75 and 1.5 Hz at ZT14 ($p < 0.01$). EEG spectra in the occipital derivation did not differ significantly between light-induced and spontaneous sleep.

Conclusions: Light exposure during the dark period reliably induces sleep in mice especially in the conditions of elevated physiological sleep pressure. Furthermore, light-induced sleep effectively dissipates sleep pressure, as manifested in reduced sleep following the light pulse. These data suggest that light-induced sleep is homeostatically regulated.

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P033 | Wanderlust - travelling and stationary sleep oscillations

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Objectives/Instruction: Slow waves and sleep spindles represent exclusive hallmarks of the sleeping brain's activity. Various conflicting theories about their physiology and emergence across the cortex exist. Here, we aim to elucidate their patterns of distribution and their spatio-temporal propagation across the brain.

Methods: We acquired high-density 268-channel MEG with additional EEG polysomnography of 10 participants. Each participant spent four 6-h nights in the MEG, enabling us to compare nights within and across participants. Slow waves and sleep spindles were automatically detected and clustered into contiguous events across sensors using a nearest-neighbour algorithm.

Results: The distribution of slow-wave events across the head showed a large diversity in their characteristics both in the temporal (stationary vs. travelling) and in the spatial domain (local vs. global). Travelling waves wandered for up to ~2s, covering distances of up to ~40 cm. Slow waves originated uniformly from locations across the entire head surface and showed little preferred travel directions. Sleep spindles also showed travelling properties, but to a lesser extent (up to ~1s and ~15 cm). They had a more local appearance, but could occur in multiple synchronous but distinct bursts. Spindles often originated simultaneously in distant, analogous bilateral regions. Spindles were preferentially detected in clusters of central and occipital-parietal sensors.

Conclusions: The higher spatial resolution of MEG in combination with advanced clustering techniques revealed some unexpected characteristics of sleep oscillations, in particular their local origination and the spatial distinctness of simultaneous events. The distinct characteristics of slow waves and spindles imply divergent physiology and might also point to functional differences.

Disclosure: Nothing to disclose.

P034 | Alteration of sleep and wake triggered by chronic social defeat stress in mice

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Objectives/Instruction: Stress plays a key role in the development of psychiatric disorders and has a strong impact on sleep. In mice, chronic social defeat (SD) stress is an ethologically valid model of stress-related disorders but little is known about its effects on sleep regulation.

Aims: Here, we investigate the acute and long term effects of a chronic SD stress on vigilance states in mice.

Methods: C57Bl/6J mice were implanted with electrodes for polygraphic recordings. After 2 weeks of recovery, implanted mice were subjected to ten consecutive days of SD, during which they were confronted to an aggressive CD1 mouse. Then, we identified susceptible mice, i.e. mice that develop long-lasting social avoidance. Sleep-wake stages were monitored by polygraphic recordings at baseline, following each stress session and 5 days after the end of SD protocol. Vigilance states, including rapid eye movement (REM) sleep, non REM (NREM) sleep and wake, and electroencephalogram (EEG) power density were analyzed. Statistical significance was ascertained by repeated measures ANOVA.

Results: SD produces biphasic changes in sleep-wake pattern that are preserved across the different SD sessions. For several hours after the SD session, wake is enhanced while REM sleep is strongly decreased (n = 9, $p = 0.0014$ and $p < 0.0001$ respectively). Concomitantly, slow wave activity is increased during NREM sleep (n = 7, $p = 0.001$); this might correspond to recovery or consolidation. Then, SD produces a delayed increase in REM and NREM sleep amounts

(n = 9, $p < 0.0001$ and $p = 0.0008$ respectively). On the 5th day of recovery following the 10-day stress, these modifications disappear. However, reduced delta activity and enhanced power in higher frequency bands emerged within NREM sleep (n = 7, $p = 0.0003$), a feature reminiscent of sleep in insomniacs.

Conclusions: Chronic SD stress induces strong adaptations of the sleep-wake pattern in mice. Altogether, our study might provide valuable insights into the pathophysiological mechanisms triggered by chronic psychological stress.

Disclosure: Nothing to disclose.

P035 | Cold-Inducible RNA Binding Protein contributes to quality of waking, REM sleep homeostasis, and modulates the cortical molecular response to sleep deprivation

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Objectives/Instruction: The sleep-wake distribution is orchestrated by interacting homeostatic and circadian processes. Clock-genes are involved in sleep homeostasis, as sleep deprivation [SD] changes clock-gene expression. How does sleep pressure affect clock gene expression? We propose a role for Cold-Inducible RNA Binding Protein (CIRBP) because (i) its expression is sleep-wake driven, likely through sleep-wake dependent changes in cortical temperature (Tcx), and (ii) CIRBP is necessary for high-amplitude clock-gene expression *in vitro*. Therefore, we predict that sleep-wake dependent changes in clock-gene expression are attenuated in CIRBP knock-out (KO) mice, thereby altering the sleep homeostat.

Methods: We assessed EEG activity, sleep-wake distribution, and locomotor activity in male KO mice (n = 17) and their wild-type (WT) (n = 20) littermates, as well as T_{cx} in a sub-cohort of the WT mice (n = 6), during two baseline days [BL], a 6 h SD starting at light onset (ZT0) and two recovery days. In a separate cohort, cortical gene expression was quantified at ZT0 and 6 h later with (SD-ZT6) or without (NSD-ZT6) sleep deprivation (n = 5 per genotype per condition.

Results: Tcx correlated well with sleep-wake state (R^2=0.76, $p < 0.0001$, n = 6, 96 values per mouse) and SD sustained high Tcx (t(5)=−35.8, $p < 0.0001$). KO mice were more active (t(31)=−2.56, $p = 0.015$), displaying faster theta activity in the EEG during active waking (t(35)=2.03; $p = 0.0506$). Furthermore, KO mice demonstrated an altered sleep-wake distribution (F(1,34)=6.02, $p = 0.0194$) resulting in higher NREM sleep EEG delta power (0.75–4 Hz) (F(1,34)=4.65, $p = 0.038$). KO mice recovered less REM sleep after SD (t(35)=2.99, $p = 0.0005$). In the cortex, a genotype dependent effect of SD was demonstrated in the clock genes *RevErba* and *Clock* ($p = 0.02$ and 0.01, resp.) but not *Per2* ($p = 0.80$).

Conclusions: Our findings confirm that also in the mouse the sleep-wake distribution drives changes in Tcx under the conditions studied. Furthermore, CIRBP contributes to the sleep-wake distribution, suppresses activity and accompanying speed of theta activity during the dark phase, and REM sleep homeostasis. *Reverba*'s response to SD is amplified by CIRBP, whereas *Clock'* response is attenuated. Overall, the relative contribution of CIRBP to SD-induced changes in (clock) gene expression and its interaction with other sleep-wake driven pathways remain to be elucidated.

Disclosure: Nothing to disclose.

P036 | Does chronic exposure to electromagnetic fields combined with noise has effects on sleep and homeostasis in juvenile rats?

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Objectives/Instruction: The electrosensitive population, estimated to 1.5 to 5% of Europeans, attributes symptoms (sleep perturbation, weight lost…) to radiofrequency-electromagnetic-fields (RF-EMF). The effects of RF-EMF are controversial maybe because simple exposure to RF-EMF would induce non-significant effects. To verify this hypothesis, we exposed juvenile rats to RF-EMF with another environmental factor frequently encountered in everyday life: noise. The aim of this study is to see the chronic effects of a low-level RF-EMF exposure combined with a high-level noise exposure in juvenile rats on sleep and homeostasis parameters.

Methods: 48 3-weeks-old male Wistar rats: 12 controls (noise level < 65 dB, RF-EMF < 0.25 $V.m^{-1}$), 12 RF-EMF animals (23 h/24, 900 MHz, 1,8 $V.m^{-1}$ and SAR=0,3 $mW.kg^{-1}$), 12 Noise animals (87.5 dB, 50–20.000 Hz, mixing environmental and artificial noises, 12 h/24 during the light-rest period) and 12 co-exposed RF-EMF Noise animals. After 3 weeks of exposure, rats were surged to dispose polysomnographic telemetric implants (EEGs and EMG) and 24-h polysomnography was performed at 5th week of exposure. Food intake and body weight were recorded. The data were expressed in Mean±SD. Significance at $p < 0.05$ (two-way ANOVA or Mann-Whitney according to Normality).

Results: The weight of RF-EMF or noise animals but not of co-exposed animals increased compared to controls ($p < 0.05$).

Noise animals ate more compared to controls ($p < 0.001$) and RF-EMF animals presented food intake pattern ($p < 0.001$). Co-exposed animals ate more ($p < 0.001$) even if the number of meals decreased ($p < 0.001$).

Noise sleep effects consisted in diminution of Quiet Wakefulness and NREM episodes ($p < 0.05$) and increased of mean duration of NREM episodes ($p = 0.058$). RF-EMF decreased frequency and mean duration of Wake episodes ($p = 0.038$ and $p = 0.044$), without modification of Wake total duration. The mean duration of NREM

episodes increased only in non-noise exposed animals (p = 0.048). In contrast to single exposures, there are no effects of the co-exposure on sleep parameters.

Conclusions: Both chronic noise exposure and RF-EMF exposure induced modification of sleep microstructure without modification of sleep macrostructure. Noise exposure induced weight gain associated with hyperphagia whereas RF-EMF exposure induced weight gain with modification of food pattern. the expected synergy effect was not observed for co-exposed animals.

Disclosure: Nothing to disclose.

P037 | The dynamic of consciousness loss when falling asleep

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Objectives/Introduction: Falling asleep is a dynamical process lasting several minutes, during which the brain changes from rapid wakefulness rhythms to slower activities specific to sleep. Yet, the precise time course of consciousness fading during sleep onset remains unclear.

We aimed at better define the falling asleep process, analyzing the precise dynamic of the cognitive and consciousness modifications that take place during the transition between wakefulness and sleep.

Methods: We presented 31 awake and falling asleep subjects with the auditory 'local-global' paradigm, a variant of the classical oddball that enables to dissociate two hierarchical prediction error signals when detecting auditory novelty: the mismatch negativity (MMN) and the P300. Subjects were asked to give a motor response to global deviant sounds, as soon as they were conscious of, and were recorded in electro- and magneto-encephalography (MEEG). Only subjects who did well apply the detection task and who presented enough sleep onset periods to extract a clear auditory event-related field were kept for analysis (N = 14). We analyzed behavioral and MEEG data using the detailed classification of the falling asleep process (Hori et al., 1994), which describes 9 stages from wakefulness to the occurrence of the first sleep spindle, using epochs of 5 sec.

Results: Behaviourally, response rate decreased and reaction times increased along sleep onset stages. The MMN progressively decreased and was not significant anymore from the occurrence of theta waves. The P300 was present only when subjects were aware of deviant sounds, almost exclusively before alpha suppression. Using permutation entropy, we showed that while theta power increased with sleep onset stages, the information embedded in this theta decreased, meaning that this theta did not support complex information usually associated with consciousness.

Conclusions: We showed that the falling asleep process, within the first stage of sleep (NREM1), embeds multiple cognitive and conscious states. Subjects are mostly conscious (motor responses, P300) and keep predictive coding capabilities (MMN and P300) before the occurrence of theta waves. After that, most of the subjects are unconscious (no behavior, no P300, decreased entropy) and may detect auditory novelty only through bottom-up sensory adaptation mechanisms.

Disclosure: Nothing to disclose.

P038 | Effects of selective silencing of layer 5 pyramidal neurons on sleep-wake distribution and local cortical EEG activity

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Objectives/Introduction: Layer 5 pyramidal neurons are a key population in the generation and propagation of cortical slow oscillations. Slow oscillations represent an electroencephalographic hallmark of non-rapid eye movement (NREM) sleep, might be functionally relevant for neuronal recovery during sleep, and their spectral power (slow wave activity, SWA) is a marker of sleep pressure. Considering the relevance of layer 5 pyramidal neurons for slow oscillations, we postulate that this cell population is additionally involved in the initiation and maintenance of slow wave sleep. Specifically, we hypothesise that chronic silencing of layer 5 pyramidal neurons affects sleep-wake regulation and the homeostatic response to sleep deprivation.

Methods: We investigated a transgenic mouse model in which ~15–30% of pyramidal cells in layer 5 are functionally silenced by removal of the t-SNARE protein SNAP25 (Rbp4-Cre; Ai14; $Snap25^{fl/fl}$). Male adult mice (10–17 weeks, four homozygous, one heterozygous and one wild type control) were housed on a 12 h/12 h light/dark cycle. We recorded frontal and occipital EEG as well as local field potentials (LFPs) and neuronal activity in the primary motor cortex with a 16-channel laminar probe. On one occasion, 6 h sleep deprivation (SD) was performed starting at light onset.

Results: During the light period, all animals demonstrated a similar distribution of vigilance states regardless of genotype (13.8–20.4 min/h awake, 32.0–36.4 min/h NREM, 4.9–7.6 min/h rapid eye movement (REM) sleep). During the dark period, layer 5 silenced animals showed extensive wakefulness (48.9 and 56.3 min/h awake) whereas the heterozygous control was awake for 40.0 min/h and the wild type control for 31.3 min/h. In response to sleep deprivation transgenic mice had a numerically lower increase of SWA relative to individual baseline averages compared to control animals. Transgenics also presented recurrent episodes of behavioural arrest accompanied by high-voltage spindles during waking and REM sleep.

Conclusions: We tentatively interpret this data as preliminary evidence for altered sleep regulation by disruption of layer 5 pyramidal cell function. We postulate that this neuronal population might represent a core element in a circuit, which tracks the homeostatic cortical need for sleep and translates it into sleep pressure.

Disclosure: Nothing to disclose.

P039 | Sleep and cardio-metabolic risk in regional dwelling individuals

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Objectives/Instruction: In Australia, individuals living in regional communities (areas that lie beyond the major capital cities) have a higher prevalence of chronic disease risk factors compared to those living in urban communities. Poor sleep is thought to negatively impact cardio-metabolic risk factors, however sleep is not a well acknowledged modifiable lifestyle factor for risk prevention. Accordingly, in an effort to determine the association between sleep and cardio-metabolic risk, we aimed to assess the effects of sleep, physical activity and diet on cardio-metabolic risk measures (i.e, blood pressure, body weight and blood lipid and glucose levels) in regional dwelling adults.

Methods: In 204 adults (76M/128F, aged 58 ± 8 years), screened for high cardio-metabolic risk, 7 day actigraphy was performed. Mean values for WASO (min), TST (min), SE (%) were assessed and percentage of time spent in levels of physical activity (light and moderate-vigorous) were calculated. To assess cardio-metabolic profile, HbA1c, total, low density and high density lipoprotein cholesterol and triglyceride levels were measured using blood collected via finger prick (Alere Afinion™). Standard anthropometric measurements were recorded as well as blood pressure (Omron™). Diet was assessed using the Dietary Questionnaire for Epidemiological Studies (DQES v2) and macro/miro-nutrient intake examined. Multiple stepwise linear regression was performed to determine predictors (sleep, diet and physical activity measures) of cardio-metabolic risk factors. Data were adjusted for gender, age, smoking status and family history of cardiovascular disease and diabetes. Level of significance was $p < 0.05$. Data are presented as mean±SD.

Results: Of a sample size of 204, average TST was 897 min/night ± 50 min, SE 97% ± 2%, WASO 12 ± 9 min. Body weight was independently associated with SE (β=-1.93, $p = 0.003$), monounsaturated fat intake (β=2.3, $p = 0.005$), moderate-and vigorous physical activity (β=-1.5, $p = 0.008$) and TST (β=-0.47, $p = 0.049$); (r^2=0.24, $p > 001$). Diastolic blood pressure was predicted by SE (β = -0.86, $p = 0.02$) (r^2=0.05, $p = 0.005$). No other risk factors were independently associated with sleep, physical activity or diet.

Conclusions: People with poorer lifestyle behaviours and worse sleep quality are more likely to have elevated risk factors, highlighting the need for improvement of sleep and diet and lifestyle modification for prevention of cardio-metabolic disease.

Disclosure: Nothing to disclose.

P040 | Hypocretin in footshock stimulation-induced REM sleep suppression

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Objectives/Introduction: To elucidate the involvement of hypocretin (hcrt), projected from the lateral hypothalamic area (LHA) to locus coeruleus (LC) and dorsal raphe nucleus (DRN), in sleep alterations when rats received an inescapable footshock stimulation (IFS).

Methods: Male Sprague-Dawley rats (250–300 g; BioLASCO, Taiwan) were used in present study. The IFS consisted of twelve times of electrical stimuli (5.0 mA, 133 V, and 50 ms of duration for each stimulation), which were randomly given within 10-min period at the beginning of the light period. The sleep-wake activity was recorded for 24 hours. To clarify the involvement of hcrt in stress-induced sleep alterations, a high dose (2.5 μg) and a low dose (1.25 μg) of hypocretin receptor (hcrtR) antagonist, TCS-1102, were directly microinjected into the DRN and LC. In the other groups of rats, the brain tissues were collected at three different zeitgeber times (ZT), ZT0, ZT1, and ZT2 after rats received the IFS, and the expression of prepro hypocretin (prepro-hcrt), hypocretin 1 (hcrt-1), and c-fos at LHA were determined after the IFS.

Results: The IFS suppressed rapid eye movement (REM) sleep during the first 6 hours of the light period; however, a compensatory REM sleep enhancement appeared during the subsequent dark period. Administration of hcrtR antagonist TCS-1102 into the LC and DRN blocked the IFS-induced REM sleep alterations. Immunoreactive cells of prepro-hcrt and hcrt-1 were increased in the LHA after the IFS. Cells expressing both prepro-hcrt and hcrt-1 were increased from 12,003 to 13,640 at ZT0; from 11,049 to 11,932 at ZT1; and from 12,929 to 16,323 at ZT2. We also found that the IFS increased c-fos expression in the LHA; however, there are more c-fos expressing neurons beyond the hcrt-1 expressing neurons.

Conclusions: Our results indicate that the IFS activated the neurons in the LHA, increased the expression of prepro-hcrt, and increased the cleavage of prepro-hcrt to hcrt-1. The IFS suppressed REM sleep and this REM sleep suppression was blocked when hcrtR antagonist was administered into the LC or DRN, suggesting the involvement of hcrt projections from LHA to LC and DRN in the stress-induced REM suppression.

Disclosure: Nothing to disclos.

P041 | Analysis of day and night-time stress markers after sleeping with nocturnal traffic noise

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Objectives/Introduction: Exposure to traffic noise is associated with increased stress markers which on the long term can lead to cardiovascular diseases. Traffic noise at night is also known to impair sleep, a vital function that helps to regulate the stress pathways. However, the importance of sleep in this association remains to be investigated.

Methods: Eighteen young volunteers (age: 19-33 y) participated in a laboratory study starting with a noise-free baseline night (BL) followed with four randomly presented noise scenarios: a 4-lane highway (scenario_A), a 2-lane country road (scenario_B), a 1-lane urban road (scenario_C), and a railway noise situation (scenario_D). All noise scenarios had an hourly Leq of 45 dB(A) at the ear of the sleeper and differed according to intermittency ratio (IR), an acoustical descriptor for the eventfulness of noise exposure. Salivary cortisol was sampled at regular interval throughout the day and urinary catecholamine (adrenaline and noradrenaline) was collected during the night. Sleep was recorded by polysomnography and subjective sleep quality was assessed each morning with the LEEDS questionnaire.

Results: Morning cortisol tended to increase after sleeping with a high intermittent road noise (scenario_C: IR=0.8) compared to BL (p = 0.1) and the railway noise (scenario_D: IR=0.9, p = 0.08), whereas no differences were reported with scenario_A (IR=0.3) and scenario_B (IR=0.7) ($F_{4,64}$=2.35, p = 0.06). Evening cortisol increased after sleeping with scenario_C compared to BL (p = 0.03) and scenario_D (p = 0.02); here also no differences were seen compared to scenario_A and scenario_B ($F_{4,68}$=3.16, p = 0.02). Nocturnal catecholamine levels did not significantly change in presence of traffic noise. None of the objective and subjective all-night sleep variables differed significantly between the noise scenarios.

Conclusions: These preliminary results suggest that at a same LAeq and a similar IR, road traffic noise is more stressful (higher cortisol secretion) than railway noise. However, nocturnal catecholamine levels, another stress marker, did not differ in presence of nocturnal traffic noise with an hourly Leq of 45 dB(A). Moreover, we did not observe significant changes in sleep variables between the different traffic noise scenarios, suggesting that sleep alterations were not involved in the detrimental effect of traffic noise on cortisol levels.

Disclosure: Nothing to disclose.

P042 | Subjective sleepiness: its relationship to actual sleep tendency and neurophysiological changes

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Objectives/Introduction: Although subjective sleepiness is a primary complainant in sleep disorders and a major treatment outcome, it is not well studied how these subjective experiences are correlated to physiological consequence. In addition, the mechanism how such subjective experiences are intervened is poorly understood. To physiologically examine the actual consequences of subjective sleepiness, we conducted a survey and additional neurophysiological measurements, during multiple sleep latency test (MSLT) and polysomonography (PSG) at preceding night.

Methods: Nineteen male and 11 female with average age of 29.47 ± 11.63 (mean ± standard deviation) years old were participated in this study. They were asked to participated to conduct tasks and fulfill the questionnaire just before the PSG and every MSLT sessions, as following:

To record subjective sleepiness, we used two independent scale; Stanford Sleep Scale (SSS) and Visual Analogue Scale (VAS). Along with the questionnaire, subjects were asked to participate in a ~20 min of attention required task, during which electro-encephalography (EEG) was recorded. The task was attention network test, which requires continuous attention so that participants response quickly and correctly to the presented stimuli. The spectral analysis of the EEG was conducted to obtain alpha, beta, and theta activity power.

Results: To examine the validity of 'subjective sleepiness', correlation between VAS and SSS were analyzed. As expected, VAS scores and SSS scores were significantly correlated on every occasion including PSG, MSLT-Nap1, MSLT-Nap2, MSLT-Nap3 and MSLT-Nap4 (linear fit model; R^2= 0.66, 0.46, 0.72, 0.30, 0.24 respectively, with $p < 0.01$ in all occasions). However, both measures were not correlated with sleep latencies in any occasions ($p > 0.05$). Correlation analysis between EEG activity with VAS or sleep latency showed similar results, with no significant correlation in most cases. In some occasions, such as beta activity at MSLT-Nap3 and Nap4 showed significant correlation with sleep latencies, although the linear fitting was not clear (R^2=0.39 and 0.16, respectively).

Conclusions: Current study showed elusive nature of subjective sleepiness. However, significant correlations in some occasions, such as between beta activity and sleep latency in afternoon, could be a result of time dependent correlations.

Disclosure: This study protocol was approved by the ethics committee of the Shiga University of Medical Science. There are no conflicts of interest. This study was supported by JSPS KAKENHI Grant Numbers 17H00872 and 15K16565.

P043 | Japanese sake yeast improves human sleep quality and daytime fatigue: a double-blind randomised placebo-controlled clinical trial

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Objectives/Instruction: We have shown that Japanese sake yeast ingestion enhances human slow wave sleep and improves sleep quality via Adenosine A_{2a} receptors (Monoi N. et al. J Sleep Res. 2016. Nakamura Y. et al., J Sleep Res. 2016). Although, sleep quality is closely associated with daytime feelings, it remains unclear whether this sake yeast-mediated sleep improvement ameliorates daytime feelings. In this study, we investigated whether sake yeast intake improves daytime fatigue and vitality.

Methods: In a double-blind, placebo-controlled cross-over clinical study, 36 healthy adults with low sleep quality were selected by the Pittsburgh Sleep Quality Index score, which is equal to or higher than 5 points. They were instructed to ingest tablets containing 300 mg of sake yeast or placebo tablets an hour before going to bed for 4 days. The effects of Japanese sake yeast were evaluated using a visual analog scale for daytime fatigue, SF-8 health survey for vitality and a subjective sleep quality questionnaire (MA version of the Oguri-Shirakawa-Azumi sleep questionnaire). The effects of Japanese sake yeast and placebo were compared by Student's paired t-test. Correlations between fatigue, vitality and sleep quality were analysed by Pearson's correlation analysis.

Results: Compared with placebo, daytime fatigue (n = 35, $p < 0.01$) and vitality (n = 35, $p < 0.05$) were significantly improved by sake yeast ingestion. In a sleep quality questionnaire, sleepiness (n = 35, $p < 0.05$) and fatigue (n = 35, $p < 0.05$) in the morning were also improved. Correlation analyses showed amount of improvement in daytime fatigue or vitality and subjective sleep quality were significantly correlated (n = 35, $p < 0.05$).

Conclusions: Sleep improvement mediated by Japanese sake yeast intake improves daytime subjective fatigue and increases vitality.

Disclosure: Nothing to disclose.

P044 | Effects of Japanese sake yeast supplementation on human skin quality and analysis of its mechanism

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Objectives/Instruction: We have demonstrated that Japanese sake yeast enhances slow-wave sleep and increases amount of growth hormone secretion during sleep (Monoi N, et al. J Sleep Res. 2016). Recent studies suggest that insomnia exacerbates skin condition, and GH increases the skin thickness and elasticity. We hypothesized that improvement of sleep quality and up-regulation of GH secretion by Japanese sake yeast ameliorate skin condition. Thus, in the present study, we examined the effects of Japanese sake yeast on skin quality and analysed the mechanism involved in the skin quality improvement.

Methods: 1) Clinical trial: We performed a double-blind placebo-controlled parallel-group comparison study. Twenty participants [twelve males and eight females; age, 34.5 ± 9.1 years, Pittsburgh Sleep Quality Index ≥ 5] intaked tablets containing 300 mg of Japanese sake yeast or placebo tablets an hour before bedtime for 5 weeks. We evaluated the subjective sleep quality and the skin elasticity and collagen density in the cheeks using the Oguri-Shirakawa-Azumi sleep questionnaire and cutometer and ultrasonic imaging, respectively.

2) *In vitro* study: Human dermal fibroblasts were treated with GH or insulin like growth factor (IGF-1; GH-dependent secreted hormone) for 24-48 h. After the treatment, cells and culture supernatant were harvested for RNA and protein analysis. We measured the skin elasticity-related factors using quantitative real-time reverse transcription PCR and enzyme-linked immunosorbent assay.

Results: 1) Clinical trial: Japanese sake yeast increased the skin elasticity and the density of collagen in the cheeks and reduced sleepiness in the morning compared with placebo (student t-test, $p < 0.05$).

2) *In vitro* study: GH and IGF-1 treatment upregulated gene expression of HAS-2, whereas IGF-1 treatment upregulated gene expression of COL1A1, COL3A1 and downregulated gene expression of MMPs (student t-test, $p < 0.05$). IGF-1 also augmented the amount of type I collagen protein and attenuated the amount of MMP-1 protein in the culture supernatant (student t-test, $p < 0.05$).

Conclusions: Japanese sake yeast enhances skin elasticity as well as improves sleep quality in humans, and GH and IGF-1 promote skin elasticity by regulating the production of factor for skin elasticity *in vitro*.

Disclosure: Nothing to disclose.

P045 | The role of self-reported feelings of getting sufficient rest on the relationship between quick returns and health complaints

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Objectives/Instruction: Research has showed an association between quick returns (QRs: < 11 hours of rest between two shifts) and negative health outcomes like shortened sleep, and sick leave. However, not all workers report negative consequences of QRs. We

examined if subjective reports of getting sufficient rest between shifts could moderate the association between exposure to numbers of QRs over 12 months on subjectively reported health complaints (SHC) the following month.

Methods: Health care workers (n = 937) completed a questionnaire about relevant background variables, prevalence of SHC, and a question about feelings of sufficient rest; "How often do you get insufficient rest between two shifts", answered on a five-point scale ranging from almost never to very often". This information was linked to objective records of shift work exposure retrieved from the employers' record. The PROCESS macro SPSS supplement was used to analyze whether sufficient rest moderated the prospective relationship between exposure to QRs and SHC. Age, shift work experience, diurnal preferences, languidity and flexibility were included as control variables in the analyses.

Results: The QRs-SHC relationship was moderated by subjective reports of getting sufficient rest between shifts. The model explained 18.6% of the variance in SHC, (F (11, 852) 17.99, $p < 0.001$). The QRs-SHC relationship was only significant for those answering "almost never"/"seldom" on obtaining insufficient rest (B = -0.07, SE=0.03, t = -2.81, $p \leq 0.01$), as opposed to those who answered "sometimes" (B = -0.03, SE=0.02, t = 1.61, p = 0.11) or "often"/"very often" (B = 0.05, SE=0.03, t = 1.59, p = 0.11). These results may suggest a protective effect of having a higher number of QRs for some workers.

Conclusions: A single question about getting sufficient rest between shifts may contribute in identifying workers who have beneficial effects of a work plan that includes a higher number of QRs. We propose such questions should be asked more routinely and taken into consideration in the planning of work schedules.

Disclosure: Nothing to disclose.

P046 | Abrupt shift to slower frequencies after arousal in healthy young adults during sleep

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Objectives/Introduction: The American Academy of Sleep Medicine criteria for scoring arousal are used to quantify certain types of sleep disturbances that abrupt shifts in electroencephalographic activity can occur in the alpha and theta bands, and frequencies above 16 Hz (without spindles), however, they do not address atypical arousals. Younger patients with obstructive sleep and disordered breathing often exhibit abrupt shifts to slower frequencies in arousal-related responses, appearing as slow wave clusters. Here, we observed arousal responses with slow wave bursts in healthy young adults, examining the prevalence of atypical arousal responses.

Methods: Eleven healthy young adults underwent polysomnography (two females, 22.4 ± 2.8 years [mean ± standard deviation]). Written informed consent was obtained from all subjects. The Registered Polysomnographic Technologist and a technologist counted the number of participants showing arousal responses shifting to a slower frequency for between several and several tens of seconds (post arousal synchronous activity). We counted the number of post arousal synchronous events per night. We examined the sleep stage and number of sleep cycles in which post arousal synchronous activity appeared, and whether post arousal synchronous activity occurred in the former or latter stage of sleep, which was divided into two total sleep periods. We conducted chi-square tests. We used an alpha level of 0.05.

Results: All subjects exhibited post arousal synchronous activity (5.5 ± 6.0 times per night). Post arousal synchronous activity appeared most frequently during N2, followed by N1 and N3. Post arousal delta bursts increased significantly in sleep stage N2 compared with N3 (p = 0.004, w = 0.44). Post arousal synchronous activity was significantly intensified in the former compared with the latter sleep period (p = 0.01, w = 0.40), and was augmented in the first sleep cycle.

Conclusions: Post arousal synchronous activity is relatively common in healthy young subjects. Post arousal synchronous activity differs from the smooth arousal reactions associated with normal arousal. We found that post arousal synchronous activity increased in light sleep, former sleep and the first sleep cycle, which contained a high degree of slow wave sleep. In future studies, we will examine the propagation of post arousal delta bursts in children and elderly people.

Disclosure: Nothing to disclose.

P047 | Red ears while sleepy: relation between ear skin temperature and sleepiness

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Objectives/Introduction: Red ears in sleepy children is a commonly described phenomenon. This ear discolouration could represent increased blood flow in the skin of the ear, consistent with an increased distal skin temperature observed before sleep onset in adults. We hypothesise that ear skin temperature is associated with objective and subjective sleepiness in subjects without sleeping disorders.

Methods: Distal, proximal and ear skin temperature were measured in two groups of patients undergoing diagnostic EEG examination for suspected epilepsy: one group was sleep-deprived (n = 7), one group was not (n = 20). Prior to, during and after the EEG examination, ear skin temperature was measured using different methods:

thermographic imaging, ear surface and wireless skin temperature measurement. Objective and subjective sleepiness were assessed by sleep-onset latency during the EEG examination and the Stanford Sleepiness Scale, respectively.

Results: We found no association between pre- and post-EEG ear skin temperature and either objective (Spearman's ρ = 0.036; $p = 0.885$) or subjective sleepiness (Spearman's ρ = 0.218; $p = 0.285$). However, the sleep-deprived group showed a trend of a stronger increase in ear skin temperature during the EEG examination compared with the group that was not sleep-deprived (1.89 ± 0.84°C vs. 0.48 ± 0.33°C; $p = 0.067$). Higher objective (1.93 ± 0.71°C vs. 0.39 ± 0.34°C; $p = 0.035$) and subjective (1.27 ± 0.39°C vs. -0.16 ± 0.55°C; $p = 0.051$) sleepiness were both associated with an increase in ear skin temperature during EEG examination.

Conclusions: Objective and subjective sleepiness are associated with an increase in ear skin temperature during EEG examination in patients without sleeping disorders. This may reflect ear skin temperature changes preceding sleep onset. Intervention studies are needed to elucidate the relationship between sleepiness and ear skin temperature and explain the physiological mechanism behind sleepy children's red ears.

Disclosure: Nothing to disclose.

CHRONOBIOLOGY 1

P049 | Later chronotype associates with higher alcohol consumption and more adverse childhood experiences in young healthy women

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Objectives/Instruction: This study aimed at examining potential associations between self-selected sleep timing and stimulant use, depressive symptoms, and BMI in a sample of healthy young women. Furthermore, it was explored whether there is a relationship between sleep-wake-behaviour as indexed by chronotype and social jetlag and adverse childhood experiences (ACEs).

Methods: 146 healthy young women (mean age 21.7 ± 1.7 years) took part in a 2-week ambulatory assessment on daily consumption of alcohol and caffeine. They completed standardized questionnaires on ACEs, chronotype, subjective sleep quality as well as symptoms of depression. Two-tailed Pearson correlations and Chi-Square tests of independence were calculated to assess the relationships between the assessed variables.

Results: Later chronotype and higher social jetlag were both associated with higher average alcohol intake ($r = 0.226$, $p = 0.006$; $r = 0.216$, $p = 0.009$). No correlations were observed between chronotype or social jetlag and caffeine intake, depressive symptoms, and BMI. Participants of the above median ACE group were more likely to be late chronotypes compared to participants of the below median ACE group (X^2 (2) = 6.595, $p = 0.037$).

Conclusions: Our findings are of clinical relevance since they show that in a sample of healthy, young women an association between late chronotype and higher alcohol consumption is evident. Furthermore, they suggest a relationship between environmental factors, namely ACEs, and chronotype. Therefore, considering self-selected sleep timing as one factor in reducing the risk of health consequences in later chronotypes is important.

Disclosure: Nothing to disclose.

P050 | Evening light exposure, sleepiness, sleep timing and duration in college students: an ecological investigation

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Objectives/Instruction: Laboratory studies have shown that evening light exposure (ELE) suppresses evening sleepiness and delays sleep timing; whereas field studies have demonstrated that later bedtime is associated with lower and later daytime light exposure. Associations between ELE, evening sleepiness, sleep timing and duration have scarcely been assessed in the ecological setting, and are the focus of this study. Specifically we examined in undergraduate students: (1) Repeated assessments of ELE and sleepiness 4-h before bedtime, comparing individuals with early, intermediate and late bedtimes; (2) Associations between magnitudes of changes in ELE and evening sleepiness and subsequent sleep timing and duration.

Methods: Twenty three healthy men and women ages 18-21 were recruited by advertisements. Data of nineteen students who completed the protocol were used for analysis. The within-subjects repeated measures study took place in early winter (November - December, standard time) and in spring (April-May, summer time). Each assessment period included 3 weeks of actigraphy monitoring (Actiwatch, CamNtech Ltd) of activity and light illuminance (lux), half hourly ratings of sleepiness (Karolinska Sleepiness Scale - KSS) 4-h before bedtime, and sleep timing and duration, derived from sleep diaries and actigraphy. Differences in bedtime were categorically divided by tertiles (BTcat) as early, intermediate and late. Mixed model analyses were performed for ELE and evening sleepiness by BTcat, and for sleep measures by changes in ELE and sleepiness

(computed as differences between levels on first and last 4-h recordings), controlling for season and day type (weekday/weekend).

Results: Over the 4-h before bedtime, ELE decreased and evening sleepiness (KSS) increased, with a less steep ELE decline for late compared to early ($F_{(2,5765)}$=20.09, $p < 0.001$), and a less steep KSS increase for late compared to early and intermediate ($F_{(2,5855)}$=54.32, $p < 0.001$) BTcat. Steeper decrease in ELE was associated with earlier bedtime ($F_{(1,585)}$=4.94, $p = 0.027$). Steeper increase in KSS was associated with earlier bedtime ($F_{(1,585)}$=37.43, $p < 0.001$) and longer sleep duration ($F_{(1,569)}$=12.25, $p < 0.001$).

Conclusions: The data suggest that differences in bedtime are associated with differences in the time courses of both evening light exposure and sleepiness.

Disclosure: Nothing to disclose.

P052 | Association between social jetlag and eating duration in Brazilian undergraduate students

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Objectives/Introduction: Current studies have demonstrated that social jetlag - a behavioral indicator of circadian misalignment - may influence eating behavior of individuals, predisposing to obesity, type 2 diabetes and depressive symptoms. Additionally, recent studies have demonstrated that restricting the time of caloric intake to a window of 8-12 hours - without modifying the quantity or quality of diet - can provide physiological benefits. However, the relationship between social jetlag and eating duration - defined as the interval between first meal and last meal in the waking period - is little explored by studies. Therefore, the aim of this study was to investigate the association between social jetlag and eating duration in undergraduate students.

Methods: The study included 721 undergraduate students from a Brazilian public university. Dietary intake and meal times were assessed by a 24-hour food recall. Social jetlag was calculated based on the absolute difference between mid-sleep time on weekdays and weekends. Multiple linear regression modeling analyses adjusted for confounders were used to assess the association between social jetlag and eating duration.

Results: Eating duration were negatively associated with the breakfast time (coefficient=-0.33; $p =< 0.001$) and lunch time (coefficient=-0.10; $p =< 0.001$); and positively associated with dinner time (coefficient=0.27; $p < 0.001$). Also, social jetlag was positive associated with eating duration (coefficient=0.08; $p = 0.03$).

Conclusions: Our results suggest a greater "window to eat" among individuals with higher levels of social jetlag. These data join the emerging body of evidence they suggest individuals with circadian misalignment are prone to food consumption at an inappropriate circadian time. Future studies are needed to confirm these findings.

Disclosure: Nothing to disclose.

P053 | Circadian regulation of breath alcohol concentration

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Objectives/Instruction: The circadian system plays an important role in drug metabolism. Previous studies have shown that alcohol toxicity and liver enzymes involved in alcohol metabolism are circadian-regulated. Here, our goal was to evaluate the degree to which the circadian system regulates breath alcohol responses in humans.

Methods: Twenty healthy adults aged 21-30 years took part in a 4-day laboratory study. Participants underwent a 40-h constant routine procedure to assess circadian rhythms. Every 4 h, participants were given a fixed oral dose of alcohol, calculated to result in a peak breath alcohol concentration (BrAC) of 0.030 g/210L based on each person's estimated total body water volume. Breathalyzer measurements were taken every 5 min to assess the time-course of BrAC across different circadian phases. We determined the peak BrAC for each oral dose of alcohol, and cosinor analysis was performed to examine group-level circadian rhythmicity.

Results: Peak BrAC values exhibited a circadian rhythm (Cosinor amplitude, $p < 0.05$), in which the range of values across the circadian cycle varied by about 10% relative to the mean. Peak BrAC values were lowest in the biological evening, near the peak of the core body temperature rhythm and the nadir of the salivary cortisol rhythm. Peak BrAC values increased during the biological night and reached their highest levels near the middle of the biological day.

Conclusions: The circadian system modulates physiologic responses to alcohol. Taking the same oral dose of alcohol at different points of the circadian cycle can result in different BrAC responses. The increase in peak BrAC during the biological night could have implications for alcohol-induced impairment of driving performance, as well as alcohol toxicity.

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P054 | Dynamics of daytime light exposure in a naturalistic setting impacts on sleep architecture

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Objectives/Introduction: While rapid eye movement (REM) sleep is predominantly circadian driven, slow wave sleep (SWS) is homeostatically driven. There is also evidence that light during daytime has an impact on subsequent sleep. A recent study by Wams et al. in 2017 found an association between the timing and amount of (natural) light exposure during daytime, REM sleep and SWS accumulation during ambulatory polysomnographically (PSG) recorded sleep episodes. The aim of the current evaluation was to replicate and expand these findings using the data from an older study performed in a semi-natural setting.

Methods: Eleven healthy adults participated in the study 2008. Individual illuminance was continuously recorded at the eye level between 8am and 7 pm (Luxblick, TU Ilmenau, Prof. C. Schierz). Four hours before habitual bedtime participants came to the laboratory and remained in dim light (< 5 lx). Their sleep episode was recorded with PSG. All PSG recordings (available from 9 participants) were visually scored according to standard criteria and illuminance recordings were collapsed into hourly bins. For analysis non-parametric tests were applied.

Results: Participants spent 59% of their days with illuminance levels lower than 50 lx and 90% below 200 lx. Participants had more SWS during the night when they had a later time of maximum light exposure (min; Rho=0.733; p = 0.025) and were exposed to more light between 2 and 3 pm (Rho= 0.70; p = 0.036). Accordingly, a later maximum light exposure was associated with less stage 2 sleep (min; Rho=-0.683; p = 0.042). The fitted slopes from accumulated SWS were significantly steeper and associated with higher illuminance between 4 and 5 pm (Rho=0.683; p = 0.042). Regarding REM sleep accumulation, less steep slopes were associated with greater illuminance between 11 and -12 am (Rho=0.683, p = 0.042). Finally, longer REM sleep latency was significantly related to higher illuminance levels between 11 and 12 am (Rho =. 90; p = 0.001). Shorter REM sleep latency was associated with more light between 4 and 5 pm (Rho=-0.700; p = 0.036).

Conclusions: Our results support earlier work showing an association of natural daylight exposure and sleep architecture during the subsequent night. Based on the explorative analysis in this small sample we hypothesize a differential impact of light at different times of day on different sleep stages.

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P055 | Sleep and fatigue in commercial aviation - a field study

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Objectives/Instruction: New EASA FTL (European Aviation Safety Agency flight time limitations) came into force early 2016 with the purpose of protecting pilots against fatigue. The present field study evaluates sleep and fatigue in Swedish commercial airline pilots since the implementation of these new EASA FTL.

Methods: 32 randomly selected Swedish commercial airline pilots participated in the field study. During a period of 13 days all pilots wore an actiwatch and completed work and sleep diaries that contained questions about sleep quality and quantity, working conditions as well as Karolinska Sleepiness Scale (KSS) ratings during predefined stages of flight (i.e., blocks off, top of climb, top of descent, blocks on). Linear mixed models were used for statistical analyses.

Results: On working days, actigraphy based sleep duration was longer at home than in a hotel (455 versus 425 min, p = 0.043), sleep efficiency was higher (95,3% versus 93,9%, p = 0.002), and KSS sleepiness levels at wake up were lower (5,8 versus 6,5, p = 0.015). Minutes of wake after sleep onset (WASO) did not differ between home and hotel sleep. Sleep duration was also longer during days off as compared to working days (489 versus 439 min, $p < 0.001$) although sleep efficiency and WASO did not differ.

Sleep duration was shorter preceding days with early (0400-0659) check-in (382 min.) compared to daytime (0700-1659) check-in (469 min.; $p < 0.001$) and evening/night (1700-0359) check-in (479 min.; $p < 0.001$).

A significant main effect of flight stage on pilot sleepiness was observed (p = 0.01), with increasing sleepiness as time in flight proceeds (0,2 KSS increase per flight). Moreover, an interaction between flights and flight stage was observed (p = 0.001), with the increase of sleepiness during flight becoming more pronounced as more flights are executed within a duty period.

Conclusions: Hotel sleep is of worse quantity and quality than sleep at home. Pilots do experience sleepiness levels to increase during the course of each flight, an effect getting worse the more flights are flown within a duty period. Moreover, early morning check-ins are associated with a strongly reduced amount of sleep.

Disclosure: Nothing to disclose.

P056 | Different chronotype profiles impact on children habits before and during sleep

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Objectives/Instruction: The objective of this study was to analyse the association between chronotype profiles, sleep bruxism and sleep characteristics among 12-year-old Brazilian children.

Methods: A cross-sectional study with 240 children and their parents was conducted in public and private's schools from Brumadinho, southeast Brazil. Parents answered a questionnaire regarding children's sleep characteristics (hours of sleep per night, sleep position, drooling and snoring) and history of sleep bruxism. Chronotype profile was assessed by means of the Portuguese version of the Puberty and Phase Preference Scale (PPPS), answered by the children in the classroom. Weight and high of all children were measured by a single researcher in a separate room at school. Body mass index (BMI) was calculated and categorized according to the recommendations of World Health Organization as follows: underweight, normal, overweight and obese. Statistical analysis was calculated using chi-square test and binary logistic regression. Statistical significance was set at $p < 0.05\%$. This study was approved by the institutional ethics committee of the Federal Brazilian University (protocol #54989816.3.0000.5142).

Results: Most participants were girls (55.7%). Eveningness profile prevalence was 52.1% and morningness was 47.9%. Among the 240 participants, 105 drooled on the pillow (43.7%). The prevalence of sleep bruxism was 17.9%. The normal BMI was observed among 151 participants (63%). Among the 24 obese individuals, 62.5% had eveningness profile and 37.1% were morningness. Chi-square test showed a statistically significant association between eveningness profile and girls ($p = 0.038$), children who eat sugar before bedtime ($p = 0.035$) and children who drool on the pillow ($p < 0.001$). Those three variables were included in the logistic regression model along with the variable 'sleep duration per night' ($p < 0.20$) and the variable 'Obesity - BMI'. The final model showed that children with eveningness profile were more likely to drool on the pillow (Prevalence Ratio [PR] = 2.96; 95% Confidence Interval [CI] = 1.56–5.61) and to eat sugar before bedtime (PR=2.03; 95% CI =1.08–3.81) when compared to morningness profile individuals.

Conclusions: The eveningness profile children were more likely to drool on the pillow and to eat sugar before bedtime when compared to their morningness peers. Educational policies should be encouraged.

Disclosure: Nothing to disclose.

P057 | Treatment outcome of non-24-hour sleep-wake rhythm disorder: a retrospective study of 24 consecutive cases in a sleep clinic

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Objectives/Introduction: Reports on the treatment outcome of non-24-hour sleep-wake rhythm disorder (N24SWD) are limited because of low prevalence. We retrospectively analyzed it using stoppage of free-run as the primary index.

Methods: We enrolled 24 consecutive patients who visited the sleep clinic of the Department of Psychiatry of Fujita Health University Hospital and were diagnosed with N24SWD according to the International Classification of Sleep Disorders, Third Edition. Data were retrospectively collected from medical records. When a stopped free-run was identified in an individual during the treatment period, the patient's clinical state was determined as one of four defined categories based on the extent of the clinical improvement, including "normalization" (i.e., normalized sleep-phase for >3 months). Chronobiological interventions (e.g., bright light therapy, ramelteon administration, and hospitalization) that were considered to have a temporal association with free-run stoppage were also examined.

Results: "Normalization" occurred in 12.5% (3/24 patients) and free-run stoppage occurred in 45.8% (11/24), whereas free-run persisted throughout the course in 45.8% (11/24). The drop-out rate during the treatment course was 54.2% (13/24 patients). No single intervention achieved "normalization," and patients with free-run stoppage tended to undergo multiple chronobiological interventions.

Conclusions: The very low "normalization" rate and the large number of patients with ongoing free-run who dropped out suggest that N24SWD is extremely refractory. The possibility of free-run stoppage using a combination of multiple chronobiological interventions may be plausible, although we were unable to identify a specific treatment that was effective. Further studies that include the analysis of therapeutic interventions are required.

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P058 | Randomised controlled trial of bright light therapy and morning activity for adolescents and young adults with delayed sleep-wake phase disorder

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Objectives/Instruction: A randomised controlled trial evaluated bright light therapy and morning activity for the treatment of Delayed Sleep-Wake Phase Disorder (DSWPD) in young people.

Methods: 60 adolescents and young adults (range= 13-24 years, mean= 15.9 ± 2.2 y, 63% f) diagnosed with DSWPD were randomised to receive 3 weeks of post-awakening Green Bright Light Therapy (~507 nm) and Sedentary Activity (sitting, watching TV), Green Bright Light Therapy and Morning Activity (standing, playing motion-sensing videogame), Red Light Therapy (~643 nm) and Sedentary Activity or Red Light Therapy and Morning Activity. Sleep (i.e sleep onset time, wake up time, sleep onset latency, total sleep time) and daytime functioning (i.e morning alertness, daytime sleepiness, fatigue, functional impairment) were measured pre-treatment, post-treatment and at one and 3 month follow-up.

Results: Contrary to predictions, there were no significant differences in outcomes between treatment groups; interaction effects between treatment group and time for all outcome variables were not statistically significant ($p > 0.05$). However, adolescents and young adults in the morning activity conditions did not meaningfully increase their objective activity (i.e movement frequency). Overall, adolescents reported significantly improved sleep timing (p = 0.007-0.04, d = 0.30-0.46), sleep onset latency (p = 0.03, d = 0.32) and daytime functioning ($p \leq 0.001$, d = 0.45-0.87) post-treatment. Improvements in sleep timing ($p \leq 0.001$, d = 0.53-0.61), sleep onset latency (p = 0.008, d = 0.57), total sleep time (p = 0.02, d = 0.51), and daytime functioning ($p \leq 0.001$-0.01, d = 0.52-1.02) were maintained, or improved upon, at the 3 month follow-up. However, relapse of symptomology was common and 38% of adolescents and young adults requested further treatment in addition to the 3 weeks of light therapy.

Conclusions: Although there is convincing evidence for the short-term efficacy of chronobiological treatments for DSWPD, long-term treatment outcomes can be improved.

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P059 | To explore the impact depression and anxiety has on shift work disorder risk amongst healthcare shift workers

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Objectives/Instruction: Mental health disorders have been linked to shift work and have been partly attributed to circadian misalignment and sleep disturbances. Some shift workers experience chronic sleep insufficiency, excessive sleepiness and/or insomnia due to their work schedules, known as Shift Work Disorder (SWD). SWD is a circadian rhythm disorder resulting from the temporal misalignment between the circadian clock and the sleep-wake cycle and affects 20-30% of shift workers. Individuals with SWD have been shown to have higher rates of depression and anxiety. Research specifically within the healthcare sector is needed due to the unique work and environmental stressors healthcare shift workers are exposed to, which makes them more vulnerable to depression and anxiety. The aim of this study to investigate the relationship between depression, anxiety and SWD in healthcare shift workers.

Methods: A cross-sectional sample of healthcare shift workers was collected from a larger clustered randomized controlled trial. Participants completed an online survey consisting of demographic information, Shift Work Disorder Questionnaire (SWDQ), Patient Health Questionnaire (PHQ-9) to measure depression and General Anxiety Disorder Questionnaire (GAD-7) to measure anxiety. Participants were categorized into high and low risk groups for SWD and comparisons explored.

Results: 202 participants were recruited. 97% were female, with an average age of 35.28 (SD=12). Nearly one-third, (29%, n = 59) were at high risk of SWD. Of these, 23.7%, had moderate to severe symptoms of depression compared to only 3.5% of those at low risk (x^2=37.45, $p < 0.001$). Furthermore, 13.6% of high risk participants had moderate to severe anxiety symptoms compared to only 2.8% at low risk (x^2=19.85, $p < 0.001$). This difference was significant, with the high risk SWD group overall having higher depression scores (M = 7.54, SD= 4.28 vs. M = 3.78, SD=3.24; $p < 0.001$) and higher anxiety scores (M = 5.66, SD=3.82 vs. M = 2.83, SD=3.33, $p < 0.001$) compared to the low risk group.

Conclusions: A substantial proportion of healthcare workers that are at high risk of SWD also suffer from severe mental health impairment. This highlights the necessity to screen and manage SWD and help alleviate this mental health risk.

Disclosure: Nothing to disclose.

P060 | Body rhythms in concert? Integrity of circadian rhythms predicts consciousness levels in severely brain-injured patients

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Objectives/Instruction: In healthy individuals, stability of the circadian sleep-wake cycle results in consolidated periods of conscious wakefulness and unconscious sleep. Therefore, circadian rhythms have previously been suggested to also contribute to consciousness levels in patient groups characterised by a relative instability thereof such as patients with disorders of consciousness (DOC) following severe brain injury. Earlier studies have however only looked at selected examples of circadian rhythms one at a time. Therefore, this study aimed at adopting a systems-level perspective taking into account three different circadian indexes. Moreover, we aimed at assessing whether the body temperature maximum could help pre-specify the optimal time point for neuropsychological assessment.

Methods: Going beyond earlier studies, we investigated the joint predictive value of circadian indexes of body temperature, melatonin secretion and body activity for $n = 20$ DOC patients' behaviourally assessed state using multilevel modelling. For behavioural evaluation we used the Coma Recovery Scale-Revised (CRS-R; Kalmar & Giacino, 2005), a well-established neuropsychological test battery. For the assessment of circadian rhythmicity, we measured variations in temperature and activity across 7 days and melatoninsulfate (aMT6s) levels during 48 h in two-hourly intervals. Additionally, we assessed in $n = 16$ whether patients' performance varies with time of day or the time offset from the body temperature maximum, that is when cognitive performance is expected to peak. Specifically, patients were assessed at five time points in regularly spaced intervals around the temperature maximum on two consecutive days. Effects denoted significant had a $p < 0.05$, trends < 0.1.

Results: We find that a higher integrity of the circadian melatonin and temperature rhythms predicts a better state of patients. Moreover, higher CRS-R scores are predicted by less deviation from the pre-specified time of occurrence of the body temperature maximum (median at 2:25 pm). Likewise, higher CRS-R scores are associated with later daytime, which overlaps with the occurrence of the temperature maximum (4 pm in the average healthy person).

Conclusions: In conclusion, results suggest that therapeutic approaches should aim at improving circadian rhythms in brain-injured patients and diagnostic procedures should preferentially be scheduled around the pre-assessed body temperature maximum.

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Disclosure: Nothing to disclose.

P061 | Effects of different light expositions on wakefulness, mood, and attention in shift workers: an ongoing field study in a morning and evening shift system

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Objectives/Introduction: Bright and/or blue light has been shown to improve alertness in experimental settings. Field studies are limited and focus on night shifts. We therefore studied different light expositions in blue collar workers working in a morning and evening shift system.

Methods: In an ongoing study Insomnia Severity Index (ISI), Epworth Sleepiness Scale (ESS), mood (non verbal face scale), subjective sleep time, actual wakefulness, light comfort, participants global impression of change (PGI), objective attention (d2 test) and sleepiness (pupillography) as well as sleep-wake rhythm (fitness tracker) were measured during the evening shifts after 2 weeks of the following light regimes: baseline (BL, 5000 K, 120 mlux), L1 (2700 K, 122 mlux), L2 (5000 K, 213 mlux), L3 (dynamic setting: 7000 K at morning - 2700 K in the evening), L4 (7000 K, 400 mlux). Light was continuously given during morning and evening shifts, excepted the dynamic L3 setting.

Results: 46 males and 4 females out of 79 workers completed the conditions BL to L3 up to now. Preliminary results based on ANOVAs for repeated measures ($n = 50$) and correlations for single conditions ($n = 65$). Mood ($p < 0.05$), PGI ($p < 0.005$), and attention ($p < 0.005$) improve significantly following all light settings compared to baseline. Light comfort differed significantly between the conditions ($p < 0.005$) being lowest at L1 and highest at L2. Although there are no changes in wakefulness over time, light comfort correlates positively to acute wakefulness and mood at BL, L2, and L3 as well as to PGI at L2 and L3 ($p < 0.05$ each); at L3 higher light comfort is also associated with a lower ISI. In contrast, light comfort shows a weak but significant negative correlation to wakefulness at L1. Objective attention increases continuously over time and doesn't correlate to any other parameter.

Conclusions: Considering the same mlux (BL, L1) respectively the same blue wavelength spectrum (L1, L2) the results indicate that brightness, light colour and blue wavelength maximum influence light content, mood, PGI, and wakefulness in evening shift workers in different ways and should be considered infurther field studies.

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Disclosure: Nothing to disclose.

P062 | Tasimelteon reentrains sleep period in a patient with phase delay syndrome

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Objectives/Instruction: The phase delay syndrome is a rare incapacitating disorder of the circadian sleep-wake rhythm. It results in sleep period which is delayed related to the environment. No therapy is available so far. We report off label use of tasimelteon in an individual curative trial which aimed to treat this disorder. Tasimelteon is an agonist at melatonin (MT) 1 and 2 receptors. The substance is approved to treat non-24-h-sleep-wake-disorder in totally blind patients.

Methods: In our trial the 62 years old patient reported a history of this disorder since his youth. Furthermore he had a history of adrenalectomy and cortisone substitution after Cushing's syndrome and of Whipple procedure due to pancreatic cancer. Before treatment his sleep onset occurred between 06.00 and 08.00 h. He awakened by 16.00 h. He received an oral dose of 20 mg tasimelteon daily one hour before bedtime.

Results: Already after some days treatment with tasimelteon the patient's sleep period was advanced by about four hours as documented by sleep diary and actigraphy. He reported improved quality of life as his participation in daily living became possible. This effect was stable so far for more than ten months. The patient reported vivid dreaming including some unpleasant dreams. Before therapy with tasimelteon he did not remember dreams. Beside these dreams the substance was well tolerated.

Conclusions: Our findings suggest that tasimelteon is capable to reentrain delayed sleep period in phase delay syndrome. Tasimelteon appears to be suited to treat circadian sleep-wake disorders also beyond non-24-h sleep-wake-disorder.

Disclosure: Nothing to disclose.

P063 | Evening cronotypes mediate the association between early life stress and emotion dysregulation in Bipolar Disorder

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Objectives/Instruction: In Bipolar Disorder (BD), both rhythms and emotion dysregulation play an important role by negatively influencing its trajectory. Recent studies also documented an association of negative life events and Bipolar Disorder onset and course. The aim was to assess the possible association between early life stress chronotype and of emotion regulation in subjects with BD.

Methods: One-hundred patients (62 females, 13 males, mean age of 48.2 ± 12.4 years) with a BD-type II depressive episode with mixed features, according to DSM-5 and 20 healthy controls (16 females, 15 males, mean age of 47.7 ± 12 years) were recruited. Subjects with BD were evaluated with the SCID-DSM-5 and the Morningness Eveningness Questionnaire (MEQ), Difficulties in Emotion Regulation Scale (DERS), Beck Depression Inventory (BDI-II), Mania Rating Scale (MRS) and Early Trauma Inventory-Short Form (ETISR-SF). An a priori power analysis has been performed, and correlations were studied with regression and mediation analyses.

Results: Twenty-nine BD subjects (29.9%) 3 healthy controls (15%) showed evening types ($p < 0.01$), the BDI-II and MRS scores were respectively 23.3 ± 11.1 and 9.1 ± 6.8 in BDs, 5.2 ± 1.2 and 3.0 ± 0.1 in healthy subjects ($p < 0.001$) and the ETISR-SF score was 9.8 ± 04 and 2.1 ± 1 ($p < 0.01$). In bipolars greater early life stress significantly correlated with greater MEQ scores (coeff= -0.49, $p = 0.03$), MEQ evening types (coeff= 0,23 $p < 0.001$) and DERS scores (coeff= 0.05, $p = 0.009$) while no correlations were found with BDI-II (coeff= 0.04, $p = 0.22$) and MRS (coeff= 0.07, $p = 0.30$). In bipolars greater early life stress independently predicted the greater emotion dysregulation ($p = 0.0009$) and evening types (coeff= 0.14, $p = 0.04$). Evening cronotypes mediate the association between early life stress and emotion dysregulation ($Z = 2.9$, $p = 0.02$).

Conclusions: Early life stress may impact on later psychopathology, especially favoring sleep rhythms and emotion dysregulation. Particularly, if evening chronotypes may contribute to the association between early life stress and emotion dysregulation in bipolars, we may hypothesized early life stress having negative consequences at first on chronobiological rhythms. Further studies with longitudinal design are required.

Disclosure: Nothing to disclose.

P064 | Obstructive sleep apnea as a predictive factor of reduced heart rate variability

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Objectives/Introduction: Obstructive sleep apnea (OSA) is a sleep disorder leading to obturation of respiratory tract, recurrent hypoxia, arousals, pathological day time sleepiness. It causes sympathetic hyperactivity, endothelial dysfunction, inflammation and oxidative stress, hypercoagulability, insulin resistance and changes in

intrathoracic pressure and leads to increase of cardiovascular risk. OSA is strongly correlated with autonomic system dysfunction and increased risk of cardiovascular diseases: hypertension, ischemic heart disease, heart failure, stroke and arrhythmias. Dysregulation of autonomic system can be diagnosed in ECG holter monitoring by gathering the heart rate variability (HRV) indices. This study evaluated the correlation of heart rate variability with different stages of OSA.

Methods: The study included 104 subjects: 24 patients with mild OSA, 31 with moderate OSA, 34 patients with severe OSA and 15 patients without apnea. Subjects were examined with in-laboratory polysomnography combined with ECG holter monitoring, laboratory tests and surveys. HRV indices were obtained and calculated with time and spectral analysis of different time periods: total recording, daily activity, night rest and 15-min fragments of daily activity and stage N3 sleep.

Results: HRV analysis revealed lower SDNN, PNN50 and higher LF/HF ($p < 0,05$) in OSA patient compared with patients without OSA, suggesting sympathetic hyperactivity in OSA patients. There is a positive, statistically significant, correlation between AHI and LF/HF. More parasympathetic HRV indices (SDNN, rMSSD, SDSD, PNN50) are reduced in moderate-severe OSA group than in control group (without OSA and mild OSA) and it is observed also during daily activity.

Conclusions:

(1) Patients with OSA have reduced heart rate variability in time and spectral analysis, due to sympathetic hyperactivity.

(2) HRV alterations are more relevant in moderate and severe OSA.

(3) Autonomic impairment in OSA patient is permanent, observed both at night rest and day-time activity.

Disclosure: Nothing to disclose.

P065 | Improvements in mood and subjective sleep measures along the course of adjunctive phototherapy: an open-label study

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Objectives/Introduction: Bright light can have antidepressant effects, which may notably operate via the restoration of sleep and circadian disruptions. Since phototherapy trials in non-seasonal depression yielded inconsistent results, there is a need to identify subgroups of individuals most likely to respond to phototherapy. Youth with depression may be good candidates since they commonly have delayed sleep-wake cycles and other sleep disruptions. This study aimed to uncover parts of the antidepressant mechanisms of phototherapy and identify predictors of treatment response.

Methods: This study included 27 individuals with depression recruited from mental health services in Australia and Canada (21.3 ± 5.0 years old; 22% males). During 4 weeks, morning phototherapy was conducted adjunctively to standard clinical care using green-blue light-emitting glasses. Seventeen participants were taking psychotropic medications, and all of them maintained a stable dosage for at least 4 weeks before study enrollment. Before, as well as after two and 4 weeks of phototherapy, participants completed the Beck Depression Inventory-II (BDI-II), Leeds Sleep Evaluation Questionnaire (LSEQ), Functional Outcome of Sleep Questionnaire (FOSQ), and Glasgow Content of Thoughts Inventory (GCTI).

Results: On average, BDI-II scores did not change significantly after 2 weeks of phototherapy, but they significantly decreased after 4 weeks (n = 20, $t(19)$=3.1, p = 0.006). Improvements on the BDI-II after 2 weeks of phototherapy correlated with reductions in pre-sleep unhelpful thoughts (n = 25, r = 0.47, p = 0.018) and improvements in the ease to fall asleep (n = 26, r = -0.48, p = 0.013). Subsequent improvements on the BDI-II after 4 weeks correlated with reductions in sleep-related daytime dysfunctions (n = 17, r = -0.67, p = 0.003). Stronger antidepressant responses were found in those who initially had more frequent pre-sleep unhelpful thoughts (n = 19, r = 0.46, p = 0.050) and worse difficulties falling asleep (n = 20, r = -0.51, p = 0.021).

Conclusions: These findings suggest that adjunctive phototherapy can alleviate depressive symptoms in youth with depression, however, this needs to be replicated in randomized control trials. The correlations between mood and sleep-related changes support the notion that the restoration of sleep, and subsequent improvements in daytime functioning, may represent one of the mechanisms underlying the antidepressant effects of light. Initial sleep difficulties and their daytime consequences may be useful predictors to identify individuals most likely to respond to phototherapy.

Disclosure: Nothing to disclose.

P066 | Altered regional neuronal activity in shift work associated with sleep and emotion: resting state perfusion MRI study

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Objectives/Instruction: Shift work is known to disrupt workers' normal circadian rhythms, and to be associated with increased health problems. In contrast to the considerable literature regarding neuropsychological function in shift work, evidence for the impact of shift work on brain functional imaging is limited. The aim of this

study is to compare regional cerebral flow (rCBF) between shift workers and day workers using perfusion brain MRI(pMRI) and investigate correlation among the altered rCBF with sleep status and neuropsychological assessment.

Methods: 15 day workers (DW) and 15 rotational shift workers (SW) were included into the study. Measures of habitual sleep were obtained from 2 weeks of wrist actigraphy. We compared demographics, emotional states, insomnia severity, daytime sleepiness and automated battery of psychometric measures between two groups. Using pMRI, the differences of rCBF were measured in DW vs SW.

Results: Shift worker was associated with higher anxiety (HADS-A score, $p = 0.029$), depressive mood (HADS-D score, $p = 0.001$), inattention (CAARS-K subscale; hyperacitivity/restless, $p = 0.029$) and reported more severe insomnia (ISI score, $p < 0.001$) than day worker. Resting state pMRI revealed decreased regional Cerebral Blood Flow (rCBF) at right cuneus, cerebellum and fusiform gyrus in shift workers. On the contrary, left inferior occipital gyrus showed increased rCBF in shift workers compared to day workers. Although sleep related measures (TST, SL, SE, WASO) and neurocognitive performance showed no significant difference between two groups, sleep onset and duration irregularity showed positive correlation with the severity of anxiety and depressive mood.

Conclusions: The pMRI showed involvement of brain areas related to depression in SW and disruption of the individuals' circadian rhythms resulting in anxiety and depressive mood, regardless of sleep quality.

Disclosure: Nothing to disclose.

BEHAVIOR 1

P068 | Sleep coaching provides help for shift workers: a field report

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Objectives/Instruction: To examine subjective ratings of sleep quality and daytime sleepiness in shift workers employed in a railway company (OEBB: Oesterreichische Bundesbahnen), and how shift-related complaints can be addressed during a 2 day sleep coaching seminar.

Methods: Pre intervention questionnaire, containing items of the PSQI and the ESS, questions about chronotype, personality factors and possible burnout risk factors. In total, 182 employees (162 male; age: 22-58, M = 45.89, SD = 8.99) took part in the investigation.

Results: Shift workers reported poorer sleep quality, prolonged sleep latencies, high sores of daytime sleepiness and a variety of daytime dysfunction as well as higher body mass indices.

Conclusions: Sleep coaching by Holzinger & Kloesch™ is a new approach for non-pharmacologic treatment of non-restorative sleep and includes psychotherapeutic aspects, which enable clients to improving their sleep quality as well as their quality of life, by developing one's own coping strategies which can be implemented in daily routine. The 2 day SC seminar is beneficial by exactly focusing on the sleep problems related to shift workers.
More research with a greater sample and a longitudinal design is needed to examine the long time effects of SC.

Disclosure: Nothing to disclose.

P069 | The association between outdoor activity and insufficient sleep among children in China

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Objectives/Instruction: The relationship between outdoor activity (OA) and insufficient sleep duration (ISD) remains unknown. We aim to examine the relationship using a school based national survey data among Chinese children.

Methods: The sample consisted of 62,517 children aged 6-17 years which were multi-stage sampled from 7 representative areas in China during September and November, 2013. In the structured questionnaire, children and their caregivers reported daily sleep hours (< 7 h, 7-9 h and > 9 h), daily outdoor activity time (less than 1 h, 1-2 h, and more than 2 h) and other behavior, demographic information. ISD was defined as < 9 hours/day (aged 6-13 years) and < 7 hours/day (aged 14-17 years). The relationship between insufficient sleep and outdoor activity were evaluated by logistic regression and multi-variable adjusted.

Results: A total of 46,639 children (50.9% boys) completed the study. The prevalence of ISD was 62.8% (61.7% in boys and 63.9% in girls). Stratified by age, comparing with < 1 h OA, the odds ratios (ORs) for ISD were 0.652 (95% CI: 0.607-0.701, aged 6-13 years) and 0.600 (0.522-0.688, 14-17 years) in >2 h OA group; 0.882 (0.830-0.937, 6-13 years) and 0.711 (0.641-0.789, 14-17 years) in 1-2 h OA group. Further stratified by gender, comparing with < 1 h OA, ORs for ISD were 0.671 (0.607-0.741, 6-13 years) and 0.692 (0.567-0.845, and 14-17 years) in > 2 h OA boys, and 0.633 (0.570-0.702, 6-13 years) and 0.522 (0.430-0.634, and 14-17 years) in >2 h OA girls; 0.897 (0.824-0.976, 6-13 years) and 0.778 (0.664-0.912, 14-17 years) in 1-2 h OA boys, 0.866 (0.794-0.945, 6-13 years) and 0.662 (0.575-0.761, 14-17 years)in 1-2 h OA girls. All the ORs were adjusted for age, gender, urban/rural area, geographical location, father's education, mother's education, BMI, physical activity and inactivity.

Conclusions: Outdoor activity time more than 1 h is associated with decreased risks for insufficient sleep duration among children

aged 6-17 years. Further research is in need to explore the causal relationship between outdoor activity and sleep duration.

Disclosure: Nothing to disclose.

P070 | Iron metabolism in epigenetics: relationship between sleep, physical exercise and movement disorders in an animal model

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Objectives/Instruction: The objective of the current study was to observe in the offspring of rats, treated with diet representing different concentrations of iron, alterations caused in sleep, locomotor activity, dopaminergic system and iron metabolism. In addition, the impact of physical exercise on these variables analyzed in the offspring was evaluated.

Methods: For this, Wistar rats were distributed in groups that received control, supplementation and iron restriction diets during the pregnancy. After weaning, the offspring of each group were divided into two groups: physical exercise and sedentary (n = 8/group). Sleep assessments (Polysomnography), behavior (Open Field) and gene expression (PCR) of the dopaminergic system (D2, DAT, TH, MAP2K5-ERK5) and hepicidina were performed after 8 weeks of physical exercise (swimming).

Results: The offspring results showed that physical exercise and iron supplementation of the mothers had an influence on the behavior after the 8 weeks of intervention. In the Open Field test, the offspring from the mothers supplementation group showed a significant increase in the Freezing when compared to all other groups most of the time (Repeated measures ANOVA $p < 0.05$). Through polysomnography, during the light period, the sedentary and physical exercise offspring from the mothers supplementation showed a higher % of Total Sleep Time and Slow Wave Sleep in relation to mothers iron restriction offspring; and reduced awakening in relation to the other groups (Factorial ANOVA $p < 0.05$). In the analysis of gene expression, the offspring groups showed no differences in the hepcidin, DAT and TH gene after 8 weeks of intervention. The sedentary group receiving iron supplementation from the mothers showed a greater expression of the D2 gene in relation to the control and the mothers iron restriction offspring with sedentary and physical exercise (Factorial ANOVA $p < 0.05$).

Conclusions: In this context, we can suggest that iron diet during pregnancy and physical exercise performed by offspring in adulthood may present some changes in the behavior, sleep and gene expression in the offspring evaluated. However, the results suggest that the presence of iron deficiency during pregnancy is not a predisposing factor for the offspring to present movement disorders in adult life.

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Disclosure: Nothing to disclose.

P071 | Comparison of sleep quality between seafarers working for European and Chinese shipping companies

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Objectives/Introduction: This large questionnaire based study compared sleep quality between seafarers employed by European and Chinese shipping companies, aiming to provide more insight into the possible cultural differences between European and Chinese shipping industry.

Methods: 454 European and 483 Chinese employed seafarers answered a revised version of the questionnaire designed in the Cardiff Seafarers' Fatigue Research program. Cross tabulation analysis was carried out to investigate whether a significant relation between pairs of variables existed in the form of joint frequencies. Pearson chi-square tests were used to examine whether the relation variables were statistically independent.

Results: A significant proportion of Chinese companies' seafarers (28.3%) reported difficulty of falling asleep, 33.1% reported difficulty of staying asleep, 37.7% reported to often wake up during sleep, and 38.4% reported restless sleep. These percentages were all considerably higher than the proportions of European seafarers with these problems, which were 18.4%, 14.3%, 20.3% and 15.1%, respectively. The reported number of sleep periods (longer than 1.5 hours) in a typical 24 hour period at sea also differs between the European and Chinese companies' seafarers. 88.5% of Chinese companies' seafarers had two or more sleep periods compared with 54.8% of European seafarers. Considering the influences of Environmental factors, which relate to noise, bad weather and ship motion, 29.3% and 19.4% of European seafarers felt their sleep were disturbed by noise and ship motion, respectively, while the percentages of Chinese companies' seafarers with this view were as high as 47.6% and 58.6%. Without exception, p -values were less than 0.001, which indicates that significant relationships between pairs of variables existed.

Conclusions: This study indicates that seafarers employed by Chinese shipping companies suffered more severely from poor sleep quality and were significantly more likely to have interrupted and disturbed sleep than seafarers that are employed by European shipping companies.

Disclosure: Nothing to disclose.

P072 | Factors related to seafarer fatigue and their importance for different categories of seafarers

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Objectives/Instruction: Fatigue has a negative impact on seafarers' health and performance and even poses a threat to their safety. This study explores the fatigue related factors and their impact on different groups of seafarers.

Methods: 454 European and 483 Chinese employed seafarers answered a revised version of the questionnaire designed in the Cardiff Seafarers' Fatigue Research program. Five aspects of fatigue were used to address the intensity and frequency of perceived physical and mental fatigue. Independent variables were those previously indicated as factors associated with fatigue (categorical variables). An optimal scaling regression model was used to analyze the factors having greatest effect size on the degree of seafarers' fatigue. Eta-squared was used to analyze the most important factors affecting fatigue in different categories of seafarers.

Results: According to the optimal scaling regression model (R^2=0,400; $p < 0,05$), the three factors affecting seafares' fatigue most are.

(1) difficulties falling asleep,
(2) constant pressure due to heavy workload, and
(3) having restless/disturbed sleep.

Eta-squared results show that fatigue in officers and in those working on deck is most significantly influenced by having restless/disturbed sleep (η^2 of 0,27 and 0,21 respectively). Fatigue in ratings (i.e. those not being officers) is mostly influenced by difficulties falling asleep (η^2 of 0,18), whereas fatigue in those working in engineering is most significantly affected by constant time pressure due to a heavy workload (η^2 of 0,26).

Conclusions: This study indicates that suboptimal sleep patterns significantly contribute to seafarers' fatigue. Moreover, different groups of seafarers are faced with different kinds of sleep problems associated with fatigue.

Disclosure: Nothing to disclose.

P073 | Cataplexy is reduced after modulation of serotonin transmission

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Objectives/Instruction: Cataplexy is a major symptom of narcolepsy and is defined as a sudden loss of muscle tone during wakefulness while consciousness is preserved. It is a dynamic, multiphased process which involves different brain regions before, during and after its occurrence. Monoaminergic neuronal populations that are important wake-promoting systems play also an important role in pathophysiology of narcolepsy with cataplexy. In this work we sought to understand if the modulation of the serotonin transmission can influence cataplexy occurrence in mice.

Methods: The mice were implanted with EEG electrodes and EMBLA™ hardware was used for signal acquisition and Somnologica-3™ (Medcare) software for data analysis. High resolution camera also was used to record animal behavior during different vigilance state.

Results: Our results showed that introducing a null 5-HTT gene (serotonin transporter) in the animal model of cataplexy (Hcrt KO mice) greatly reduced cataplectic attacks but REM sleep amount increased. The decrease in cataplexy was displayed both in episod number and time in state and was even more pronounced after sleep deprivation, with 4 fold decrease as compared to Hcrt KO mice. Power spectral analysis showed that wake quality follows the same pattern across the knockout and wild type animals.

Conclusions: This finding indicates that serotonergic system is a major downstream hcrt pathway to regulate cataplexy onset and duration supporting the serotonergic system as the therapeutic target for controlling cataplexy in narcolepsy patients.

Disclosure: Nothing to disclose.

P074 | Cabin crews' views on managing fatigue and the importance of sufficient rest and company support: a qualitative study

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Objectives/Instruction: Considering the important role of Cabin Crew in maintaining passenger and cabin safety, Cabin Crew fatigue and its associated risk needs to be managed carefully. Because fatigue is a 'whole-of-life' issue, its management must be a shared responsibility between the employer and employee. To be able to reduce or mitigate fatigue, the causes and consequences of fatigue need to be understood. However, Cabin Crews' views on fatigue and their strategies for mitigating it, have seldom been sought.

Methods: A qualitative study was conducted using semi-structured focus group discussions. Thematic analysis was undertaken with data from 25 Cabin Crew using a 6-phase iterative process. Taking a pragmatist approach, the analysis was situated within the existing knowledge of fatigue risk management and a safety system approach.

Results: Participants indicated that the consequences of Cabin Crew fatigue are twofold, affecting

(1) Cabin Crew health and wellbeing and
(2) safety (cabin, passenger and personal) and cabin service.

Whereas the primary causes of fatigue were sleep loss and circadian disruption, participants identified a range of other factors including: insufficient time for rest, high workload, the work environment, a lack of company support and limited fatigue management training. They highlighted the importance of sufficient rest, not only for obtaining adequate recovery sleep but also for achieving a work-life balance. They also highlighted the need for company support, in the form of fatigue-related provisions, effective communication and management's engagement with Cabin Crew in general.

Conclusions: Whereas traditionally fatigue has been managed through prescriptive limits on maximum duty duration and minimum rest durations, the present findings demonstrate the need for a much broader approach. Fatigue Risk Management Systems (FRMS) that are based on scientific and operational knowledge about the causes of fatigue and its management, and include fatigue management training for all relevant personnel (including senior management) as well as an effective fatigue reporting system, can ameliorate the gaps identified and thus improve Cabin crews' safety and service, and health and well-being.

Disclosure: This study was made possible by Wynand Serfontein at South African Airways and it was funded by the Sleep/Wake Research Centre, Massey University.

P075 | Night-competition affects sleep quality and perceived recovery in top-level athletes

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Objectives/Instruction: It is becoming increasingly evident that sleep plays an essential role for athletes' well-being and recovery. Several factors are able to negatively influence sleep and both the kind and timing of physical activity significantly affect athletes' sleep quality. It has indeed been showed that high-intensity acute exercise, especially when performed late in the evening or close to bedtime, may negatively affect sleep. Therefore, we investigated actigraphy-based sleep quality and perceived recovery before and after a night-game in top-level athletes.

Methods: Sleep parameters were evaluated through actigraphy for three consecutive nights with 24 elite volleyball players (12 males and 12 females, mean age = 26.0 ± 3.4) during the competitive season 2016-2017. One night before (PRE) and two nights after (POST 1 and POST 2) an official night-match were studied and athletes' subjective perception of recovery was evaluated by the Total Quality Recovery scale (TQR). The following actigraphic parameters were studied: Time in Bed (TB), Sleep Latency (SL), Sleep Efficiency (SE), Wake After Sleep Onset (WASO), Total Sleep Time (TST), Immobility Time (IT), Moving Time (MT), and Fragmentation Index (FI).

Results: Repeated-measures analysis of variance (RM-ANOVA) followed by the Bonferroni post-hoc test highlighted significant differences for all sleep variables. Partial eta squared ($\acute{\eta}_p^2$) was used to determine the magnitude of the effect for significant outcomes in RM-ANOVA. Sleep quantity parameters were lower at POST 1 compared to PRE ($p < 0.05$) and POST 2 ($p < 0.001$) (TST: $p = 0.0001$; $\acute{\eta}_p^2$=0.66). Similarly, sleep quality parameters were worse immediately after the night-competition compared to both pre-match values ($p < 0.05$) and the second night after competition ($p < 0.001$) (SE: $p = 0.0005$; $\acute{\eta}_p^2 = 0.44$). The same differences among three nights were observed in TQR values ($p < 0.001$; $\acute{\eta}_p^2 = 0.54$).

Conclusions: Actigraphy-based sleep quality and perceived recovery were significantly affected by night-competition and more attention should be paid to the first night after night-match. These preliminary results can be utilized by team coaches to implement behavioral strategies in top-level athletes and to develop a greater knowledge of how sleep differs during different phases of competition.

Disclosure: Nothing to disclose.

P076 | Actigraphic measurement of physical activity changes due to sleep extension intervention

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Objectives/Instruction: Epidemiologic research suggests that both short (< 7 h) and long sleep (>9 h) are associated with adverse health outcomes. Evidence that supports a causal link between longer sleep and adverse health outcomes is particularly unclear. One hypothesis is that decreased physical activity due to oversleeping may affect health. However, laboratory studies consistently show cardiometabolic and cognitive benefits of sleep extension. The current study aims to determine whether, and the extent which, a week of sleep extension alters activity levels across 24 hours as well as within the waking active period and sleep period to determine whether increased time in bed is related to an increase in sedentary behavior.

Methods: Twenty-seven healthy volunteers (24.37 ± 5.41 years old, 16 males) wore wrist actigraphs (Actiwatch 2.0, Philips) for 6 days during their normal schedules and for 6 days during a sleep extension intervention. During baseline conditions, participants maintained their normal activities and sleep practices at home. Participants then extended time in bed to 10 hours for the 6-night sleep extension period but maintained normal daily activities. Independent students' t tests compared the mean difference (MD) between weekly average activity counts per minute (AC/min) for the active period (AP), sleep period (SP) and 24 hour period (24P) for baseline and sleep extension conditions.

Results: Sleep duration for the sleep extension week was significantly greater than during the baseline condition (MD):98 min, t = 8.00, $p < 0.001$). There were no significant differences in weekly activity for 24P (MD:10.00 AC/min; t = 0.90, $p = 0.37$), AP (MD:12.00 AC/min; t = 0.66, $p = 0.51$) or SP (MD:0.88 AC/min, t = 0.60, $p = 0.55$) between baseline and sleep extension conditions.

Conclusions: These findings suggest that extending time in bed for 1 week increases sleep without altering weekly average activity levels in healthy individuals. An association between long sleep and low activity may develop over time and therefore, may not be evident in short term sleep extension. It is also possible that the observed association between long sleep duration, low levels of physical activity and overall mortality in epidemiological populations may be due to underlying lifestyle or health factors as opposed to increased sedentary behavior due to time in bed.

Disclosure: Nothing to disclose.

P077 | Sleep is shortened prior to morning and night shifts in Air Traffic Controllers

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Objectives/Instruction: There is evidence that shift timing impacts the amount of sleep obtained prior to the shift, with early starts curtailing sleep and night shifts displacing sleep. These analyses aimed to investigate the effects of shift timing on the sleep of Air Traffic Controllers (ATCs).

Methods: Thirteen ATCs (11 male, mean age 48 years) were monitored using wrist actigraphy across four work patterns each 4 days long (patterns 1–4) and one 7-day work pattern (pattern 5). Shifts were classified as 'morning', 'afternoon' or 'night' shifts. Pattern 5 included a 24-h period free of duty prior to the first of two consecutive night shifts, whereas in patterns 1 and 2 a single night shift started on the day the morning shift ended. Total sleep time (TST) was calculated as the amount of sleep occurring in the 24 h prior to the start of each shift. Linear mixed models were conducted to determine: 1) whether TST prior to a shift differed between morning, afternoon and night shifts and 2) whether TST prior to a night shift differed between shift patterns.

Results: ATCs obtained significantly less sleep prior to a morning than an afternoon shift ($p < 0.01$, difference 50 min) and significantly less sleep prior to a night shift than an afternoon shift ($p < 0.01$, 50-min difference). There was no significant difference in TST prior to a morning compared to a night shift ($p=0.98$). ATCs obtained significantly more sleep prior to the first night shift in pattern 5, following 24-h off-duty, relative to pattern 1 ($p=0.03$, 57-min difference) but not pattern 2 ($p = 0.08$, 45-min difference). Prior to the second night shift in pattern 5, they obtained less sleep than prior to the night shift in patterns 1 and 2 (respectively $p = 0.02$, $p < 0.01$, 61- and 74-min difference) and the first night shift of pattern 5 ($p < 0.01$, 118-min difference).

Conclusions: Overall, the timing of a shift impacted the amount of sleep obtained by ATCs prior to their shift with morning and night shifts resulting in shortened sleep duration. However, it appears that a 24-h period free of duty prior to a night shift can mitigate this effect.

Disclosure: This study was industry funded.

P078 | Subjective mood and the processing of emotional stimuli following a brief, midday nap

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Objectives/Introduction: Napping is an effective intervention for daytime fatigue and sleepiness and has also been shown to confer additional benefits such as increasing frustration tolerance. This may indicate that napping provides facilitation of emotion regulation, more generally. The processing of emotional stimuli is an important component process of emotion regulation and is widely believed to be affected by continued wakefulness. Thus, the present study aimed to examine the impact of a brief, midday nap on subjective mood and the processing of emotional stimuli.

Methods: 40 participants between the ages of 18–50 were randomized into a 60-min nap or no-nap condition. Mood was measured using visual analogue scales, both before and after the nap or no-nap period. A subset of 30 participants also completed a dot-probe task that assessed attentional bias to emotional stimuli, analyzed using a repeated measures ANOVA with condition (pre or post-nap) as a within-subjects factor and group (nap or no-nap) as a between-subjects factor.

Results: Results revealed that those in the no-nap condition demonstrated shorter reaction time to emotional images while those in the nap group exhibited similar reaction times to emotional vs neutral images, $F(1, 28) = 4.52$, $p < 0.05$. While those in the no-nap condition showed no change in mood, $F(1, 38)=8.91$, $p < 0.01$, those in the nap condition showed a worsening of mood following the nap which was not associated with level of sleepiness.

Conclusions: Our results indicate that over the course of the day, continued wakefulness may be associated with an increase in response bias toward emotional stimuli, even when subjective mood is not affected. Napping may prevent these biases from occurring, however may come at the cost of subjective mood impairments. As sleepiness was not associated with mood ratings in the nap group, further research will be needed to identify the mechanism responsible for mood impairments post-nap.

Disclosure: Nothing to disclose.

P079 | Relationship status, sleep patterns and sleep quality - how are they related?

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Objectives/Introduction: Sharing a bed may affect usual sleep patterns but sleeping with a partner seems to have a beneficial impact. The aim of this study was to examine the differences in sleep quality (SQ) and sleep patterns between people who slept with their partners and those who slept alone. In addition, we wanted to examine the predictive value of the relationship quality and relationship duration for subjective SQ.

Methods: The study was conducted with 449 participants (79% women, *M* = 32.3 years, *SD* = 11.37), where 56% were married or living with partner, 23% were in relationship but not cohabiting, and 21% were single, divorced or widowed. A total of 225 reported regularly sharing bed with a partner and 176 reported sleeping alone. Seventy percent of participants were highly educated, and 62.4% employed full-time. Online questionnaire comprised general questions, questions on sleep patterns on work-days and weekends, napping, estimated sleep need and subjective SQ, and the Relationship Assessment Scale.

Results: T-tests showed significant differences between participants sleeping with or without a partner in several sleep characteristics. Participants who shared bed with a partner estimated shorter sleep latency ($p = 0.005$), had earlier bedtimes and wake-up times on workdays ($p = 0.000$), were napping less on work days ($p = 0.000$), went to bed earlier, woke up earlier and slept shorter on weekends ($p = 0.000$), and generally needed less sleep ($p = 0.027$). Regression analysis showed that, irrespective of bed-sharing, in those who were in the relationship age, relationship quality, duration of relationship and duration of cohabitation significantly explained only 4% of SQ variance ($p = 0.037$). The only significant individual predictor was the relationship quality ($p = 0.001$).

Conclusions: The results of our study indicate differences in sleep patterns and other sleep characteristics indicative of SQ between those who slept with their partners and those who slept alone, although the groups did not differ in subjectively estimated SQ. The results showed that sleeping with a partner could be considered a protective factor for healthier sleep patterns, and that being in a good relationship significantly contributes to better subjective SQ.

Disclosure: Nothing to disclose

P080 | Refraining from smartphone use for 30 min before bedtime prevents the extension of the following sleep latency

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Objectives/Introduction: The purpose of this study was to examine the effect of smartphone use through polysomnography (PSG) recording, especially to examine until how many minutes before the prescribed bedtime smartphone-use would affect the following sleep quality.

Methods: In our preliminary questionnaire survey on university students' information and communication technology (ICT) use at nighttime and sleep habits ($n = 160$), it was found that the most used ICT apparatus was smartphone, and the most frequent activity was to search something on the internet. Pittsburgh Sleep Quality Index (PSQI) score of the group that used smartphone until just before their bedtime was worse than that of the group that refrained from using smartphone before their bedtime for at least 30-min or longer ($ps < 0.05$). Then, having controlled the time difference between the last smartphone use and prescribed bedtime, a psychophysiological experiment was conducted using PSG. Participants were 6 male university students (mean age = 21.3 years). The controlled times were, 60-min, 30-min, and 0-min (just) before the prescribed bedtime (0:00), and within-subject comparisons were performed. It was confirmed that they all had regular sleep habits before the experiments.

Results: Sleep structures were not affected by the difference time; however, the sleep latencies were significantly extended in the 0-min condition than the 30- or 60-min before conditions ($ps < 0.05$).

Conclusions: It was experimentally indicated that when one used smartphone until just before the bedtime, the sleep latency would be longer, and that refraining from use 30 min until bedtime could prevent the effect. Habitual delay of sleep onset time could be followed by worse sleep health.

Disclosure: Nothing to disclose.

P081 | Social patterning of inadequate sleep and behavioural sleep problems: findings from the 2016 sleep health foundation Australia survey

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Objectives/Introduction: Inadequate sleep costs the Australian community $66 billion annually. Given the pervasiveness of

inadequate sleep and sleep problems in the population, there is a need to identify specific social groups which may be most vulnerable to inadequate sleep to facilitate development of targeted public health interventions.

Methods: A 2016 online survey of a representative sample of 1,011 Australian adults included social patterning predictors of housing situation, income, educational attainment, work status/schedules, financial savings/strain, neighbourhood index of relative socioeconomic disadvantage, metro v rural status, domestic partnership, and country of birth. Outcome variables were perceived habitual sleep adequacy and symptoms of a sleep problem (including daytime symptoms, sleep onset or maintenance problems, fatigue, irritability/moodiness). Multivariable-adjusted binary logistic regression analyses were conducted for each significant social patterning predictor controlling for age, sex and clinical sleep disorders (sleep apnea, insomnia, restless legs).

Results: *Perceived Habitual Sleep Adequacy was significantly associated with* income, financial savings status, work status and work schedules (all $p< 0.05$). In adjusted models, only those working evening or night shift were less likely to report feeling they achieve adequate sleep (*OR* = 0.56, *CI* = 0.34, 0.91, $p = 0.021$). *Sleep Problems* were associated with sex, financial strain, financial savings status, bed partner status, work status and work schedule (all $p < 0.05$). Those married/defacto were less likely to report symptoms reflecting a sleep problem (OR = 0.59, CI = 0.42, 0.84, $p = 0.003$). Work status also remained significant in adjusted models indicating a reduced odds of sleep problems in full time workers (OR = 0.33, CI = 0.15, 0.73, $p = 0.006$), part time workers (OR = 0.24, CI=0.10, 0.56, $p = 0.001$) and retirees (OR = 0.37, CI = 0.14, 0.99, $p = 0.049$) compared with students. No associations were seen with neighbourhood-level disadvantage.

Conclusions: Associations of sleep adequacy and sleep problems with financial strain or savings behavior were attenuated in multivariable models. However, occupational and educational stressors, rather than socioeconomic disadvantage and living arrangements, are predictive of poor sleep. Further research is needed in Australian samples to determine whether additional social patterning factors including neighbourhood characteristics (noise, violence and perceived safety) and family status influence perceived habitual sleep adequacy and prevalence of behavioural sleep problems.

Disclosure: This research was funded by the Sleep Health Foundation in a grant awarded to CIA Adams.

P082 | A field-study on the role of sleep in stress resilience in rescue workers: preliminary analyses of wrist-actigraphy and home-polysomnography

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Objectives/Introduction: Previous research suggested that good quality sleep may benefit stress resilience and emotional regulation. Here we aim at better understanding the role sleep plays in stress resilience in rescue workers, an at-risk group for stress disorders.

Methods: To date, we monitored a sample of 15 rescue workers (male and female, 18–65 years) continuously over the course of 1 month. Data on psychological stress and sleep-wake habits were collected by post-traumatic stress disorder checklist 5 (PCL-5) and continuous recordings of wrist-actigraphy (ACT) and heart rate, validated by single-night polysomnographic (PSG) sleep recordings at home.

Results: Preliminary analyses of sleep latency and sleep efficiency derived from ACT compared to home-PSG revealed similar values ($n = 15$; $p_{all} > 0.05$), demonstrating the accuracy and reliability of continuous real-time wearable data collection over the one-month study period. Regression analysis indicated PCL-5 scores as significant predictor of sleep duration, such that those with higher stress scores compared to lower stress scores slept longer ($p = 0.013$).

Conclusions: The preliminary findings of this ongoing study indicate inter- and intrasubject variability in sleep profiles and stress management, which warrant further investigation. Simultaneous recording of long-term estimates of sleep quality and heart rate and smartphone/app assessed stress events in a larger study sample may substantiate a distinct role for sleep in stress resilience in rescue workers.

Disclosure: Nothing to disclose

P083 | Making errors at work due to sleepiness or sleep problems is not limited to shift working populations: results of the 2016 Sleep Health Foundation survey

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Objectives/Introduction: As many as 30% of Australians report making errors at work as a consequence of sleepiness or general sleep issues. While fatigue risk management systems are intended to reduce the risk of errors and accidents at work as a consequence of work-related fatigue, such systems are typically implemented in workplaces with shift working operations. Long working hours and commutes also impact day workers' sleep behaviours and opportunities. Our aim was to determine the relationship between sleep duration and disorders, sleep health and hygiene factors, work related factors and errors at work in Australian workers.

Methods: From a sample of 1011 Australian adults, age-adjusted binary logistic regression analyses were conducted in 512 workers who provided responses to the question "Thinking about the past 3 months, how many days did you make errors at work because you were too sleepy or you had a sleep problem?"

Results: A number of sleep behaviours and poor sleep hygiene factors were linked with work errors related to sleepiness or sleep problems, with age-adjusted odds of errors (confidence intervals) up to 11.5 times higher (5.4–25.1, $p < 0.001$) in some sleep disorders, 7.7 (4.6–12.9) times higher in those who report multiple sleep problems ($p< 0.001$), 7.0 times higher (3.4–14.8) in short (≤5 h/night) sleepers ($p< 0.021$), 6.1 times higher (2.9–12.7) in those staying up later than planned most nights of the week ($p< 0.001$) and 2.4 times higher (1.6–3.7) in those drinking alcohol ≥3 nights/week before bed ($p< 0.001$). More than 40% of shiftworkers reported making errors at work and they were more likely to be young (compared to the main sample of workers) and more likely to engage in work activities in the h before bed.

Conclusions: Sleep factors beyond clinical sleep disorders were also associated with increased likelihood of sleep-related work errors. Both shift workers and non-shift workers engage in work, sleep and health behaviours that do not support good sleep health, and these behaviours may be impacting safety and productivity in the workplace through increased sleepiness-related errors.

Disclosure: This work was funded by a grant from the Sleep Health Foundation awarded to CI Adams.

P084 | Long-term trends of sleep disturbances related with attitude towards the health and cardiovascular prevention in women 25–44 years in Russia/Siberia

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Objectives/Introduction: To determine the 23-year dynamics (1994–2017) of the relationship between sleep disorders (SD) and attitude towards the health and cardiovascular prevention in female population aged 25–44 years in Russia/Siberia.

Methods: Under the third screening of WHO program MONICA - Psychosocial a random representative sample of women aged 25- 44 years in one of Novosibirsk district (n = 282) were examined in 1994 and it was done in 2017 (n = 668). The sleep assessment was performed using the Jenkins Sleep Questionnaire. Attitude to their health and the prevention of cardiovascular diseases were studied using the "Knowledge and attitude to one′s health" scale proposed by protocol "MONICA".

Results: The prevalence of sleep disorders in the open population among women aged 25–44 in the dynamics from 1994 to 2017 decreased from 59.6% to 47.3%. From 86.2% to 67.6% the proportion of women with sleep disorders who consider themselves not completely healthy or sick has decreased. The majority of women with sleep disorders (57%) consider a high probability of getting a serious illness in the next 5–10 years, but only 7% of women with sleep disorders have regular preventive checks. By 2017 people with sleep disorders have become more likely to seek medical help when signs of heart disease appear and they prefer to conduct a more thorough examination and obtain the opinion of outside specialists during diagnostics. The share of those who were satisfied with medical care increased by 2017, but does not exceed 13%. In case of a malaise, only 1 in 10 women apply to a doctor, as in 1994. The intensity of work of young women with sleep disorders is higher compared to a good sleep; they more often (more than 40%) do additional work, have a higher responsibility. The growth of family stress in women with SD by 2017y is due to frequent relatives' illness or death or changes in their marital status.

Conclusions: We found decreasing in SD rates over two decades. There is more careful attitude to their health in those with SD by 2017 but increased intensity and responsibilities at work and family stress.

Disclosure: Nothing to disclose.

LEARNING, MEMORY & COGNITION 1

P085 | ADHD symptoms are associated with decreased activity of fast sleep spindles and poorer procedural overnight learning during adolescence

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Objectives/Instruction: ADHD and its subclinical symptoms have been associated with both disturbed sleep and weakened memory consolidation. As sleep spindle activity during NREM sleep plays a key role in both sleep maintenance and memory consolidation, we examined the association between ADHD characteristics and sleep spindle activity. Furthermore, we hypothesized that sleep spindle activity would mediate the effect of subclinical ADHD characteristics on overnight learning in a procedural memory task.

Methods: We studied these questions in a community-based cohort of 170 adolescents (58% girls, mean age = 16.9, SD = 0.1 years), who filled in the Adult ADHD Self-Report Scale (ASRS-v1.1), and underwent an overnight sleep EEG coupled with a mirror tracing task before and after sleep.

Results: Elevated ADHD symptoms were associated with lower fast spindle amplitude at frontal derivation (p = 0.04), shorter fast spindle duration at both frontal (p = 0.005) and central (p = 0.04) derivations, as well as weaker fast spindle intensity at both frontal (p = 0.01) and central (p = 0.03) derivations. Elevated ADHD symptoms (p = 0.04) as well as lower sleep spindle amplitude (p = 0.03 at central derivation and p = 0.04 at frontal derivation) and intensity (p = 0.04 at both central and frontal derivations) were associated with poorer overnight learning in the procedural memory test. However, sleep spindles, contrary to the hypothesis, did not mediate the association between ADHD symptoms and overnight learning.

Conclusions: Our results show that a higher level of ADHD symptoms in adolescence is associated with similar alterations in sleep spindle activity at frontal areas as observed in many neuropsychiatric conditions.

Disclosure: Nothing to disclose.

P086 | Associations between brain oscillation cross-frequency coupling during sleep and declarative learning in healthy older adults

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Objectives/Introduction: Learning and memory consolidation processes may be mediated by a spontaneous synchronization of neuronal oscillations known as cross-frequency coupling (CFC). Coupling of neuronal oscillations is observed in both awake and asleep electroencephalogram (EEG) recordings. Associations between learning and increased CFC during non-rapid-eye-movement (NREM) and rapid-eye-movement (REM) sleep have been observed in animals and young adult humans. However, similar studies have rarely been conducted in older adults. The current study with healthy older adults tested a hypothesis that increases in CFC during sleep are positively associated with better performance on a sleep-dependent declarative memory task.

Methods: Nineteen healthy, community-dwelling older adults (M (SD) age = 67.8 (5.12) years; 13 female) completed a baseline polysomnography to rule-out severe sleep apnea, followed by 7 days of ambulatory monitoring using actigraphy and a daily sleep diary. A second overnight polysomnography was performed at least 1 week after the first and included a word-pair associates task (40 word-pairs), with immediate (pre-sleep) and delayed (post-sleep) recall periods. Phase-amplitude CFC was quantified using the modulation index from frontal (Fz) and central (Cz or C3) EEG data between delta (1–4Hz) and sigma (11–16Hz; adapted) bands during the first NREM sleep cycle (NREM2, NREM3, NREM2/3), and between delta (1.5–3Hz) [or theta (4–7Hz)] and gamma (50–100Hz) bands during total REM sleep. Associations among relative changes in CFC between overnight recordings (Night 2-Night 1) and word-pair memory performance were examined using linear regression, controlling for age, sex, education (years), and apnea-hypopnea index.

Results: A greater relative increase in delta-sigma CFC during NREM2/3 was positively associated with better word-pair recall performance in both immediate (R^2_{change} = .281, β = .694, p = 0.008) and delayed testing conditions (R^2_{change} = .299, β = .715, p=.003). A greater relative increase in theta-gamma CFC during REM sleep was positively associated with greater word-pair performance stability between immediate and delayed recall conditions (R^2_{change} = .206, β= .497, p = 0.047). Results were significant only on central EEG channels.

Conclusions: Findings from this study further add to a growing theory that CFC during sleep reflects a neural mechanism underlying

offline memory consolidation for newly learned declarative material. This study also provides novel evidence for relations between CFC during sleep and declarative learning in healthy older adults.

Disclosure: Nothing to disclose.

P087 | Overnight production of false memories in adolescents - associations with sleep EEG and spindles

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Objectives/Introduction: The process of reorganizing and consolidating memories is one of the central cognitive functions of sleep. During sleep, the brain reorganizes newly encoded material, and facilitates remembering. One likely mechanism is through sleep spindles, the thalamocortical oscillations which occur during stage 2 sleep. The role of sleep in memory consolidation is not restricted to the reorganization of veridical memory, but growing evidence demonstrates that sleep also facilitates the extraction of semantic regularities amongst the newly encoded memories, which may also lead to increased false memories. We investigated the potential role of sleep spindles and sleep stage proportions in the formation of adolescents' false memories.

Methods: Participants came from a healthy, full-term birth cohort and underwent ambulatory overnight polysomnography (PSG) (SomnoScreen plus, SomnoMedics) at mean age 16.9 year (SD = 0.1). 196 adolescents participated (61% girls). We used the standard Deese, Roediger & McDermott (DRM) procedure to induce false memories with eight lists of 15 words (altogether 120 words) in the evening, with free recall the following morning. Sleep was scored manually into stages 1, 2, 3 and REM. Central and frontal region spindle number, frequency, density (number of spindles per 30-s-epoch), duration (seconds), and amplitude (μV) were used as measures of general spindle activity and individual spindles for slow (10–13 Hz) and fast (13–16 Hz) ranges.

Results: Girls' produced a higher number of correctly recalled studied words, critical lures (false memories), and intrusion words than boys (all $p \leq 0.001$). In linear regression analyses, girls' longer sleep duration was associated with more intrusion words, but not with critical lures ($p = 0.03$). In girls, a lower amount of critical lures was associated with higher spindle frequency ($p \leq 0.009$), density ($p \leq 0.009$), amplitude ($p = 0.029$), and number ($p \leq 0.028$). These associations survived adjustment for age, pubertal status, and intelligence. Regarding boys, no significant results emerged regarding these associations.

Conclusions: We found that in adolescents girls higher spindle activity was associated with fewer critical lures being falsely recalled in the DRM paradigm. Unlike studies using adult participants, we did not observe any association between stage 3 sleep and false memory formation.

Disclosure: Nothing to disclose.

P088 | Baseline cortical activity predicts reactivity to nociceptive stimuli during sleep

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Objectives/Instruction: Nociceptive stimuli are known to disrupt sleep and this sleep disruption follows the apparition of a 'cognitive' wave, supposed to reflect the activation of a widespread cortical network (Bastuji et al. 2008). The factors allowing the activation of this network are unknown and remain to be identified. The aim of the present study was to test if the characteristics of baseline cortical activity can predict reactivity to these nociceptive stimuli. For this purpose, intra-cerebral electrophysiological signal before nociceptive stimuli during sleep were analysed in the time-frequency domain.

Methods: Intracerebral recordings were obtained in 14 epileptic patients receiving thermo-nociceptive stimulations, calibrated slightly above the individual pain threshold, during whole night sleep. Spectral content of 5 s pre-stimulus EEG signal and phase coherence between posterior insula and 14 other brain areas were compared according to presence or absence of arousal post-stimulus, during sleep N2 and paradoxical sleep (PS).

Results: Spectral power of delta activity pre-stimulus was significantly lower before arousal reaction as compared to that with no arousal in N2 ($p < 0.0001$), and higher in PS ($p < 0.001$). Pre-stimulus phase coherence between posterior insula and other brain areas was significantly higher before post-stimulus arousal as compared to no arousal, and this in N2 as well as in PS.

Conclusions: Arousal occurrence is related to a lighter sleep when the nociceptive stimulus is delivered and a higher functional connectivity between the sensory and other cortices. This greater connectivity between sensory and association areas may facilitate information propagation leading to conscious perception and physiological response.

Disclosure: Nothing to disclose.

P089 | Sleep strengthens spontaneous retrieval processes in prospective memory

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Objectives/Instruction: Prospective memory (PM) is defined as remembering to execute a future intention. Here, we investigated

the effect of sleep on prospective memory as well as the relationship between macrostructural features of sleep and prospective memory consolidation.

Methods: Forty-nine adults (mean age ± SD: 22.1 ± 1.71 years; 18 males) encoded intentions comprising 4 related ('phone-unplug earphones') and 4 unrelated ('mirror-close the book') cue-action pairs. They were instructed to remember to perform these actions in response to cue words presented during a semantic categorization task performed 12-h later. The interval was either across a period of wakefulness (09:00–21:00; n = 24) or following overnight sleep that was monitored with polysomnography (21:00–09:00; n = 25).

Results: We found a significant group x relatedness interaction for prospective memory accuracy ($F(1,47) = 8.35$, $p < 0.01$). The sleep group successfully executed a significantly higher percentage of related intentions compared to the wake group (mean ± SEM: 94.00 ± 2.61% vs. 66.67 ± 6.84%, $p < 0.01$).There was no significant group difference in the percentage of unrelated intentions successfully executed (82.00 ± 5.10% vs. 72.92 ± 6.88%, $p = 0.29$). Further, the benefit for related intentions was associated with more post-learning slow wave sleep ($p < 0.05$).

Conclusions: Sleep may selectively strengthen spontaneous retrieval processes in prospective memory, promoting the execution of intentions comprising intuitively linked cue-action pairs.

Disclosure: Nothing to disclose.

P090 | Information processing during sleep is linked to changes in sleep microstuctures

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Objectives/Introduction: While for a long time it was assumed that the brain is 'shielded' from the environment during sleep, we now know that processing of information continues even during the deepest stages of sleep including REM sleep. However, brain responses to salient stimuli change from wakefulness to sleep. In particular, it has been proposed that such changes may reflect the appearance of sleep-specific microstructures such as arousal, K-complexes, sleep spindles and slow oscillations, which have been shown to influence information processing. We investigated the changes in sleep microstructures induced by auditory stimulation and the effect of this change on information processing.

Methods: We employed nocturnal (8 h) 256-channel EEG recordings to measure brain responses to salient stimuli during sleep in 17 healthy sleepers. More specifically, we presented participants with their own name and unfamiliar names uttered by a familiar voice or an unfamiliar voice. We assessed changes in sleep microstructures namely; arousals, K-complexes and fast spindles (13–15Hz), following the presentation of auditory stimuli. Analyses were performed on 4 s epochs starting with stimulus onset (evoked) and baseline corrected to random 4 s epochs where no auditory stimuli were presented (spontaneous). To identify the difference between the two groups, non-parametric **tests** were calculated. Effects $p < 0.05$ are denoted significant.

Results: The incidence of auditory-evoked arousals to occur was significantly higher than that of spontaneous arousals ($p < 0.01$). However, there was no difference between the duration of auditory-evoked and spontaneous arousals. Similarly, the amount of evoked K-complexes measured on both left and right hemispheres was significantly higher than spontaneously generated K-complexes ($p< .01$, at C3 and C4). Interestingly, only on the left hemisphere the mean amplitude of evoked K-complexes was lower than that of spontaneous K-complexes ($p < .05$ at C3). Finally, fast spindle activity increased significantly following auditory stimulation ($p < .05$). Ongoing analyses focus on the subtle alertness changes (evaluated by Hori scale; Tanaka et al., 1996) evoked by different auditory stimuli.

Conclusions: Our results suggest that information processing is ongoing even during the most "inhibitory" events in sleep. They also propose a direct link between the activity of sleep microstructures and information processing.

Disclosure: Nothing to disclose.

P091 | The consolidation of cognitive strategies is enhanced by sleep, but not the motor skills needed to acquire it

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Objectives/Instruction: Sleep is beneficial for the consolidation of both "cognitive procedural memory" (CPM) and "simple procedural memory" (SPM). CPM involves the acquisition of a novel cognitive strategy through the execution a series of motor movements. By contrast, SPM involves motor skills learning of a cognitively simple sequence of movements. Sleep has been implicated in the consolidation of implicit CPM, whereas the role of sleep in implicit SPM remains unclear. The present study directly compared the differential benefit of sleep for CPM vs. implicit SPM consolidation.

Methods: To disentangle and directly compare SPM to CPM, subjects were tested on: (1) the "classic" Tower of Hanoi task (ToH) where the solution requires the use of both recursive elements (i.e., a repetitive series of movements, thus involving SPM) and non-recursive elements (i.e., a non-repetitive series of movements that can only be learned by acquiring the underlying cognitive strategy, thus involving CPM); and (2) a "modified" version of the ToH, akin to the serial reaction time (SRT) task, designed to prevent the

acquisition of a cognitive strategy, thus isolating the SPM component of the task. Participants (n = 57) were trained on either the ToH or SRT, then retested on both the ToH and SRT. Half were trained in the evening, retested after a night of sleep, and again after a day of wake (PM-AM-PM). The other half were counterbalanced (AM-PM-AM).

Results: The time taken to complete the ToH improved following sleep vs. wake from training to retest ($F(2, 52)=3.22$, p = 0.048), but not for the SRT ($F(2,54)$ = 0.324,p = 0.725). Follow-up tests revealed that performance improved only for the ToH after sleep – and only after sleep – either immediately after training, or 1 day later. Moreover, sleep significantly enhanced the non-recursive elements but not the recursive elements of the ToH, but not the SRT.

Conclusions: Sleep preferentially supported CPM, whereas implicit SPM improved regardless of sleep or wake. These results suggest that sleep benefits the cognitive aspects of procedural memory, rather than strengthening the implicitly acquired motor sequences involved in learning the strategy itself.

Disclosure: Nothing to disclose.

P092 | Dynamic of the hippocampus activity during arousing reaction from sleep: an intracranial EEG study

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Objectives/Introduction: Short phasic activations during sleep are considered as transient elevations of the level of vigilance and are called arousals (3–15 s) or awakenings (more than 15 s). As predicted by the arousal-retrieval model (Koulack & Goodenough 1976), we previously found that the average duration of intra-sleep awakenings was a good predictor of dream recall (2 min vs 1 min in average in high vs low dream recallers, Vallat et al. 2017). Intracranial EEG studies have shown that cortical patterns of activation during short arousals were inconsistent across time and heterogeneous according to brain regions, but none of them had the chance to explore the hippocampus (Peter-Derex et al. 2015).

Methods: We investigated the hippocampus activity during sleep and short arousing reactions lasting from 3 s to 2 min using intracranial recordings (S-EEG) in 4 drug-resistant epileptic patients undergoing pre-surgical investigation. Sleep EEG recordings from the thalamus and hippocampi free of epileptic activity were analysed. The average power in S-EEG hippocampal signal for frequency bands of interest (between 0.5 and 140 Hz) was calculated in 4 time windows: the 10 sec of sleep preceding the arousal, the first 3 sec of the arousal, the end of the arousal, and 10 sec of evening wakefulness.

Results: A total of 617 arousing reactions were analysed. Comparisons between hippocampal spectral power in the 4 time windows of interest showed that 1) the power in several frequency bands during the arousals was intermediate between the power during wakefulness and the power in the preceding sleep, 2) the longer the arousal, the more wake-like the power in these frequency bands, 3) the power in the gamma band was not significantly lower in N2 sleep than in wakefulness, and 4) the power in the delta band was not significantly different in REM sleep and wakefulness.

Conclusions: The results show that during short arousals/awakenings

1. the hippocampus activity changes,
2. the reinstatement of the wakefulness hippocampus activity takes several tens of seconds,
3. the timing of the hippocampus reactivation is coherent with the timing of dream recall/forgetting and awareness of wakefulness reinstatement at awakening.

Disclosure: Nothing to disclose.

P093 | Influence of hypnotic suggestions on spindles, slow oscillations and memory consolidation during sleep

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Objectives/Instruction: Slow Oscillations (SO) and sleep spindles are associated with memory consolidation during sleep (Mednick et al., 2013; Ngo, Martinetz, Born, & Mölle, 2013; Rasch & Born, 2013). Moreover, fast spindles seem to mediate information processing during sleep (Cairney, Guttesen, El Marj, & Staresina, 2017) in association with SOs (Helfrich, Mander, Jagust, Knight, & Walker, 2018; Latchoumane, Ngo, Born, & Shin, 2017; Niknazar, Krishnan, Bazhenov, & Mednick, 2015).

Two recent studies provided evidence that listening to a hypnotic suggestion to "sleep deeper" prior to a nap or a night of sleep prolongs subsequent SWS (Cordi & Rasch, under revision; Cordi, Schlarb, & Rasch, 2014). This beneficial effect only occurred in participants suggestible to hypnosis (HS) but not in low suggestible (LS). Despite of the large inter-individual differences in SWS between the hypnosis and control night, no benefit of declarative memory consolidation occurred. Here we examined whether a more fine-grained analysis of SO and sleep spindles would explain the lack of memory consolidation effect during sleep.

Methods: We used the SpiSOP toolbox (Frederik D. Weber, 2013) based on Matlab 2015a (Mathworks, Natick, USA) that utilizes Fieldtrip (Oostenveld, Fries, Maris, & Schoffelen, 2011) to detect slow and fast spindles and SO in the EEG Data. Healthy young participants listened either to a hypnosis a control tape before a nap (N = 30) or a full night of sleep (N = 48), in a within-subject cross-over design.

Results: As expected, SO density was significantly increased ($p < .001$) in the hypnosis vs. the control condition for HS, while the

pattern was reversed in LS. However, spindle density did not significantly follow this results pattern (p = .19). Pilot analysis suggested a reduced synchrony between occurrence of spindles and slow oscillation in the hypnosis condition for high suggestible participants.

Conclusions: Hypnotic suggestion to sleep deeper might have a larger effect on slow oscillations as compared to sleep spindles. This differential effect on SO vs. sleep spindles might reduce the association strength between SO and sleep spindles necessary for promoting declarative memory consolidation during sleep.

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P094 | Evaluating short and long-term effects of full-night sleep and heart rate variability on procedural memory performance

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Objectives/Instruction: Sleep and memory studies primarily focus on overnight rather than long-term performance changes, and traditionally investigate associations with sleep architecture and sleep spindles. Yet, heart rate variability (HRV) during wakefulness has been positively associated with cognitive performance, and may therefore be an additional variable of interest when studying overnight performance changes. This study investigated overnight and long-term performance changes for procedural memory, and evaluated potential associations with HRV (standard deviation of RR intervals [SDNN]), sleep characteristics, and sleep spindle activity.

Methods: Participants (N = 20, M_{age} = 23.40 ± 2.78 years) were trained on a procedural mirror-tracing task for counterbalanced control (normal vision) and learning (mirrored vision) conditions. Performance was evaluated after evening training (T1), a full-night of sleep (T2), and seven days (T3). Performance changes, HRV, sleep architecture, and spindle activity were analyzed for both conditions.

Results: Overnight performance changes (T1–T2) resulted in fewer errors (p = 0.002) and shorter error time (p = 0.039), whereas a long-term (T2–T3) improvement was observed for speed (p = 0.004). Overnight performance change for speed was negatively associated with SDNN during sleep stages NREM1 (p = 0.004) and REM (p = 0.001); meaning that higher variability in RR intervals resulted in lower performance the next day. Contrasting participants based on performance change for speed showed that SDNN was higher for non-improvers compared with improvers during NREM1 (p = 0.002) and REM (p = 0.022). No associations were found between overnight performance changes, sleep architecture, or spindle characteristics after correcting for multiple comparisons (all $ps \geq 0.021$). Contrasting participants based on a change in spindle activity from control to learning conditions showed that only participants with increased spindle activity had a significant overnight reduction in the number of errors (p = 0.012) and long-term improvement in speed (p = 0.021).

Conclusions: This study demonstrated that long-term performance changes can occur following overnight changes. Furthermore, these results indicate HRV should be considered as a variable of interest when evaluating overnight memory consolidation, in addition to traditional sleep characteristics.

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P096 | Effectiveness of reappraisal and distraction in regulating emotion across sleep

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Objectives/Introduction: Sleep provides an ideal neurobiological medium which depotentiate prior negative experiences and restores optimal post-sleep affective reactivity and cognitive functions (Walker and van der Helm, 2009). The first and central factor in order that predict the effectiveness of emotion regulation strategies is the underlying operating mechanism and the cognitive resources required for modulation. The present study compares the effectiveness of two affect regulating strategies (distraction and cognitive reappraisal) in reducing negative affect across sleep.

Methods: Seventeen healthy participants performed on visual emotion regulation task after sleep deprivation or sleep-filled nights. The dependent variable was valance rating on Self-Assessment Manikin Scale. Subjects on experimental nights provided valence ratings on the Self-Assessment Manikin Scale (SAM) under both no-regulation (control) and regulation (distraction/appraisal) strategies. Statistical analyses were carried out using Statistical Package for Social Sciences (SPSS).

Results: Separate repeated measure ANOVA were performed on valance rating across [session (sleep/deprivation) and strategy (control/regulate)] for both the regulation strategies. Self-reported rating of valance for group using distraction strategy varied significantly [($F(1, 16) = 4.56$, $p < 0.05$)] across sleep and deprivation sessions. Similarly, distraction as compared to control lead to significant differences on self-reported valence score [$F(1, 16) = 24.97$, $p < 0.05$]. For cognitive reappraisal strategy, no significant differences for valance rating

across sleep and deprivation nights resulted. However, there was a significant difference in valence rating across control and regulation strategy [$F(1, 16) = 66.49$, $p < 0.05$]. Both the regulation strategy caused significant changes in valence as compared to control strategy. In addition only distraction strategy revealed significant changes in valence ratings across sleep and deprivation sessions.

Conclusions: Regulation strategies successfully modulated valence when compared to no regulation sessions. In addition, only appraisal strategy was able to modulated valence across sleep deprivation leading to similar valence ratings across both deprivation and sleep nights. Possible reason behind these results could be the underlying mechanism and use of cognitive resources in individual strategy.

Disclosure: Nothing to disclose.

P097 | The role of sleep spindle activity in consolidating statistical learning in obstructive sleep apnea patients

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Objectives/Introduction: Statistical learning (SL) is where statistical regularities, in either auditory and/or visual stimuli, are learnt implicitly, as in with no conscious awareness. Studies in healthy individuals show that increased spindle activity during sleep is associated with improved SL. Although deficits in sleep spindle activity have been reported in overnight electroencephalogram (EEG) recordings of untreated patients with obstructive sleep apnea (OSA), no study has examined the relationship between sleep spindles and SL in this population. This study examined whether spindle frequency activity in NREM sleep during overnight polysomnography was associated with SL performance in moderate to severe OSA patients.

Methods: Patients underwent overnight full polysomnography (PSG) in the sleep laboratory. Power spectral analysis was performed on the EEG signals to derive spindle frequency activity, specifically very slow (9–11Hz), slow (11–13Hz) and fast (13–16Hz) activity in NREM sleep. SL was assessed by exposing participants to a reaction time 'cover task' at 7 pm before the sleep study. Cartoon alien pictures would flash on the screen, and participants would be asked to respond to a repeated picture. Unbeknownst to participants, the pictures appeared in groupings of three. 24 h later participants were asked to judge the triplets. Correlations between spindle activity and SL performance were conducted using Spearman's correlation coefficients.

Results: Forty seven participants were studied (age 49 ± 9, BMI 30.0 ± 4.2, AHI 35.5±22.9). Average SL performance was 55.4%, which was significantly above 50% chance level ($t_{46} = 2.45$, p = 0.018). Very slow and slow spindle frequency activity at both frontal (F3 and F4) and central (C3 and C4) brain regions were significantly correlated with improved SL performance Furthermore, fast spindle activity at F3 and C4 sites significantly correlated with improved SL performance (e.g., F3: very slow spindle activity, rho = 0.39, p = 0.008; slow spindle activity, rho = 0.41, p = .006; fast spindle activity. rho = .353, p = 0.019).

Conclusions: This study demonstrates that those OSA patients with increased cortical spindle activity during overnight sleep had greater SL performance. This highlights the potential importance of spindle activity as a marker of implicit learning encoding in untreated OSA patients.

Disclosure: Study funded by NHMRC Project Grant (no. APP1028624). Authors declare no conflicts of interest.

P098 | Remembering emotional information over a week: does sleep play any role?

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Objectives/Introduction: Sleep seems to play a key role in consolidating emotional memories. Nevertheless, most of the studies have been focused on a single sleep period, and whether sleep preferentially facilitates the consolidation of negative memories over time remains unclear. Here, we investigated the role of sleep in remembering emotional information over a week.

Methods: Using an incidental learning paradigm, 31 healthy university students (23F) were exposed to a first set of 40 neutral and 40 unpleasant pictures. Fifteen minutes later they performed an immediate recognition test where they were presented again 40 of the previous pictures intermixed with 40 novel stimuli. They had to decide whether they had seen the picture before. Seven days later they performed a delayed recognition task with the remaining 40 pictures presented at the encoding intermixed with 40 novel stimuli. During each session participants also rated the subjective valence and arousal evoked by image viewing. Sleep pattern during the week between the two recognition tasks was monitored actigraphy.

Results: At the immediate recognition, participants showed a higher memory recognition (*d'*) for neutral compared to unpleasant pictures ($p = 0.016$). As expected, one-week later participants showed a reduced performance compared to the immediate test for both unpleasant and neutral memories ($p < 0.001$), but this time the *d'* did not differ between picture types ($p = 0.80$), indicating a reduced degree of forgetting for emotional memories. Subjective arousal level only nominally decreased between the sessions for both stimuli types, while valence rating remained stable across time. Wake time

was positively associated with changes in memory discrimination (r = 0.42, p = 0.018) and negatively with false alarm rate (r = –.32, p = 0.078) for the unpleasant stimuli, indicating that individuals who spent more time awake were the ones who showed less forgetting for emotional memories.

Conclusions: Our results showed that after 7-days, emotional memories exhibit a reduced degree of forgetting compared to neutral ones. However, participants with worse sleep quality were the one who remembered better emotional information. We suggest that emotional memories are more resistant to forgetting than neutral ones over a week, and poor sleep may induce a paradoxical effect, turning these memories even more resilient.

Disclosure: Nothing to disclose.

METHODOLOGY & COMPUTATION 1

P099 | Can insomnia be a predictor of attrition in longitudinal studies?

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Objectives/Instruction: Attrition in longitudinal studies can be due to mortality, disability, ineligibility (the participant no longer meet the study requirements), refusal (the participant drop out voluntarily by refusing to participate in later months), and loss of contact. Age and sex can be related to some of these forms of attrition. For example, participants who left due to mortality can be older on average, and more likely to be male in comparison with those who remained in a study. There may also be other factors that make participants more likely to withdraw. Can insomnia be one of them?

Methods: Four hundred and fifty-one participants (ages 18–82; mean = 27.9; 21.3% male) took part in a longitudinal study we conducted. Each participant filled in the Insomnia Severity Index (ISI) online. The questionnaire was to be completed monthly for a year.

Results: A multiple regression was performed between the number of months completed in the study as the dependent variable and ISI total score in month one, age, and sex as independent variables. The results of the regression indicated that the three predictors explained 7% of the variance (R^2 = 0.07, F(3,417), $p < 0.001$). Only ISI total score (beta = –0.090, p = 0.006) and age (beta = 0.078, $p < 0.001$) were statistically significant.

Conclusions: Although the magnitude of the results is relatively small, this study suggests that insomnia can be a risk factor for attrition. These findings may be important to inform future studies on ways to lessen or prevent systematic loss of participants.

Disclosure: Nothing to disclose.

P100 | Concomitant actigraphy and polysomnography at home in different sleep disorders

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Objectives/Introduction: Actigraphy (ACT) is a much cheaper and less cumbersome method for measuring sleep than polysomnography (PSG). We aimed to compare sleep parameters measured with ACT and ambulatory PSG in clinical practice.

Methods: We included 290 clinical measurements to 281 subjects (mean age 37.9 years, 182 female) in the study. Subjects were referred to us with suspicion of some sleep disorder causing excessive daytime sleepiness. Concomitant ambulatory PSG and ACT of sleep laboratory patients were analysed to determine the agreement between the two methods in subjects with obstructive sleep apnea, narcolepsy, periodic leg movement disorder, hypersomnia, other rarer disorder (circadian rhythm sleep-wake disorder, REM sleep behaviour disorder etc.) or no organic sleep disorder (usually suffering from insufficient sleep syndrome).

Results: Actigraphy's estimation of sleep time showed excellent and statistically highly significant correlation to total sleep time in PSG in all diagnostic subgroups. The Spearman's rank correlation coefficients in different sleep disorders varied from 0.691 to 0.918 ($P \leq 0.001$ in all subgroups). Correlations for sleep efficiencies were also good and statistically significant. The correlation coefficients ranged from 0.371 to 0.665 ($p < 0.001$ to P = 0.047). The best correlation coefficients were achieved in subgroups with no organic sleep disorder and hypersomnia.

Conclusions: ACT is a useful tool for measuring sleep time and sleep efficiency in situations when multiple nights are needed (preceding Multiple sleep latency test, for example) or PSG is not available. However, the effectiveness of ACT in determining sleep seems to decrease in subjects with very low sleep efficiencies.

Disclosure: Nothing to disclose.

P101 | Results from an on-road driving performance study in non-elderly and elderly healthy subjects with dual orexin receptor antagonist lemborexant

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Objectives/Introduction: Sedating CNS-active drugs are typically studied for the potential to impair next-morning driving. Data from an on-road driving performance study are presented for lemborexant (LEM), a dual orexin receptor antagonist under development for insomnia disorder.

Methods: Randomized, double-blind, 4-period, incomplete cross-over design. Healthy subjects (n = 24 non-elderly, n = 24 elderly; 26M, 22F) received placebo (P), zopiclone 7.5mg (Z; positive control), and 2 of 3 LEM doses (2.5/5/10 mg). P and LEM were taken for 8 consecutive nights; Z was dosed on Night 1 and Night 8 with P on Nights 2–7. The standardized 1-hr on-road driving tests on Day 2 (D2) and Day 9 (D9) started ~9h post dose. Standard deviation of lateral position (SDLP in cm) was the primary endpoint.

Results: All 48 subjects completed the study. Assay sensitivity was demonstrated, as for Z vs P, the 95% CI upper bound was > 2.4 cm (standard threshold for impairment) at both D2 and D9. Additionally, mean SDLP for Z vs P and symmetry analyses of subjects with SDLP difference in Z vs P > 2.4cm vs < -2.4cm were statistically significant at D2 and D9 ($P< 0.01$). For each LEM dose vs P, the 95% CI upper bound was < 2.4 cm. No mean SDLP for LEM vs P was significant for any dose on D2 ($p > 0.05$) or D9 ($p > 0.05$). Symmetry analyses were not statistically significant for any LEM dose on D2 or D9 ($p > 0.05$). Results were similar in age and sex subgroups. No serious or severe adverse events (AEs) were reported. AEs of somnolence were reported more frequently after LEM 10 mg than LEM 2.5 and 5 mg administration.

Conclusions: As measured by SDLP and at the doses tested, lemborexant did not impair driving performance after either single (Day 2) or multiple (Day 9) dose administration. These results warrant continued testing of the efficacy and safety of LEM for the treatment of insomnia disorder.

Disclosure: This study was financially supported by Eisai, Inc. and Purdue Pharma LP. AV, EV, SJ, CVL, AVO, JR have nothing to disclose. PM, MM, CP are employees of Eisai Inc. KP is an employee of Eisai Ltd.

P102 | Custom-built electronic referral system for home oximetry studies

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Objectives/Introduction: Pulse oximetry is often used as an adjunct to clinical consultation in the diagnosis of obstructive sleep apnoea (OSA). It is a low cost, simple diagnostic test carried out in the patient's home, with a high sensitivity in the detection of OSA.

The Medical Physics Department at the James Cook University Hospital receives over 50 referrals per week for oximetry studies from clinicians throughout the region. Previously, referrals were received via a number of routes; telephone requests, letters, faxes and emails. This was inefficient and inaccurate; risking delays in referrals reaching the department, incorrect/incomplete referral data and the possible loss of referrals.

Create a paperless solution that reduces inefficiencies and improves data quality in the referral pathway.

Methods: We have created a Home Oximetry Study E-Referral System (the system) that streamlines the patient referral process into the Home Oximetry Service. The system has been custom designed and integrated with an existing MS Access database, which stores patient's overnight oximetry results electronically. Data are stored securely and comply with all relevant data protection regulations.

The web front end is integrated with the existing MS Access Database using a linked table, which allows the existing database to access the actioned referrals from the referral system. The system also utilises a MSSQL Database for admin authentication, system logging/auditing and email alerting.

Results: Since the implementation of the system, over 400 standardised referrals have been created. These referrals contain all essential data and are received electronically instantly, enabling a fully paperless workflow.

The system enables patient waiting times to be accurately determined and allows audit of the entire patient pathway, from initial referral to final report creation. The result is a reduction in delays in the patient pathway and higher quality data throughout.

Conclusions: We have created a Home Oximetry Study E-Referral System that streamlines the patient referral process into the Home Oximetry Service, enabling a paperless workflow, and ensuring that all referrals are of a sufficiently high standard to be processed. The system can be used to monitor patient delays and referral statistics, improving both service quality and patient experience.

Disclosure: Nothing to disclose.

P103 | Sleep prediction algorithm based on machine learning technology

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Objectives/Instruction: Clinicians believe that maladaptive sleep-related factors such as inactivity during daytime, excessive time spent in bed, poor exposure to light, and high stress level contribute development of chronic insomnia. However, there's paucity of evidences which factors are important to sleep. Moreover, traditional assessment methods cannot integrate sleep outcome with sleep-related factors by itself. We want to find relationship of sleep outcome with sleep-related factors including daytime activity, exposure to light, and stress-related index. Also, we tried to develop algorithm that can predict sleep quality by using machine learning technology.

Methods: Forty-six healthy participants (mean age 31.5, 47.8% male) were enrolled to our study. We measured their sleep and sleep-related factors by using actigraphy and heart rate sensor for two weeks. We used metabolic equivalent of task (MET), and sorted it as vigorous activity (MET≥6), moderate activity (3≤MET< 6), and light activity (MET< 3). Exposure to light was divided into outside light and inside light. For heart rate variability, we used pNN50. Alcohol and caffeine consumption were assessed by sleep diary. Daytime data was subdivided into 3 part: wake-up to noon (period 1), noon to 18:00 (period 2), and 18:00 to bedtime (period 3). The dependent variable of the analysis was sleep quality(sleep efficiency ≥90%). We performed logistic regression analysis which was optimized to maximize accuracy. For machine learning, we used multi-input one-dimensional convolutional neural network (1D-CNN) model.

Results: By ten times of optimized logistic regression, vigorous activity during period 1, total activity during period 1 and 2, exposure to light during period 1, and exposure to outside light during period 2 showed significant correlations with sleep quality. The effect of stress level on sleep quality was below significance level. Logistic regression's accuracy rate was 71.5% Machine learning algorithm acquired by 1D CNN model showed 73.2% of accuracy rate.

Conclusions: The results suggest that morning activity, especially vigorous activity, and exposure to any light in morning, and outside light during afternoon are important to sleep quality. The algorithm made by 1D-CNN model can predict sleep quality accurately which is comparable to the traditional logistic regression.

Disclosure: Nothing to disclose.

P104 | Comparison of automated methods for REM sleep without atonia detection

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Objectives/Introduction: REM sleep without atonia (RSWA) detection is a prerequisite for REM sleep behaviour disorder (RBD) diagnosis. Since current visual methods for RSWA detection are subjective and tedious, several automated methods have been proposed. This study aims to compare their accuracies in identifying RSWA and to analyse the influence of respiration and arousal-related movements in such accuracies.

Methods: In a cohort including 27 healthy control subjects (C), 25 Parkinson's disease (PD) patients without RBD (PD-RBD), 29 PD patients with RBD (PD+RBD), 29 idiopathic RBD patients and 36 patients with periodic limb movement disorder (PLMD), the following *indices* were calculated: The REM atonia index (RAI), the supra-threshold-REM-activity metric (STREAM), the Frandsen index (FRI), the short/long muscle activity indices (sMAI/lMAI) and the Kempfner index (KEI). The indices were calculated in various *cases*: 1) considering all muscle activities; 2) excluding the ones related to arousals; 3) excluding the ones during apnea events; 4) excluding the ones before and after apnea events; 5) combining cases 2 and 3; and 6) combining cases 2 and 4. In each case, each index was used to train and test a logistic regression model with 10-fold cross-validation scheme to calculate accuracies in the following *comparisons*:

1. (C, PD-RBD, PLMD) vs (PD+RBD, RBD);
2. C vs RBD;
3. PLMD vs RBD;
4. C vs PD-RBD;
5. C vs PLMD;
6. PD-RBD vs PD+RBD; and
7. C vs PLMD vs RBD.

Kruskal-Wallis tests were used to assess whether the accuracies for each index and comparison were varying significantly across the cases.

Results: The indices showed varying performances across cases and comparisons, making it impossible to identify one index as significantly better than the others. In all comparisons and cases, the average test accuracy of each index was lower than 80%. Moreover, apnea and arousal-related movements did not influence significantly the performance of the algorithms in group distinctions.

Conclusions: None of the automated method can be elected as *the optimal* one for RSWA detection and the accuracies suggest the need of improvements. Automated methods seem robust towards respiration and arousal-related movements.

Disclosure: Nothing to disclose.

P105 | Validation of a new data-driven method for identification of muscular activity in REM sleep behaviour disorder

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Objectives/Introduction: REM sleep behaviour disorder (RBD) is a parasomnia characterized by lack of atonia during REM sleep. Gold standard methods for RBD diagnosis require manual REM sleep without atonia (RSWA) scoring, which is time-consuming and subjective. We propose and validate a new data-driven algorithm and compare it to other automatic methods based on RSWA detection for identifying RBD patients.

Methods: We included 27 control subjects (C), 29 idiopathic RBD patients and 36 patients with periodic limb movement disorder (PLMD). After artefact removal, mean absolute amplitude values of 1-s windows of chin, tibialis left and right EMG signals during REM from 9 randomly selected controls were used to define a probabilistic model delineating atonia. For the remaining subjects, each 1-s window was labelled as *movement* if its probability of being atonia was lower than an optimized threshold. For each EMG signal, we calculated the percentages of 1-s windows with movements and the median intra-movement distance during REM and NREM. Using these indices, a classification algorithm was trained and tested (5-fold cross-validation) to distinguish the three subject groups. For comparison, the REM atonia index (RAI), Frandsen index (FRI) and Kempfner index (KEI) were calculated for the same cohort and an analogous classification algorithm was applied to each of them. The overall test accuracies, sensitivities and specificities for C, RBD and PLMD were calculated for each method.

Results: The following test performances were achieved (mean and standard deviation across the five folds in %): Overall accuracy: 79.58±9.16 (this work), 44.56±6.27 (RAI) 46.73±5.40 (FRI), 49.08±11.82 (KEI); RBD sensitivity: 81.67±17.08 (this work), 53.67±13.03 (RAI), 58.71±10.94 (FRI), 58.81±28.37 (KEI); RBD specificity: 83.98±5.09 (this method), 83.59±4.12 (RAI), 85.48±4.18 (FRI), 77.80±5.54 (KEI). Further, the proposed method achieved higher sensitivity and specificity for identifying C and PLMD than the other ones.

Conclusions: The proposed data-driven method outperforms other automatic methods in distinguishing C, RBD and PLMD subjects and is more sensitive for RBD detection. Compared to the other methods based only on RSWA detection, this method uses also NREM muscular activity to characterize patients groups. The obtained high performances thus confirm previous findings of increased NREM muscular activity in RBD patients.

Disclosure: Nothing to disclose.

P106 | Sleep disorders in *Praxeos medicae universae praecepta* by Joseph Frank (1771 - 1842)

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Objectives/Instruction: Joseph Frank (1771–1842) was a graduate of the University of Pavia, whose most famous teachers were Antonio Scarpa (1752–1832), Alessandro Volta (1745–1827), and his father Johann Peter Frank (1745–1821). J. Frank spent 20 years in Vilnius (1803–1823): he was Professor of Special Therapy and Clinical Medicine, an organiser, a reformer, a founder of clinics, institutes, and medical societies.

Methods: We analyzed descriptions and clinical cases presented in J. Frank's textbook *Praxeos medicae universae praecepta… continens doctrinam de morbis systematis nervosi in genere et de iis cerebri in specie* ("Practical Textbook of General Medicine… Containing Doctrine of Nervous System Diseases and the Special Diseases of Cerebrum"), written in Vilnius in Latin and published in 1818 in Leipzig.

Results: J. Frank analyzed the phenomena of hypersomnia (*cataphora*), insomnia (*agrypnia*), snoring (*rhonchus*), restlessness with or without limb movements (*jactatio*), leg cramps, hot flushes (*ardor*), night terrors (*pavor in somno*), nightmares (*somnia terrifica*), breathlessness with feeling pressure on the chest (*incubus*), somnambulism, catalepsy and other diseases described in his chapter devoted for the sleep disorders. The author analyzed the predisposing factors, causes and symptoms of the diseases, prognosis (for example, stated that snoring predisposes patients to apoplexy and headaches), and also discussed about treatment options, mentioning the importance of antiphlogistic methods (bloodletting, leeches, cupping therapy, laxatives, diuretics), stimulating drugs (camphor, aether), opium, animal magnetism and proper sleep hygiene (recommended diet, safe environment, gymnastics, fast walks, to avoid long sitting and sleeping during daytime).

Conclusions: J. Frank presented the most important sleep disorders in his textbook, devoted for nervous system diseases, and suggested using antiphlogistic methods for the treatment, based on humoral theories that were still very popular in the beginning of the nineteenth century in Vilnus and other European universities and clinics.

Disclosure: Nothing to disclose.

P107 | Measurement of daily sleep behaviour and symptomatology through self-report anamnesis questionnaire. A validation by means of sleep diaries

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Objectives/Instruction: Retrospective self-report questionnaires about sleep difficulties constitute a standard instrument for clinical routine even in patients with suspected obstructive sleep apnea (OSA). Nevertheless, the actual validity has been barely examined, yet. In particular findings related to sleep breathing disorders are rare, even though an increasing prevalence underlines the importance of a precise diagnostic. Furthermore, a sleep quality index could be able to provide easy access to further specific anamnesis. Hence, this study investigates whether a retrospective sleep anamnesis questionnaire and a sleep quality index are valid methods to measure sleep behaviour.

Methods: 326 patients (219 men, mean age of 58.8 ± 12.5 years) completed a sleep diary for fourteen days, followed by a retrospective sleep questionnaire. Stepwise multiple regression analyses were conducted to test if the questionnaire predicted the average sleep diary ratings: time in bed, sleep latency, restoration after sleep, daytime tiredness and concentration. A sleep quality index (SQI), generated by questionnaire items, was added to analyses as both single and additional predictor. Personal features like gender, age, body mass index and comorbidities were adjusted and used as comparative models. The significance threshold was set at .05, two-sided.

Results: Questionnaire items significantly predicted sleep diary measures (all $p < 0.001$). Together, these multivariable models explained 35–47% of the variance, which is significant more than the comparative models. The sleep quality was found to be a significant predictor of subjective sleep quality and all sleep parameters except time in bed (all $p < 0.001$). Furthermore, the additional SQI predicted feeling rested, daytime tiredness and concentration better than the given questionnaire items alone (all $p < 0.05$).

Conclusions: Results strongly indicate that sleep questionnaires are a valid method to measure daily sleeping behaviour and symptomatology. Therefore, an application by patients with OSA is well-funded. The SQI conveys deeper information about the patient′s daily conditions and subsecently permits an appraisal of the suffers as well as therapy′s urgency and necessary intensity.

Disclosure: Nothing to disclose.

P108 | Influence of daytime activity on hormone secretion in saliva after awakening in infants

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Objectives/Introduction: Appropriate sleeping time and ensuring sleep quality are essential for the development of children. Therefore, in this research, we aim to clarify the influence of daytime activity on the quality of sleep and salivary hormone levels of infants.

Methods: The subjects comprised 15 infants (3.4 ± 0.6 years of age) whose parents provided us with consent. Data from daily activity recorded by MTN-210. In addition, Heart rate (HR) during sleep was examined using data obtained by non-contact sheet sensor device.This study was approved by the ethics committee of Shiga University.

Results: HR during sleep gradually decreased with the passage of sleeping time regardless of the amount of activity during the day. However, HR in infants with high activity levels during the day (high activity group) tended to increase before awakening. In contrast, in infants with low activity levels (low activity group), no significant fluctuation was observed in HR, even close to the wake-up time. Furthermore, when subjects were classified into two groups based on differences in the amount of activity during the day, significantly increased HR before awakening was observed in the high activity group ($p < 0.05$). The salivary cortisol concentration tended to increase in both groups from immediately after awakening to 30 min after waking ($p = 0.06$). There was no significant difference in the salivary dehydroepiandrosterone (DHEA) response upon awakening. However, the DHEA response upon awakening was higher in the high activity group than in the low activity group ($p = 0.07$). Interestingly, it has been demonstrated that DHEA is related to the reactivity immediately after waking and quality of sleep in adults.

Conclusions: Adequate activity during the day leads to improved sleep efficiency and ensures high-quality sleep. This leads to a gradual increase in sympathetic nerve activity near the time of waking and a pleasant awakening. The present findings suggest that the above series of events lead to a sense of ‘sleeping well’. In general, it is known that ‘If you move frequently, you can sleep well’. However, the results of our study suggest that the aforementioned well-known axiom may even be applicable to infants.

Disclosure: Nothing to disclose.

P110 | Nodding off but can't disconnect: development and validation of the iNOD index of Nighttime Offline Distress

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Objectives/Instruction: Despite attracting widespread media and public attention, the link between social media use and sleep outcomes is based on evidence that relies heavily on single-item measures assessing frequency and duration of social media use, rather than understanding underlying emotional and cognitive drivers. However, recent research indicates that these factors – including emotional connection to social media and fear of missing out – are in fact stronger predictors of poor sleep outcomes than time spent using social media. This study responds to the need for a rigorously developed, validated measure that captures the extent of difficulty disengaging from social media at night, arising from these underlying cognitive and emotional drivers.

Methods: Using a data-driven approach, 31 original candidate items were developed based on thematic analysis of focus group data on drivers for bedtime social media engagement. 220 participants (aged 16–62) rated each candidate item from "not at all true of me" to "extremely true of me", and completed measures of social media engagement and sleep duration, timing and quality.

Results: Iterative exploratory factor analysis and reliability analyses produced a final 12-item measure (Cronbach's alpha = 0.94), with 3 subscales: Arousal, Obligation and Fear of Exclusion (alpha = 0.87, 0.90, 0.91, respectively). Higher scores on this final measure – the iNOD index of Nighttime Offline Distress - were associated with using social media for longer after intended bedtimes (r_s = 0.50, $p < 0.001$), poorer sleep quality (r_s = –0.25, $p < 0.05$), longer Shut Eye Latency (SEL; r_s = 0.26, $p < 0.05$) and later sleep onset (r_s = .35, $p < 0.001$). The iNOD outperformed existing measures in models of poor sleep quality, bedtime social media use and perceived sleep impact. Further validation in adult and adolescent samples is currently ongoing.

Conclusions: This study provides a validated 12-item self-report measure of difficulty disengaging from social media at night, which has high validity with bedtime social media behaviours and related sleep outcomes. This provides a data-driven tool for today's sleep researchers and practitioners wishing to move beyond simply measuring duration of social media use, to instead examine and understand core underlying issues.

Disclosure: Nothing to disclose.

P111 | Gentle rocking stimulation influences the regulation of sleep in poor sleepers

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Objectives/Introduction: We previously demonstrated that a gentle rocking motion (0.25Hz) can beneficially affect sleep in healthy volunteers (Bayer et al., 2011, Curr Biol 21, R461-2). More recently, we again showed that the same rocking stimulation administered continuously during a whole night shortened sleep latency and increased spindle activity, while it also increased time spent in deep sleep with fewer arousals, and improved declarative memory performance (submitted manuscript). Given these effects on sleep in good sleepers, here we asked whether a continuous rocking stimulation may benefit sleep in a population complaining of sleep difficulties.

Methods: We studied 12 poor sleepers (mean± SD age = 24.8 ± 3.7), i.e. with difficulties to fall asleep and/or maintain sleep at least 2 nights per week in the last 3 months (screened with questionnaires, actigraphy and clinical polysomnography). Each participant slept during two experimental nights in the rocking bed, which either remained in a stationary position or rocked gently at 0.25Hz. Whole night polysomnography included EEG (24 scalp electrodes), EOG, EMG, and ECG.

Results: There was a tendency for increased sleep efficiency (p = 0.06) mediated by a decrease in time spent awake during rocking night (p = 0.06). Participants also exhibited a tendency to better sleep maintenance as suggested by lower sleep fragmentation score (total number of awakenings and shifts to lighter stages/total sleep time; p = 0.09) and decrease in arousal density, more specifically during late NREM (i.e., second half of the night; p = 0.01). While there was no overall difference in delta and sigma power, rocking stimulation decreased EEG power within the high beta band (19-30 Hz) during NREM and REM, suggesting reduced cortical arousal.

Conclusions: The present findings suggest that a continuous low-frequency rhythmic rocking stimulation applied during a whole night of sleep beneficially influences the regulation of sleep in poor sleepers, while moderating the "hyper-aroused" state that characterizes patients with insomnia.

Disclosure: Nothing to disclose.

P112 | Bedside approach in the diagnosis obstructive sleep apnea using postprandial oximetry testing. Comparative study with polisomnography

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Objectives/Introduction: Obstructive sleep apnea (OSA) is associated with important morbidity and mortality that includes cardiovascular, metabolic, and neurocognitive impairment. Therefore, the early diagnosis of OSA is important. Polysomnography (PSG) is gold standard for OSA diagnosis. However, PSG has many difficulties, including access availability, requiring a specialized laboratory, and cost issues. To avoid challenges from PSG, there is a need for simpler tests for an initial assessment of the patients with suspected OSA, serving as a gatekeeper for PSG. The patients with OSA according to the Berlin questionnaire and Epworth sleepiness scale have been known to suffer from somnolence after meal or driving. Taking this fact into account, we introduced a bedside test in the patients with suspected OSA by using postprandial oximetry testing (POT).

Methods: This single center prospective study included 42 patients (32 patients with suspected OSA and 10 patients no symptom OSA). In POT, after at least a 7–8 h of awake period, the patients were admitted into PSG room. Then the patients ate lunch at 12.30 pm. After lunch, all the patients were monitored for 1 h with pulse oximetry and standard electroencephalographic system for sleeping documentation. The desaturation events (SpO2 drops below 90% and 90% in a postprandial oximetry recordings were accepted as indicative of moderate-to-severe OSAS. Above 90% SpO2 level and ≥4% lowest oxygen level/initial oxygen percent was defined indicative of mild OSA. Unaffected oxygen percent or < 4 lowest oxygen level/initial oxygen percent was accepted as normal. Finally, all of the patients were performed PSG testing for comparison. Exclusion criteria included known diagnosed OSA, diabetes mellitus.

Results: The mean age of the patients was 40.50 ± 7.06 (37 male, 5 female). The patient body mass index was 30.15± 6.21 kg/m^2. Their average homeostatic model assessment of insulin resistance (HOMA-IR) was 1.68 ±0.74. Positive correlation was found between POT and PSG-derived AHI (Cramer correlation 0.712, p< 0.001). The reliability for POT was 95%. Accuracy was 0.903 for POT.

Conclusions: POT may be useful as a bedside technique in the initial assessment of the patients with suspected OSA, serving as a gatekeeper for PSG.

Disclosure: Nothing to disclose.

P113 | Simulating sleep homeostasis in mice: effects of time of day and waking experience

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Objectives/Instruction: Sleep-wake history, time and lighting conditions influence sleep, but neither their relative contribution, nor the underlying mechanisms are fully understood. To investigate the impact of extrinsic factors on sleep homeostasis, we adapted for the first time an 'elaborated' version of the two-process model of sleep to mouse data. This model describes the interaction between a sleep/wake-dependent 'Process S' and a circadian 'Process C', and is used to predict electroencephalogram (EEG) slow-wave activity (SWA, 0.5–4Hz) during sleep. We hypothesised that the influence of extrinsic factors – such as time of day or wake behaviour – on sleep homeostasis would manifest in deviations between empirical SWA and model predictions.

Methods: We used undisturbed 48-h EEG recordings from adult male C57BL/6J mice; vigilance states were annotated in 4-s epochs. EEG electrodes were implanted in the occipital and frontal regions of the neocortex. To investigate the impact of waking behaviour on the performance of the model, 3 conditions were used: access to a regular-wheel (RW, n = 7) or a complex-wheel (CW, n=7) and exploratory wakefulness (EW, n = 7).

Results: Simulated SWA matched empirical levels well across conditions, throughout 24 h and within non-rapid eye movement sleep episodes. The model's performance was satisfactory across conditions, with neither waking experience (p = 0.904) nor light phase (p = 0.529) being found to have a significant influence on the fit between data and simulation. However, Process S declined during sleep consistently faster in the frontal than in the occipital derivation, as shown by decay rate values (Frontal: $9.6 \pm 0.7 \times 10^{-4}$ epoch^{-1}, Occipital: $6.4 \pm 1.3 \times 10^{-4}$ epoch^{-1}, p = 0.031, mean±SEM). The upper asymptote of Process S was also higher in the frontal area (Frontal: 469±25% mean SWA, Occipital: 270 ± 22% mean SWA, p = 0.016, mean ± SEM).

Conclusions: Our results support the notion of local sleep regulation, with regional inhomogeneity in the dissipation and build-up of sleep pressure across brain areas. The model's robustness to specific waking behaviours suggests that extrinsic factors do not strongly influence sleep homeostasis, despite their major role in shaping daily sleep-wake architecture. Finally, this modelling approach is a valuable tool to gain insights into sleep regulation in a novel mutant mouse line with striking sleep-wake and SWA patterns.

Disclosure: Nothing to disclose.

P114 | Signatures of the sleep and wake drives identified by comparison of electroencephalographic spectra obtained for different sleep and wake states and sub-states

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Objectives/Instruction: Circadian rhythmicity of sleep and wake states originates from the interaction between two competing regulatory processes, the sleep and wake drives. This interaction cannot be traced by pure measuring slow wave activity that is viewed as an electroencephalographic (EEG) indicator of only one of these drives. We previously suggested that the contributions of the sleep and wake drives to the EEG signal can be separated by scoring the 1st and 2nd principal components of the EEG power spectrum, respectively. Here we proposed another approach to calculation of a single measure (SM) of each of the drives.

Methods: In four experimental studies with, in total, 80 participants the EEG signals were recorded during night sleep, multiple naps, and sleep deprivation. Each differential spectrum (DS) was calculated as a difference between the EEG spectra obtained for two distinct sub-states within the continuum of sleep and wake states and sub-states. Such a DS provided a set of weights that were used to calculate one SM by summation of weighted spectral EEG power densities constituting each initial EEG spectrum. Each such initial EEG spectrum was replaced by the set of SM representing the corresponding set of DS for alert vs. sleepy sub-state of wake state, one vs. another conventional sleep stage, initial vs. final interval of the whole night sleep, higher vs. lower level of homeostatic sleep pressure during wake state, higher vs. lower intensity of the sleep debt payment process during sleep, etc. These sets of SM were subjected to principal component analysis.

Results: A high loading (>0.7) was shown by each SM on either 1st or 2nd principal component of variation in these measures. Such result suggested possibility to reduce all kinds of DS to only two general DS interpreted as the EEG signatures of the sleep and wake drives, respectively.

Conclusions: Research on regulation and dysregulation of the sleep-wake cycle can be facilitated by implication of the suggested approach to calculation of SM of the sleep and wake drives into quantitative evaluations and model-based simulations of the opponent regulatory processes underlying normal and abnormal alternations of sleep and wake states.

Disclosure: Nothing to disclose.

P115 | EEG connectivity measures wPLI and wSMI identify distinctive differences in brain functional interactions during wakefulness and sleep

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Objectives/Introduction: Functional connectivity measures represent a powerful tool to investigate brain inter-regional interactions in distinct behavioural states. We recently demonstrated that the weighted Phase Lag Index (wPLI) and the weighted Symbolic Mutual Information (wSMI), two connectivity measures that are relatively immune to volume-conduction, present a different sensitivity for linear and non-linear interaction dynamics, respectively. Here we investigated whether these two methods may unveil distinct functional differences between wakefulness and sleep, as well as across the distinct sleep stages.

Methods: Twelve healthy volunteers (25±4 years, 6F) participated in the study. All subjects underwent hd-EEG recordings (256 channels, 500Hz) during the night (11.30 PM-7 AM) and while awake in bed after sleep (8AM; 6 min, eyes-closed). After pre-processing, 70 2 s data segments (minimum common number across subjects and stages) were extracted from wake data (W) and from the first sleep epochs of stable N2, N3 and REM-sleep. For each electrode, the median connectivity between each pair of channels was computed in delta, sigma and gamma bands. Friedman tests were used to investigate stage-related effects, while signed-rank tests were used in post-hoc comparisons ($p < 0.05$, Bonferroni correction).

Results: Delta-wPLI was significantly increased in all sleep stages relative to W, whereas delta-wSMI was decreased in REM-sleep as compared to W and N2 ($p < 0.05$; $N = 12$). In sigma-band, wPLI was significantly higher in N2 relative to W, while wSMI was significantly higher in N2 and N3 relative to REM-sleep. Finally, gamma-wSMI was significantly lower in REM-sleep relative to N2 and N3, and in W relative to N3. No significant stage-effects were found for gamma-wPLI.

Conclusions: All sleep stages were characterized by a significant increase in linear dynamics within the delta range, likely due to the presence of travelling low-frequency oscillations. Sleep spindles may account for changes in sigma-connectivity specific to NREM sleep, while differences in high-frequency activity are consistent with previous work reporting the occurrence of hypercorrelated gamma activity in this stage. These results demonstrate that sleep is associated with both general and stage-specific changes in linear and non-linear brain dynamics. Their combined study may offer a valuable tool for assessing changes in level of consciousness under physiological and pathological conditions.

Disclosure: Nothing to disclose.

P116 | Quantitative modelling of the direct alerting effects of light

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Objectives/Introduction: Light affects alertness in two distinct ways: (i) via its effects on the circadian phase thus adjusting the daily rhythm in alertness, and (ii) as a stimulant, by directly increasing alertness during light exposure. Prediction of alertness would prove highly useful, especially under shiftwork and jetlag conditions where reduced alertness increases the risk of accidents. A number of models have succeeded in predicting the circadian rhythm of alertness. To date, however, none have accounted for the direct alerting effects of light. We have extended our model of arousal dynamics to incorporate the direct alerting effect of light and tested those predictions against experimental data.

Methods: Our model of arousal dynamics simulates the flip-flop switch between the sleep- and wake-active neuronal populations under the effects of the homeostatic and circadian drives. The phase of the circadian drive is adjusted by light according to the human phase- and dose-response curves. The model has been successful in prediction of subjective sleepiness and objective performance under acute sleep deprivation and forced desynchrony in dim light conditions. It has been proposed that the direct effects of light on alertness are regulated by the homeostatic rather than circadian mechanisms. Here this theory is tested computationally and an extended model is developed to incorporate the direct alerting effects of light.

Results: The model is tested against published experimental data from five laboratory studies investigating direct alerting effects of light (with 39 to 14 subjects). The model successfully reproduces the dose-response of subjective sleepiness to light exposure at night as well as the effects of bright vs. dim light exposure at different circadian phases on subjective sleepiness and objective performance. The model is further tested for compliance with previous results for sleep propensity and for alertness dynamics in dim light conditions. It is thus shown to perform well against data from twenty-two studies with protocols challenging prediction of alertness under different conditions.

Conclusions: A modified model of arousal dynamics is successful in reproducing the experimentally observed alerting effects of light and allows for testing of potential mechanisms.

Disclosure: Svetlana Postnova (SP) serves as a Theme Leader, Steven W Lockley (SWL) as a Program Leader, and Peter A Robinson (PAR) as a Chief Investigator in the Cooperative Research Center for Alertness, Safety, and Productivity. TT, SM, SWL, PAR and SP have no additional conflicts of interests related to the research or results reported in this paper.

P117 | Relationship between sleep structure of patients after ischemic stroke and daily measures

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Objectives/Introduction: We aim to identify specific sleep temporal profiles reflecting important physiological aspects of sleep of patients following an ischemic stroke.

Methods: We applied the developed probabilistic sleep model (PSM) to the polysomnographic data from 24 patients following an ischemic stroke. Subjects performed a battery of tests for assessment of attention, concentration, working memory and fine-motor activity and questionnaires scoring their subjective level of drowsiness, exhaustion and motivation before and after performing the tests.

The PSM represents the sleep process by posterior probability values of a finite set of sleep microstates. This representation can in turn be considered as a set of temporal curves and the methodology of functional data analysis can be applied. In the present work functional cluster analysis and time synchronization of curves is used for detecting groups of subjects with similar curve - profiles. Finally, the Kruskal-Wallis test is used for testing significant differences in daily measures between the formed clusters.

Results: Relationship between clustering structure and daily measures was found for several sleep microstates. Subjects with deeper sleep were observed to feel less drowsy or exhausted after performing the whole battery of tests and they were able to remember more digits in backward order (p-value 0.02) than their colleagues with low probability values for the deep sleep. On the other hand they showed higher reaction times (p-value 0.02).

In the case of the *Wake* stage and related sleep microstates the curves alignment led to inferior results in comparison to the clustering of original curves. Therefore, we hypothesize that the exact occurrence of the wake periods during the night are important factors establishing a stronger relationship between sleep and the investigated daily measures. Increased probability of sleep microstates similar to the *S1* stage was observed to improve performance in the Fine Motor Activity test (p-value 0.02). However, increased probability for sleep microstate laying on a border between stages *S1* and *S2* led to opposite results.

Conclusions: This preliminary study shows statistically significant relationships between the sleep structure of patients after stroke and daily measures. The PSM and functional data analysis are promising tools for the analysis of the sleep process.

Disclosure: This research was supported by the Slovak Research and Development Agency (grant number APVV-16-0202) and by the VEGA 2/0011/16 grant.

BREATHING DISORDERS 1

P118 | Soft cervical support in obstructive sleep apnea: a pilot study

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Objectives/Instruction: A soft cervical collar can limit antero-posterior flexion/extension of the head and backward motion of the mandible. Prior to a randomized controlled trial of a soft cervical collar to treat obstructive sleep apnea (OSA), our pilot study assessed 1) night tolerance of the soft cervical collar in patients with OSA; 2) alteration of pharyngeal patency with this support in OSA; 3) trial population size for conclusive results.

Methods: Among 78 consecutive subjects referred for suspicion of sleep apnea, 21 patients with severe OSA according to baseline nocturnal polygraphy were randomly assigned to second polygraphy either with no intervention (control group, n = 10) or wearing a soft cervical collar (intervention group, n = 11). Polygraphy data were compared and night collar tolerance was assessed with a questionnaire. Required trial population size was calculated using Cohen's d method.

Results: Fourteen men and seven women aged 53.9 ± 2.6, 33.8 ± 0.2 kg/m^2, were studied. Questionnaire showed that the collar was generally well tolerated by the patients. No polygraphy data were significantly different between the baseline and second recordings in each group, e.g., apnea-hypopnea index was 57.8 ± 5.5 vs. 52.4±7.2 (p = 0.40) in the control group and 54.2 ± 7.7 vs. 51.5 ± 7.6 (p = 0.47) in the intervention group. Data changes between the two recordings were the same in both groups. For conclusive effects according to the study design, trial population size was calculated at 246 patients equally distributed between both groups.

Conclusions: In our small-scale short-term randomized pilot study, a soft cervical collar was well tolerated and had no obvious effects on pharyngeal patency in patients with OSA. A larger-scale randomized controlled trial with conclusive results appeared feasible. On the other hand, beneficial effects of combination of a soft cervical collar with CPAP ventilation with a facial mask used to treat OSA in five patients have been recently published. It could reinforce the interest of further studies on cervical supports in patients with OSA.

Disclosure: Nothing to disclose.

P119 | Living obstructive, mixed and central apneas in the same epoch: an interesting OSAS case

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Objectives/Instruction: Sleep related breathing disorders consists of several different disorders, like obstructive sleep apnea, central sleep apnea and Cheyne-Stokes respiration. An apnea is the near to interruption or interruption of airflow for at least 10 second. Central apnea, obstructive apnea and mixed apnea are respiratory events used to diagnose sleep related respiratory disorders. An obstructive apnea is associated with evidence of ongoing breathing efforts throughout the event. However, the central apnea is associated with the absence of breathing efforts and the mixed apneas are associated with the absence of respiratory effort at the beginning of the event, followed by respiratory effort during the second part of the event.

Methods: A 68-year-old male patient. He applied to our clinic with complaints of snoring, witnessed apnea, excessive daytime sleepiness, gasping and choking in the sleep. The patient was diagnosed as having obstructive sleep apnea syndrome (OSAS) with electroencephalography (EEG), electrooculography (EOG), electrocardiography (ECG), chin and pretibial electromyography (EMG), oximeter, pulse transit time (PTT), oro-nasal airflow, snoring voice, pulse and body position recordings were taken with all night polysomnography. During the recording, the sleep technician was ready for the whole shooting.

Results: The duration of total recording was 392.3 minutes and sleep efficiency was 80.4%. The REM stage was detected as 13.8%. The duration of non-REM stage-1 sleep was 7.3%, stage-2 was 65.2% and stage-3 was 13.8%. 251 obstructive apnea, 50 mixed apnea, 33 central apnea and 334 apnea in total were detected. However, 40 hypopneas were scored. Apnea index was calculated as 78.0 h and apnea hypopnea index (AHI) as 87.5 h. The lowest oxygen desaturation value was measured as 64% and the oxygen desaturation index (ODI) was measured as 93.6 h. According to the International classification of sleep disorders-3 criteria, the patient was diagnosed with severe obstructive sleep apnea syndrome.

Conclusions: The aim of this case is to determine in the same epoch both obstructive, central and mixed apneas during the polysomnographic respiration scoring (Figure 1). This situation has made our case interesting. We hope that this screen will contribute to literature as a education patient.

Disclosure: Nothing to disclose.

P120 | Retinal vascular tortuosity in patients with obstructive sleep apnea-chronic obstructive pulmonary disease overlap syndrome

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Objectives/Instruction: Obstructive sleep apnea (OSA) and chronic obstructive pulmonary disease (COPD) are linked with microvascular changes. Retinal microvasculature can be examined in a direct noninvasive way.

The aim of this study was to evaluate tortuosity of the retinal vessels in patients with COPD, OSA, and overlap syndrome.

Methods: A total of 60 participants were included:15 patients with OSA,15 patients with COPD,15 patients with COPD-OSA overlap syndrome, and 15 matched controls. All participants underwent digital retinal photography, polysomnography, arterial blood gases, spirometry, Epworth sleepiness scale, and STOP-BANG questionnaire.

Results: Tortuosity of most retinal vessels was higher in all patient groups when compared with the control group ($p< 0.05$), and tortuosity was more marked in the overlap syndrome group ($p< 0.001$). There was a negative correlation ($-1< r >0$, $p< 0.05$) between tortuosity of retinal vessels and PO2, O2 saturation, and minimum O2 saturation, and a positive correlation ($0 < r >1$, $p< 0.05$) with PCO2, apnea hypopnea index, O2 desaturation index, BMI, and smoking index.

Conclusions: Retinal vascular tortuosity occurs in OSA, COPD, and overlap syndrome. Retinal vascular tortuosity is correlated with arterial blood gases parameters, polysomnographic findings, smoking index, and BMI.

Disclosure: Nothing to disclose.

P121 | Associational analysis between sleep-related variables and sleep positional difference of Apnea-Hypopnea Index in obstructive sleep apnea syndrome

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Objectives/Instruction: Obstructive sleep apneas are likely to increase more in supine position. But, it is known that apnea-hypopnea index (AHI) is not associated with sleep position time in obstructive sleep apnea syndrome (OSAS). This study investigated how sleep-related variables associate with positional difference of AHI in patients with OSAS.

Methods: A total of 313 men with OSAS were enrolled. Sleep positional difference of AHI (ΔAHI) was indicated that supine AHI (during supine position, sAHI) minus AHI. ΔAHI were partially correlated with the variables of demographic data, sleep structure, sleep position, sleep apnea, age and body mass index (BMI). Sleep position-related variables included supine position time(SPT), non-supine position time(NSPT), index of SPT(%; 100xSPT/sleep position time, ISPT) and transitional index (number of positional changes per hour). Subjects were divided into two groups by score 5 of ΔAHI. A group with a ΔAHI of 5 or more was Positional OSAS Group (PG-OSAS; $N = 135$), and a group with less than 5 was Non-Positional OSAS Group (NPG-OSAS; $N = 178$). Two groups were compared with above variables by independent-T test.

Results: sAHI was higher than AHI (42.06 vs. 34.11, $p< 0.001$). ΔAHI showed a very high correlation with sAHI ($r_p = 0.50$, $p< 0.001$). ISPT was most highly correlated with ΔAHI ($r_p= -0.64$, $p< 0.001$). Transition index showed a very high correlation with ΔAHI ($r_p = 0.31$, $p< 0.001$). PG-OSAS showed lower ISPT (58.16 vs. 86.31, $p< 0.001$), higher transitional index (3.27 vs. 1.82, $p< 0.001$), higher sAHI (52.84 vs. 33.88, $p< 0.001$), non-significant AHI (35.96 vs. 32.71, $p = 0.21$), lower snoring percentage (22.35 vs. 27.76, $p = 0.007$), and lower difference of NREM-REM sleep average oxygen saturation (0.09 vs. 1.02, $p = 0.000251$).

Conclusions: Sleep positional difference was significantly correlated with sAHI, but without AHI. It is suggested that both sAHI and AHI should be considered when analyzing the degree of sleep apnea in OSAS patients with larger portion of non-supine position time. The differences in NREM-REM sleep average oxygen saturation and ISPT were significantly greater than in the group with lower ΔAHI. This may mean that the group with higher ΔAHI is more likely to take a non-supine position to prevent severe hypoxia during REM sleep.

Disclosure: This study was supported by research fund of Seoul Konkuk University Medical Center.

P122 | The distributions and importance of respiratory events in the patients with severe Obstructive Sleep Apnea (OSA)

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Objectives/Instruction: The apnea hypopnea index that means predominantly obstructive respiratory events per hour of sleep during a PSG in the diagnostic criteria of obstructive sleep apnea is used. However, in this definition, the effects of the excess of the patient′s apnea or hypopnea on the current OSA and OSA results are unknown.

Methods: We retrospectively reviewed the files and polysomnography records of 81 (70 M/11 F) severe OSA patients who underwent polysomnography. Patients were divided into two groups as the total apnea numbers> the total hypopnea numbers (group 1),

the total hypopnea numbers > the numbers of total apnea (group 2). We compared comorbidities, and polysomnographic findings of the patients.

Results: There were 71 patients (10F/61 M) in group 1 and 10 patients (1F/9 M) in group 2. The mean age of the patients was higher in group 2 (p = 0.031). There was no difference in gender distribution (p = 0.592). Although, there were no statistically significant difference in terms of sleep architecture between two groups, the sleep efficiency is lower in the group 2 (p = 0.01) and the WASO is lower in the group 1 (p = 0.01). In the group 1, the total AHI (p = 0.025) was higher. And, the mean apnea duration were higher in NREM stages of the patients with group 1 (p = 0.012). While the mean hypopnea number was higher in the group 2 (p< 0.01), there were no difference in terms of the mean hypopnea duration both NREM and REM sleep stages (p; 0.708 0.785, respectively) between the two groups. The total ODI was higher in the group 1 (p = 0.029), there were no statistically significant difference in terms of average oxygen saturation, minimum Sp02, and % of nocturnal oxygen desaturation (p; 0.669, 0.272, 0.193, respectively) between two groups. Despite the shortcomings in the file information, the additional disease (15 patients) in the group 1 was significantly higher than that in the group 2 (5 patients).

Conclusions: Our study showed that patients with apnea dominat OSA had a heavier OSA and had more comorbidities at an earlier age, although the distribution of patients was not equal.

Disclosure: Nothing to disclose.

P123 | Polysomnography and clinical characteristics of patients presenting to a single sleep referral clinic: a study on 1248 patients over 6 years

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Objectives/Instruction: Sleep disordered breathing (SDB) disorders are a major cause of morbidity and mortality. We studied clinical characteristics and Polysomnography (PSG) correlation of SDB in patients referred to our sleep clinic. There has been no single very large study in Asia correlating the clinical features with PSG findings in patients of SDB. We also wanted to see if these characteristics differed in our overseas patients from African continent who visit our institution for medical reasons compared to our Indian patients.

Methods: 1248 patients analysed who presented to our referral sleep clinic from June 2012 to March 2018. Mallampatti (MPT) and Epworth Sleepiness Scale (ESS) were scored. PSG's were scored manually and revalidated by a single sleep specialist. Gender, BMI, ESS, MPT, snoring pattern, AHI, oxygen desaturation, arousal index and arrhythmias were recorded and analysed. Demographic and PSG differences in Indian and African patients were also studied.

Results: 1248 patients were studied. Mean BMI was 31.62. Mean ESS score was 11.38. Mean Arousal index was 49.26. Postural relation was present in 250 (20%) patients of OSA. Atrial fibrillation (AF) was present in only 5 (0.5%) patients of OSA. 1021 (81.8%) patients had OSA alone. 227 (18.1%) had upper airway resistance syndrome (UARS) with OSA. Twenty six (2.0%) had UARS only. Three had narcolepsy. Six had complex sleep apnoea. Two had mixed apnoea. 6 had primary snoring. One (0.2%) patient had Idiopathic hypersomnia. Four (0.3%) had sleep onset and maintenance insomnia without respiratory disturbance. Only 5 (0.4%) had normal study. AHI of > 30/hr was found in 48% of Africans vs 58% of Indians. SWS was very short to absent in 49% and protective in 23% of Africans vs 34% and 29% of Indians respectively.

Conclusions: Almost 58% SDB patients had severe OSA and almost 33.41% of all SDB patients had an AHI >60/hr. AF in our series is very uncommon present in only 0.5% patients of SDB. Indians had relatively higher OSA severity than African patients with matched BMI. Also MPT and ESS were significantly higher among Indians compared to their African counterparts.

Disclosure: Nothing to disclose.

P124 | Supine and non supine obstructive sleep apnoea syndrome (OSAS): comparison between gender, Body Mass Index (BMI), and OSAS severity

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Objectives/Instruction: In our sleep centre, we have noticed increasing number of predominantly non supine OSA. This study aims to determine the comparison between Supine and Non-Supine OSAS in relation to gender, BMI and Severity of OSA.

Methods: The polysomnography studies (PSGs) of patients referred to our sleep centre, from 2016 up to the second quarter of 2017, were retrospectively reviewed. All patients with AHI >/= 5 per hour were included. All patients were investigated with full PSG. Respiratory events were defined as hypopnoea or apnoea. We classified OSAS between Supine and Non Supine, gathered and compared their gender, BMI and OSAS severity.

Results: 210 patients were included in the study. 148 patients have supine OSAS while 62 patients have Non-Supine OSAS. Of the 148 predominantly supine OSAS patients, 61% were male and 39% were female. The average BMI of this group is 31.4, and 89% have a BMI >25. In this group 46% were classified as severe OSAS. Of the 62 predominantly Non-Supine OSAS patients, 63% were male and 37% were female. The average BMI of this group is 33.6, and 92% have a BMI of >25. In this group 53% were classified as mild OSAS.

Conclusions: Presently, we found no difference between gender and BMI in both supine and non-supine OSAS; there were however, more severe cases of OSAS in the supine population than in non supine population.

Disclosure: Nothing to disclose.

P125 | An indigenous device to detect lung and sleep disorders using labview

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Objectives/Instruction: The pressure of exhaled breath is detected through a pressure sensor and the flow rate is calculated from differential pressure using Bernoulli′s formula. Pulmonary disorders directly affect the sleep of a patient because of variation in oxygen circulation. This device also detects the various sleep modes of the patient using the number of breaths taken per minute. Detection of sleep modes helps a physician to treat the snoring problems faced by a patient. The design and implementation involved NI DAQ 6009 and LabVIEW 2016 software for processing.This is a low-cost respiratory monitor to address this issue.

Methods: The thermistor and pressure sensor are placed inside the nebulizer mask.Temperature is detected by the thermistor in mill volts and then converted into degree Celsius. The indication of degree Celsius is connected to comparison blocks where temperatures for various respiratory diseases are compared to check whether any correlation occurs. Since the pressure sensor gives the output in terms of differential pressure it can be used to find the flow rate of exhaled air by Bernoulli's formula. The output is compared with the values fed in the comparison block to find the presence of disease.

Results: The number of breaths calculated per minute in this loop is used to detect whether the patient is in NREM sleep or in REM sleep. It is also used to detect the presence of disease by comparison with the values in the blocks.The output of the pressure sensor is in a volt which is then converted into cmH_2O. The obtained values are fed into the comparison blocks to check whether the pressure value correlates with any of the pressure values indicating the presence of disease.

Conclusions: This respiratory monitor can be useful for obtaining respiratory rate and for detecting sleep abnormalities. With the known fact that temperature, pressure and flow rate of exhaled air increases or decreases with ailing respiratory system, this project is done. From the values of the exhaled air it is also possible to detect the presence or absence of other lung disorders, since those conditions have increased exhaled air temperature, pressure and flow rate.

Disclosure: Nothing to disclose.

P126 | Comparing the efficacy of Uvulopalatopharyngoplasty (UPPP) with Modified Radiofrequency Tissue Ablation (MRFTA) in mild to moderate Obstructive Sleep Apnea

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Objectives/Instruction: The aim of this study was to compare the efficacy of Modified Radiofrequency Tissue Ablation (MRFTA) with Uvulopalatopharyngoplasty (UPPP) based on both subjective and objective outcome measures in mild to moderate Obstructive Sleep Apnea (OSA) patients.

Methods: Forty patients with mild to moderate OSA were randomly divided into UPPP and MRFTA groups. Apnea Hypopnea Index (AHI), Sleep Apnea Quality of Life Index (SAQLI) and Epworth Sleepiness Scale (ESS), were evaluated immediately before the surgery and 6 months postoperatively.

Results: The postoperative AHI scores were improved significantly in both groups, although the postoperative AHI in UPPP group was significantly lower than MRFTA group (p value = 0.02). The difference between success rates for moderate OSA in UPPP and MRFTA was significant (77% vs. 30%, p value = 0.03) but there was no significant difference between success rates for mild OSA in UPPP and MRFTA groups (70% vs. 50%, p value = 0.36). Comparing postoperative ESS scores in two groups showed no significant difference (p value = 0.24). The post operative scores in social interaction, treatment related symptoms domain and SAQLI total score were significantly higher in MRFTA group.

Conclusions: MRFTA as well as UPPP can greatly improve daytime sleepiness and AHI, especially in patients with mild OSA. MRFTA proved to be more effective than UPPP to enhance quality of life of patients with OSA. Further studies with longer follow-up are required to evaluate long-term safety and efficacy of these procedures.

Disclosure: Nothing to disclose.

P127 | Obesity hypoventilation syndrome and neurocognitive function - impact of positive airway pressure therapy

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Objectives/Instruction: We investigated neurocognitive function, anxiety and depression in stable obesity hypoventilation syndrome (OHS) patients compared with obstructive sleep apnoea (OSA) patients, at baseline and after 3 months of positive airway pressure

(PAP) therapy. It was hypothesised that there will be limited improvements post PAP in the OHS cohort due to poorly reversible brain injury.

Methods: OHS patients with a BMI >40 kg/m^2 and spirometric ratio > 0.7, and OSA patients with an AHI >20 events/hour were recruited. Patients underwent a PAP titration and review study at baseline and after 3 months of PAP therapy respectively, with neurocognitive tests including psychomotor vigilance test (primary outcome: PVT slowest 10% of the reciprocal reaction time) and Stroop tests, depression and anxiety questionnaires, functional outcomes of sleep questionnaires and Epworth sleepiness scale scores performed in the evening of both sleep studies.

Results: Thirty-six patients with OSA (mean partial pressure of carbon dioxide, PCO2 = 42mmHg, duration of oxygen saturation < 90%, TST< 90% = 140 mins, daytime oxygen saturation, SaO2=96%) and 15 patients with OHS (mean PCO2 = 51 mmHg, TST< 90% =308 mins, SaO2 = 92%) were recruited. Post-PAP pCO2 was 43 mmHg in the OHS group. In the majority of neurocognitive tests, including the primary outcome, there were no significant differences within or between OSA and OHS groups, at baseline and post PAP therapy, and neither group improved with PAP. Anxiety and depression scores and ESS improved in both groups post PAP therapy ($p < 0.05$), but no differences were found between groups. A higher % slow wave sleep was also observed at 3 month post PAP therapy in the OHS cohort (31 vs. 22%; $p < 0.05$) compared with OSA patients.

Conclusions: In summary, no significant neurocognitive function differences were observed between groups after 3 months of PAP therapy despite improvements in gas exchange, mood and sleepiness.

Disclosure: Nothing to disclose.

P128 | Sleep apnea patients with high and low sleepiness response: clinical and polysomnographical differences

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Objectives/Introduction: Sleepiness response is the intensity of the daytime sleepiness associated to the severity of sleep apnea. The objective of the present study is to determine clinical and polysomnographic differences between patients with high and low sleepiness response.

Methods: In order to measure sleepiness response, we used a ratio between Epworth Sleepiness Scale scores and apnea/hypopnea index. All patients were submitted to polysomnography and clinical interview. Forty-eight patients, 27 females and 21 males, aging 22-79 years with apnea/hypopnea index (AHI) ≥5 were included. A ratio between Epworth Sleepiness Scale score and apnea/hypopnea index (E/A ratio) was calculated for each patient in order to assess the sleepiness response to the respiratory disturbance. The sample was divided in two E/A ratio groups: Lower E/A ratio group, below 50th percentile (< 0.32) and higher E/A ratio group, above 50th percentile (≥ 0.32). Differences between both groups were assessed by *t*-tests for independent samples.

Results: The lower E/A ratio group presented shorter slow-wave sleep duration ($p< 0.05$) and lower slow-wave sleep percentage ($p< 0.01$). Patients in the lower E/A ratio group were older ($p< 0.05$) and had higher AHI ($p< 0.01$).

Conclusions: Lower sleepiness response was associated to older age and shorter slow-wave sleep duration. Lower sleepiness response may be associated to a decreased homeostatic process in older patients with sleep apnea syndrome.

Disclosure: Nothing to disclose.

P129 | Effects of a weight-loss Mediterranean lifestyle intervention on obstructive sleep apnea: preliminary results of a randomized controlled clinical trial

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Objectives/Instruction: Continuous positive airway pressure (CPAP) is currently the first-line treatment for obstructive sleep apnea (OSA) and is prescribed alone as standard care in the vast majority of patients. Given that obesity is a well-established risk factor for OSA, weight loss through lifestyle changes has also emerged as an important therapeutic approach for overweight patients. The aim of the present study was to explore whether a weight-loss Mediterranean lifestyle intervention (MLI) combined with CPAP is superior in the management of OSA, compared to CPAP alone.

Methods: Participants were 108 adult overweight patients [79% men, mean age: 47±10 years, mean body mass index (BMI): 35.9±6.2 kg/m^2] with polysomnography-diagnosed moderate-to-severe OSA [mean apnea-hypopnea index (AHI): 59.6±31.6 events/h]. Patients were randomized to either a standard care group (SCG, n = 54) or a MLI group (MLIG, n = 54). Patients in SCG received CPAP and general written lifestyle advice, while those in MLIG participated in an intensive 6-month lifestyle intervention, in addition to CPAP, aiming at a 5–10% weight loss and an increase in the level of adherence to the Mediterranean lifestyle (compliance to the Mediterranean diet, increased physical activity and optimal sleep habits). Patients were evaluated pre- and post-intervention with regard to polysomnographic data, OSA symptomatology, anthropometric indices and lifestyle habits. Per protocol analysis was implemented.

Results: The two groups did not differ in anthropometric, lifestyle or clinical parameters at baseline. Drop-out rates were 24.1% for MLIG and 31.5% for SCG. Following intervention, weight and BMI were lower, while the level of adherence to the Mediterranean diet, physical activity and daily sleep duration were higher in MLIG, compared to SCG (all P_between_groups < 0.05). The AHI decreased by 3.7 events/h in SCG (P_within_group = 0.3) and by 31.2 events/h in MLG (P_within_group < 0.001), and the difference between groups was statistically significant even after adjusting for baseline AHI, weight change and adherence to CPAP (P_between_groups = 0.003). Both groups experienced significant reductions in daytime sleepiness and degree of insomnia (P_within_groups < 0.05); however, reductions were greater in MLIG (P_between_groups < 0.001).

Conclusions: A weight-loss MLI combined with CPAP offers significant additional improvements in OSA severity and symptomatology, compared to CPAP alone.

Disclosure: Nothing to disclose.

P130 | Associations of obstructive sleep apnea (OSA) and hypoxemia with heart rate variability in a population-based sample of men

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Objectives/Instruction: Autonomic dysfunction may result from OSA-related hypoxemia and arousals but population-based studies are scarce. The aim of this study was to determine the relationship of a measure of autonomic function, nocturnal heart rate variability (HRV), with OSA metrics, in a population-based sample of men.

Methods: In the population-based Men Androgen Inflammation Lifestyle Environment and Stress (MAILES) Study of men ≥ 40 year, HRV measures (SDNN, standard deviation of normal-to-normal RR-intervals; RMSSD, root mean-square of successive differences of N-N intervals) were calculated from the ECG channel during periods free from scored respiratory events or arousals from home-based full unattended polysomnography (Embletta ×100). To compute respiratory sinus arrhythmia (RSA), inspiratory onsets were automatically detected from RIP signals to obtain the magnitude of phase-averaged RR modulation. Linear regression models determined associations of sleep metrics with HRV/HR adjusted for age, BMI, blood pressure, smoking and insomnia. Unstandardised B coefficients (SE) are presented.

Results: OSA was present in *n* = 443 (53%), with moderate OSA in 14% and severe in 12%. Valid HRV measures were available on 761 men during non-rapid eye movement (NREM) sleep and 671 men during REM sleep. In NREM sleep, apnea hypopnea index (AHI) was significantly associated with increasing mean heart rate [HR: 0.05 (0.02), $p = 0.036$]. Oxygen desaturation index [-0.14 (0.07), $p = 0.032$] and percentage total sleep time with $SaO_2 < 90\%$ [−0.2 (0.1), $p = 0.014$] were associated with decreasing SDNN and with increasing mean HR (all $p < 0.001$). In REM sleep, AHI was significantly associated with increasing mean RSA [0.1 (0.05) $p = 0.036$] and hypoxemia metrics were associated with increasing mean HR ($p < 0.01$). No associations were seen with RMSSD.

Conclusions: In a community dwelling sample of middle aged and older men, during NREM sleep, AHI showed inconsistent associations with HRV. Direct measures of nocturnal hypoxemia were modestly associated with lower overall HRV that may contribute to increased cardiovascular risk in OSA. Increasing OSA severity by any metric was generally associated with increasing heart rate across both NREM and REM sleep.

Disclosure: Nothing to disclose.

P131 | Improved CPAP compliance with pillow height change: a case report

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Objectives/Instruction: Continuous positive airway pressure (CPAP) is the most effective treatment for the obstructive sleep apnea (OSA). CPAP adherence is main issue of successful treatment. The high CPAP is a major cause for patients to suffer from various reasons and to reduce the rate of CPAP adherence

Methods: This patient was a 32-year-old female who had been recognized snoring since severe years ago. She had been diagnosed with impaired glucose tolerance and hypertension for the past two years. To manage medial problems, she decided to visit sleep clinic. Her BMI was 46.02 Kg/m^2. Apnea Hypopnea idex (AHI) was 60.5/hr that is severe OSA. She had CPAP treatment and optimal pressure for 2 weeks was reported to 14 cmH_2O. She appealed discomfort of air leak and had trouble with high pressure phobia. In order to reduce the pressure, we proposed to vary the pillow height. At the first step, the height of the pillow was 11.5 cm, and the height of the cervical vertebral when the pillow was 4.5 cm. At the first trial, residual AHI was 4.3/hr and pressure of CPAP was 14 cmH_2O. At the next step, the height of the pillow was 8cm, and the height of the cervical vertebral when the pillow was 2 cm. At the second trial, residual AHI was 3.9/hr and pressure of CPAP was 13 cmH_2O. The pressure was reduced by only 1cmH2O, but she showed a better adaptation to the use of CPAP.

Results: Pillow is valuable factor to increasing CPAP adherence especially for with severe OSA. By lowering the height of the pillow, the position of the head is changed to a form that broadens the airway.

Conclusions: If the patient have difficulty using CPAP, it is important to consider the height of the pillow.

Disclosure: Nothing to disclose.

P132 | The reconstruction of upper airway after velopharyngeal surgery in obstructive sleep apnea patients

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Objectives/Instruction: To analyze the upper airway anatomical changes and its influence factors after velopharyngeal surgery in obstructive sleep apnea (OSA) patients, explore the relationships between the reconstruction of upper airway and treatment outcomes.

Methods: Forty-seven OSA patients underwent velopharyngeal surgery including revised uvulopalatopharyngoplasty with uvula preservation and transpalatal advancement pharyngoplasty was included. Pre- and postoperative upper airway 3-dimensional computed tomography and polysomnographical parameters were obtained. We conducted an analysis on changes of upper airway anatomical parameters and its influence factors.

Results: The overall apnea hypopnea index (AHI) decreased from 54.2±20.8times/h preoperatively to 21.4 ± 16.1 times/h postoperatively ($p< 0.001$). The VmCSA, VmLAT, GmCSA and GmLAT significantly increased and mAP of the glossopharynx significantly decrease after surgery. The LAT/AP ratio was significantly increased after surgery, from 1.8 to 2.5 velopharynx ($p = 0.004$) and from 1.1 to 2.3 in glossopharynx ($p<0.001$), respectively. Preoperative AHI ($r = –0.390$, $p = 0.007$), AHTI ($r =–0.387$, $p = 0.008$) and GmAP ($r = –0.529$, $p<0.001$) have significant correlation with the change in GmAP and only AHTI was independent predictor of the change in GmAP ($p =0.019$, $R_2 = 0.123$). Changes in mCSA of the velopharynx (VmCSA) was the only significantly different anatomical parameters between responders and nonresponders.

Conclusions: Velopharyngeal surgery can effectively change the lumen dimensions not only in velopharynx but also in glossopharynx and change the shape of upper airway in depth. The reconstruction of upper airway was thought to make the upper airway tend to be more stable.

Disclosure: Nothing to disclose.

P133 | Correlations between sleep parameters and inflammatory and oxidative stress biomarkers in patients with obstructive sleep apnoea

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Objectives/Instruction: Obstructive sleep apnoea (OSA) not only is considered a respiratory disorder, but also a significant cause of morbidity and mortality due to its close relationship with obesity and cardiometabolic complications. Inflammation and oxidative stress may be involved in OSA pathogenesis. The aim of this study was to investigate potential associations between sleep parameters and several reliable inflammatory and oxidative stress biomarkers in patients with OSA.

Methods: Participants were 199 adult Greek patients with OSA (145 males, aged 25-70 years, mean body mass index: 35.4 ± 6.4 kg/m^2). Polysomnography was performed to evaluate the presence and the severity of OSA as indexed by the apnoea-hypopnea index (AHI; mean value: 53.1±33.0 events/h). Circulating adiponectin, tumor necrosis factor-a (TNF-a), and high-sensitivity C-reactive protein (hsCRP) levels were measured in fasting serum samples, while 8-iso-prostane (a marker for lipid peroxidation) and 8-OH guanosine (a marker of oxidative DNA damage) were measured in first morning urine samples. Spearman correlation analysis was used to evaluate the associations between biomarkers and sleep parameters. Mann-Whitney U test was used to test differences between patients with severe and mild/moderate OSA.

Results: Serum adiponectin concentrations showed a statistically significant negative correlation with AHI, (rho = –0.25, $p < 0.001$), oxygen desaturation index (rho=–0.22, $p = 0.004$), AHI in REM sleep (rho=–0.21, $p = 0.02$), and AHI in non-REM sleep (rho = –0.26, $p = 0.001$), while a positive correlation was observed between serum hsCRP and the above sleep parameters (rho = 0.27, 0.32, 0.28 and 0.26, respectively, all $p \leq 0.001$). Moreover, compared to patients with mild/moderate OSA ($5 \leq$AHI < 30 events/h, $n = 64$), patients with severe OSA (AHI$\geq$30 events/h, $n = 135$) exhibited lower serum adiponectin levels [median (IQR): 3.4 (2.2-4.9) vs. 4.9 (2.6-7.1) μg/mL, $p = 0.001$) and higher hsCRP levels [3.4 (1.4-5.9) vs. 2.1 (0.9-3.8) mg/dL, $p = 0.003$). In contrast, no significant differences between the two groups were observed for serum TNF-a [3.2 (2.3-4.2) vs. 3.1 (1.9-4.4) pg/mL, $p = 0.54$), and in creatinine corrected urinary 8-iso-prostane and 8-OH guanosine levels [0.5 (0.3–1.2) vs. 0.4 (0.3–0.9) ng/mg, $p = 0.18$ and 65 (43–104) vs. 66 (49–93) ng/mg, $p = 0.63$, respectively).

Conclusions: Our findings confirm the involvement of inflammation in OSA pathogenesis and suggest that circulating adiponectin and hsCRP levels may be predictive markers for disease severity.

Disclosure: Nothing to disclose.

P134 | Nicotine dependence in patients with Obstructive Sleep Apnea Syndrome

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Objectives/Instruction: Smoking is highly prevalent in patients with Obstructive Sleep Apnea Syndrome (OSAS) and may act as a risk factor for developing OSAS. Studies have revealed that OSAS might be responsible for nicotine addiction.

Objectives: To evaluate if there are differences in nicotine dependence measured with Fagerstrom Test for Nicotine Dependence (FTND) between different severity groups of OSAS (i.e. no, mild, moderate, severe).

Methods: Patients visiting a Sleep Clinic were prospectively studied. They completed FTND, Epworth Sleepiness Scale (ESS), Stop Bang (SB) and Athens Insomnia Scale (AIS). Sleep studies were performed.

Results: SPSS version 17.0 was used for the statistical analysis. Analysis of variance (ANOVA) was used for the analysis of the differences between group means and Pearson correlation coefficient (for normally distributed) and Spearman correlation (for non-normally distributed data) to evaluate significant correlations between different variables. Tests were two-tailed and $p < 0.05$ was accepted as statistically significant. In the study, 383 smokers (mean age: 48.56±12 years, 69.2% male) were involved with FTND 5.23±2.83. From them, 26.1% did not suffer from OSAS, 14.5% suffered from mild, 21.6% from moderate and 37.8% from severe (mean AHI:27.5 ± 26.2). The mean pack/years (p/y) was 35.4 ± 28.8 with 23.45±14.13 cigarettes/day. ESS was 8.99 ± 4.67, SB: 4.04 ± 1.45, AIS: 8.4 ± 5.25. Neither the FTND nor each of the questions of the FTND presented statistically significant differences between the different OSAS severity groups. The only significant difference found was between p/y and cigarettes per day especially between no, mild and severe OSAS ($p < 0.05$). There was a strong correlation between AHI and p/y ($p < 0.001$), AHI and cigarettes per day ($p < 0.001$), ESS and p/y ($p < 0.001$), ESS and cigarettes per day ($p < 0.002$), AIS and FTND ($p = 0.002$).

Conclusions: Nicotine dependence measured by FTND did not differ between OSAS severity groups; significant correlations were found between AHI and ESS with p/y and cigarettes per day.

Disclosure: Nothing to disclose.

P135 | High risk and low treatment response in obstructive sleep apnea: a real-world study in office occupational population

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Objectives/Introduction: To investigate the prevalence and the treatment response of OSA among office occupational population to provide the basis for medical management decision.

Methods: Using cluster sampling, we conducted a cross-sectional survey in office occupational population. The Berlin Questionnaire was used to screening for high-risk patients and home sleep test to diagnose. For all diagnosed patients, we carry out an active intervention by CPAP and regular follow-up to determine their treatment response.

Results: For all 1241 adults, a total of 1036 subjects completed valid questionnaire and were included. The average age was 40.6 ± 0.3 years. 22.0% subjects with positive result of Berlin Questionnaire was regarded as high-risk OSA. The related factors of high-risk OSA were age, BMI, neck circumference, waist circumference, hip circumference, pharynx morphology, ESS score, insomnia, anxiety, depression, smoking, and drinking (p all < 0.05). Among 228 high-risk OSA subjects, 75 rejected home sleep test and there left 154 completed. Results showed an OSA morbidity of 65.6% in high-risk subjects. The related factors of OSA were gender, age, BMI, neck circumference, waist circumference, pharynx morphology, middle-age drinking (p all < 0.05). The prevalence of OSA was estimated as 10.5%. The OSA awareness survey showed 99.1% of the high-risk population has never been diagnosed. In high-risk population the score of OSA patients in energy/fatigue ($p = 0.021$) and emotional well-being ($p = 0.049$) was higher than non-OSA subjects. It may be associated with an excessive exaggeration of their symptoms due to mental problems in the screening of OSA, resulting in a positive questionnaire. Free Auto-CPAP treatment was given to all OSA patients. Among them 46 subjects didn't receive initial treatment, The primary reasons for rejection were self-behavior intervention, and self-concept of non-requirement. 54.4% patients received initial treatment. After 1-week, 32.7% patients gave up, the main reasons for giving up were nasal discomfort, insomnia, and suffocating feeling.

Conclusions: High risk, high prevalence, and low rate of diagnosis and treatment for OSA were existed in office occupational population. It should be emphasized to diagnose and manage OSA patients in office occupational population.

Disclosure: Nothing to disclose.

P136 | Derived arterial stiffness in OSAS with persistent sleepiness on CPAP and periodic limb movement

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Objectives/Introduction: Untreated obstructive sleep apnea (OSAS) is associated with increased arterial stiffness and increased cardiovascular risk. The effect of the CPAP in improving the derived arterial stiffness, in sleep apnea patients is well documented.
We aimed in this work to assess the derived arterial stiffness in patients who were still sleepy on CPAP and developed PLMs.

Methods: In a tertiary sleep disorders center at Guy's and St Thomas Hospital, patients who had OSAS diagnosed by polysomnography, complained of persistent sleepiness on CPAP and developed increased PLMs index on follow up polysomnography were included. Measurement of the arterial stiffness index was done through the index of large artery stiffness derived from the digital volume pulse (SIDVP). SIDVP was derived from the raw data of photoplethysmography of the nocturnal polysomnography. The measurement was averaged for 2 min prior to sleep initiation (baseline), on completion in the morning.

Results: 12 patients were included. 9(75%) of patients were males. Average calculated CPAP use was 6.024 ± 1.335 hr/night. No significant difference in the BMI, ESS pre- and post-CPAP was found. There was significant difference in the AHI pre- and post- CPAP. Significant difference was found in the mean SIDVP in early night measure, as well as the minimum, maximum and mean of the SIDVP measured in the early morning. SIDVP increased.

Conclusions: The derived arterial stiffness index increased in patients with OSAS with persistent sleepiness on CPAP, who developed PLMs. This implies the incremental effect of periodic limb movement on the arterial stiffness.

Disclosure: Nothing to disclose.

BREATHING DISORDERS 2

P137 | Fat mass distribution measured by Viscan as a risk factor for Obstuctive Sleep Apnea Syndrome

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Objectives/Instruction: Obstuctive Sleep Apnea Syndrome (OSAS) prevalence is increasing in modern society. The most common predisposing factors for OSA include obesity, central fat distribution, male sex, age, postmenopausal state and structural factors.

Objectives: To evaluate central fat mass distribution measured by Viscan as a risk factor for OSAS.

Methods: Patients visiting a sleep clinic were prospectively studied. Anthropometric values (age, gender, BMI, neck, waist, hip circumference) were measured and Epworth Sleep Scale (ESS) was completed. Viscan that uses Dual Frequency BIA technology was used for the measurement of fat mass (trank, visceral). Sleep studies were performed. Multivariate logistic regression analysis was used to assess the association between OSAS and possible risk factors and $p < 0.05$ was accepted as statistically significant.

Results: The study included 106 patients (84% male) aged 47.9±12.4 years, with BMI 30.6 ± 6.4 kg/m^2, ESS: 7.9 ± 5.5 and Apnea Hypopnea Index (AHI) : 34.4±26.15/h. From them, 9.4% did not suffer from OSAS, 17.9% from mild, 22.6% from moderate and 50% from severe. Trunk fat percentage and visceral fat mass measured by the Viscan were 30.6±6.4% and 18.2±7.9 respectively. In the univariate regression analysis, anthropometric risk factors for OSAS involved: neck circumference (OR: 1.44, 95% Confidential interval (CI) 1.19–1.73, $p < 0.001$), visceral fat (OR: 1.21, 95% CI 1.11–1.32, $p < 0.001$), BMI (OR: 1.14, CI 1.04–1.24, $p = 0.003$),waist circumference (OR: 1.1, 95% CI 1.05–1.15, $p < 0.001$), trunk fat percentage (OR: 1.06, CI 95% 1.01–1.11, $p = 0.018$) and age (OR: 1.04, 95% CI: 1.002–1.08, $p = 0.04$). In multivariate logistic regression analysis adjusted for gender and age, risk factors associated with moderate-severe OSAS included neck circumference (OR: 1.45, 95% CI 1.18–1.78, $p < 0.001$), visceral fat (OR: 1.2, 95% CI 1.09-1.32, $p < 0.001$), BMI (OR: 1.14, CI 1.05–1.26, $p = 0.003$), waist circumference (OR: 1.09, 95% CI 1.04–1.14, $p< 0.001$) and trunk fat percentage (OR: 1.09, CI 95% 1.03–1.15, $p = 0.003$). There was a strong correlation ($p < 0.001$) between waist, neck circumference, BMI, AHI, trunk fat percentage and visceral fat mass.

Conclusions: Fat mass distribution measured by Viscan was found to be stronly associated with OSAS and correlated well with other antropometric measures and AHI.

Disclosure: Nothing to disclose.

P138 | Obstructive sleep apnea as a risk factor of insulin resistance in nondiabetic patients

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Objectives/Instruction: Obstructive sleep apnea (OSA) is associated with increased prevalence of metabolic syndrome, type 2 diabetes mellitus (DM) and obesity however the association between

OSA and prevalence of insulin resistance (IR) in nondiabetic patients needs further studies.

This research provides the information about the association between polysomnography (PSG) parameters, daytime sleepiness scored with Epworth Sleepiness Scale (ESS) and IR.

Methods: Our study group estimated 102 nondiabetic individuals. Sleep analysis included an overnight PSG examination. The HOMA index was calculated on the basis of fasting plasma insulin and glucose concentration.

Results: Among study sample (n = 102) 71 men and 31 women, mean age 53.02 ± 12.37 suspected of having OSA, n = 85 (83.3%) had OSA, 64 men (75.3%) and 21 (24.7%) women. The difference between groups with and without OSA was not statistically significant on existence of arterial hypertension, body mass index (BMI) and age. After the study sample was divided according to apnea-hypopnea index values (AHI) we observed statistically significant ($p < 0.05$) higher fasting plasma insulin concentration and HOMA-IR index values in patients with moderate to severe OSA (AHI $\geq$ 15) comparing with group with AHI < 15. The statistically relevant difference ($p< 0.01$) in parameters of carbohydrate metabolism was also present in group with severe OSA (AHI $\geq$ 30) compared to patients with AHI< 30. There was not any correlation between ESS rates and fasting plasma glucose/insulin concentration. Higher percentage of desaturation time below 90% was an independent risk factor for higher fasting glucose levels ($p < 0.05$).

Conclusions: Individuals with moderate to severe OSA without DM had higher HOMA- IR indexes than patients without or with mild OSA. This study revealed that there is no evidence if the evaluation of daytime sleepiness using ESS is a predicting factor of developing IR. Higher AHI and oxygen desaturation index (ODI) were independent risk factors for higher fasting plasma insulin concentration and higher HOMA- IR index.

Disclosure: Nothing to disclose.

P139 | Adherence in positive airway pressure in naïve obstructive sleep apnea patients: the importance of the first month of treatment and the impact of telemedicine monitoring

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Objectives/Introduction: Long-term conditions are associated with poor adherence. Is especially prevalent in conditions where symptoms may fluctuate or may be hidden like Obstructive Sleep Apnea (OSA). Untreated OSA lead to high morbidity, such as reduced cognitive function, depression, infertility, increased risk of accidents, and it is associated with diseases such as hypertension, diabetes, myocardial infarction, and stroke. Chronic multimorbidity is a new challenge and must involve a change in the global organization of care and follow-up.

We prospectively assessed adherence using daily telemonitoring of naïve Positive Airway Pressure (PAP) OSA patients′ data and associated clinical parameters of cardio-metabolic risk during one year. The ultimate goal of this trial will be to develop an effective, extensible and cost-effective system to promote improved adherence to CPAP patients.

Methods: In a single center, 60 naïve PAP adult patients with moderate to severe OSA were randomized in two groups: standard care consisting in first, third and sixth month consultations and those with daily telemonitoring information (i.e., adherence, air leak, residual AHI) plus first and second week consultation and standard care (first, third and sixth month consultations). Subjects who used PAP for at least 5 hours per night for at least 90% of the days monitored were regarded as adherent. We also analyzed the correlation between adherence and cardio-metabolic clinical parameters.

Results: 52 patients were enrolled, 34 were randomized to telemedicine and 18 to standard care. The mean age was 54,2 year, mean AHI was 38,3 events/hr, and 56% of patients were male. Only after 1 month, mean PAP adherence was significantly greater in the telemedicine arm versus the standard arm. After 3 mo. PAP adherence in the telemedicine arm was almost total sleep time (7h34) versus 3h47 in the standard arm.

Conclusions: PAP adherence should be improved with the use of a web-based telemedicine system at the beginning of the treatment. This trial demonstrates that good PAP adherence occurs during the first few days and can be predicted in first two consultations. Cardio-metabolic clinical parameters significantly improved with total sleep time PAP adherence associated with body mass control and exercise.

Disclosure: Nothing to disclose.

P140 | The impact of a telemedicine monitoring on positive airway pressure in naïve obstructive sleep apnea patients' outcomes: a randomized controlled trial

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Objectives/Introduction: Untreated Obstructive Sleep Apnea (OSA) can lead to high morbidity, such as reduced cognitive function and increased risk of accidents, and it is associated with diseases such as systemic arterial hypertension, metabolic syndrome, acute myocardial infarction, and stroke. Multimorbidity implies to change organization of care and follow-up. We prospectively assessed

adherence using daily telemonitoring of naïve Positive Airway Pressure (PAP) OSA patients' data and other associated clinical parameters of cardio-metabolic risk during one year. The ultimate goal of this pilot trial will be to develop an effective, extensible and cost-effective system to promote improved adherence to CPAP patients, as well as monitor clinical parameters (HR, hypertension, glycaemia, and oximetry) of frequently associated OSA co-morbidities.

Methods: In a single center, 80 naïve PAP adult patients with moderate to severe OSA were randomized in two groups: standard care consisting in first week, first, third and sixth month consultations and those with daily telemonitoring information (i.e., adherence, air leak, residual AHI) plus standard care. Subjects who used PAP for at least 5 h per night for at least 90% of the days monitored were regarded as adherent. We also analyzed the correlation between adherence and cardio-metabolic clinical parameters.

Results: 73 patients were enrolled, 35 were randomized to telemedicine and 38 to standard care. The mean age was 57.2 year, mean AHI was 38,4 events/hr, and 59% of patients were male. After 1 month, mean PAP adherence was significantly greater in the telemedicine arm versus the standard arm. But after 6 months mean PAP adherence was almost total sleep time in both arms (6h34 vs 5h58).

Conclusions: PAP adherence can be motivated and faster with the use of a web-based telemedicine system at the beginning of the treatment. This trial demonstrates that sustained long-term PAP adherence occurs during the first few days. Telemedicine monitoring of naïve PAP OSA patients can be cost-effective by reducing the need of consultations. Also cardio-metabolic clinical parameters significantly improved with total sleep time PAP adherence associated with body mass control and exercise.

Disclosure: Nothing to disclose.

P141 | CPAP mask usage time and its effect on air leak

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Objectives/Instruction: Unintentional air leaks during CPAP therapy is common. Such leaks may be related to mask leak or mouth breathing. The silicon and strap characteristics may change over time, leading to poorer mask fit. It is unknown how often masks should be replaced. The purpose of this study is to evaluate modifications of air leaks over time.

Methods: All patients were followed for CPAP therapy. The hospital proposed one mask per year at no cost to the patient. Different mask types and brands were used. We evaluated 89 consecutive patients during their yearly visit for leak values obtained from the ResScan program. Leak values during the first month of use were compared to those at 12 months.

Results: Eighty-nine patients used 89 masks for a mean period of 578 ± 379 days. Mean patient age was 58 years. There were 28 Female and 61 male patients. There were eight full-face masks, six of which were ResMed Quatro masks. Of the 64 nasal masks, 32 were Respironics Comfort Classic, 17 were Resmed Mirage Micro/Ultra or Softgel, 18 were Fischer & Paykel Flexifit 406 or 407. Of the 17 nasal-pillow masks, 15 were ResMed Swift II or LT. Mean leak values at 12 months were not higher than during the first month of use (8.261 vs. 7.218 L/min, F [1, 134] = 0.370; P = 0.544).

Conclusions: Unintentional air leak did not increase after one year of using the same CPAP mask. Our results indicate that CPAP masks continue to fit well after one year of CPAP use.

Disclosure: Nothing to disclose.

P142 | Comparing the current classification of obstructive sleep apnea severity with oxygen saturation parameters

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Objectives/Instruction: Current guidelines categorize Obstructive Sleep Apnea (OSA) severity according to the Apnea Hypopnea Index (AHI). However, there is a lack of clarity as to what best defines OSA severity.

We aim to assess the correlation of American Academy of Sleep Medicine (AASM) classification of OSA severity to various oxygen saturation parameters.

Methods: This study followed a survey on the prevalence of OSA among 2,682 middle-aged people in Saudi Arabia. Among the 346 subjects who underwent PSG, 235 had OSA. OSA severity was classfied according to the AASM criteria using AHI into (5–14) mild, (15–30) moderate and (> 30) severe. This standard classification of OSA severity was compared with different oxygen saturation as well as PSG parameters. These include: Number of desaturations per hour of sleep; minimal oxygen saturation; percent of sleep time with desaturation; sleep time with oxygen saturation below 90%; average duration of apnea and hypopnea; total arousal index and respiratory arousal index; and duration of Rapid Eye Movement (REM) sleep. The study was limited to PSG studies of at least 240 minutes duration with REM sleep.

Results: Of the 346 subjects whom underwnt PSG, 189 had PSG of at least 240 min duration with REM sleep. Of these, 129 had obstructive sleep apnea based on an AHI of > 5. There was significant correlation between OSA severity based on AHI and different oxygenation parameters: Number of desaturations per hour of sleep; minimal oxygen saturation; percept of sleep time with desaturation; sleep time with oxygen saturation below 90%; and average duration of apnea had significant Spearman rank correlation coefficients with

(p-value < 0.001). Index of total arousals and of respiratory arousals again correlated well with severity (p-value < 0.001). The duration of REM also was found to be assicated with OSA severity (p-value < 0.003). However, there was no significant correlation with the duration of hypopnea (p-value = 0.704).

Conclusions: This study revealed a significant correlation between the current standard OSA severity classification based on AHI and different variables of oxygenation and PSG parameters, which confirms its practicality to be used clinically.

Disclosure: Nothing to disclose.

P143 | Impacts of time of day and seasonal light variation on cognitive performance in patients with suspected Obstructive Sleep Apnea

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Objectives/Instruction: Time of day (ToD) and seasonal light variation (SLV) are factors that may influence cognitive testing. Obstructive Sleep Apnea (OSA) may also be associated with mild cognitive impairment (MCI). Little is known how ToD and SLV may affect cognitive testing in OSA.

Methods: Adult patients (N = 391) with suspected OSA who underwent in-lab polysomnography were recruited into a multi-center observational cohort study (Canadian Sleep and Circadian Rhythm Network) to determine the association between OSA and MCI. Patients completed the Epworth Sleepiness Scale (ESS) and the Montreal Cognitive Assessment Test (MoCA). ToD and SLV were defined as the time of day and the time from sunrise to sunset when the MoCA was completed. Patients were stratified into four categories using Apnea-Hypopnea Index (AHI): no (AHI < 5), mild (AHI 5–15) moderate (AHI 15–30) and severe (AHI > 30) OSA. Multiple linear regression and pairwise correlations were completed using Stata 13.0.

Results: SLV, age, ToD, sex (female), AHI, ESS were significant predictors of performance on the MoCA (r^2 = 0.16, p < 0.0005) in that order (Betas: 0.23, –0.20, –0.17, 0.1, –0.1, –0.1). MoCA score worsened during later ToD in participants with no, mild, and moderate OSA (r = –0.37, p = 0.003; r = –0.19, p = 0.05; r = –0.25, p = 0.02 respectively), but those with severe OSA were not impacted (p = 0.3). SLV affected all participants, except those with mild OSA (r = 0.15, p = 0.1), (No OSA, r = 0.34, p = 0.002; Moderate, r = 0.39, p < 0.0005; Severe, r = 0.20, p = 0.009). However, the impacts of SLV were only present when individuals completed the MoCA in the morning (r = 0.25, p < 0.0005) or evening (r = 0.33, p = 0.02), but not in the afternoon (p = 0.7).

Conclusions: ToD may affect MoCA performance in those with no or less severe OSA, while SLV may have impacts on most individuals regardless of OSA severity. SLV and ToD may interact, suggesting exposure to sunlight may affect cognition.

Disclosure: Funded by the Canadian Institute of Health Research (CIHR) through the Canadian Sleep and Circadian Network (CSCN).

P144 | Effects of nocturnal ventilatory treatment in cognitive functions in a cohort of patients affected by OHS

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Objectives/Introduction: Obstructive sleep apnea syndrome (OSAS) and obesity-hypoventilation syndrome (OHS) are the most frequent forms of sleep disordered breathing (SDB) associated to obesity (BMI>30). OSAS and OHS are important negative factors in management and prognosis in obese patients, and may have several common complications, namely excessive daytime sleepiness, mood disorders, increased risk of car accidents, hypertension, and cardiovascular events and stroke. OSAS and OHS may cause cognitive impairment, such as attention/vigilance deficit, delayed verbal and visual long-term memory, visuospatial/constructional abilities, and executive function, due to sleep fragmentation and nocturnal intermittent hypoxia/hypoventilation. The greatest dysfunction is reported to concern the executive functions, carried out by prefrontal cortex (PFC). Damage of PFC may be due to sleep fragmentation, disruption of circadian rhythm, cerebrovascular disease, and nocturnal intermittent hypoxia/hypoventilation. Brain tissue damage, once occurred, may be only partially reversed by regular treatment with CPAP/NIV.

Methods: Among the patients referred to the outpatient service of Sleep disorders center of University of Cagliari, 30 consecutive obese patients were selected. 26 patients underwent to a full-night complete polysomnography (PSG); arterial blood gas analysis was performed in 19 subjects, 8 patients underwent to PAP titration and neuropsychological assessment which was made both before starting nocturnal ventilator treatment and after 6 months of treatment. Diagnosis of OSAS/OHS was made according to AASM criteria.

Results: OSAS (AHI≥5) was diagnosed in 83% of subjects, and OHS (BMI≥30 and PCO2>45mmHg) in 31%. Cognitive assessment showed impairment in executive function, in particular a deficit in attention (visual attention, attention flexibility, selective attention and more). After 6 months of nocturnal treatment we found a significant improvement in "attention" (time interference effect at Stroop test: p = 0.022; visual search: p = 0.017; trial making test-A: p = 0.019) and in logical thinking (Raven's progressive matrices: p = 0.015).

Conclusions: The prevalence of SDB in obese subjects is very high. Early identification of any SDB in obese patients and set up of adequate ventilator nocturnal treatment may improve nocturnal and diurnal quality of life of these patients and may also prevent brain tissue damage to develop, contrasting permanent cognitive impairment.

Disclosure: Nothing to disclose.

P145 | The impact of arousal on sleep-related deglutition in patients with obstructive sleep apnea hypopnea syndrome

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Objectives/Instruction: Sleep-related deglutition in patients with obstructive sleep apnea-hypopnea syndrome (OSAHS) and its correlation with sleep stage and cortical arousals were investigated.

Methods: Simultaneous polysomnography and pharyngeal pressure monitoring were performed in 23 adult patients with OSAHS, the following parameters were analyzed: (1) the relationship between arousal and deglutition; (2) the effect of sleep stage on deglutition; (3) The relationship between the frequency of deglutition and the severity of OSAHS.

Results: The study subjects aged 43±12 years, and the mean apnea-hypopnea index (AHI) was (49.2±27.7) times/hour. A total of 1382 deglutition were recorded during sleep, with a median of 9.2 [5.8, 13.8] times/person. There was a positive correlation between deglutition frequency and AHI(r = 0.570, p = 0.005) and negatively correlated with oxygen saturation (r = −0.639, p = 0.001). The majority of the deglutition (73.7%) occurred after the respiratory event and in association with respiratory arousal. Deglutition occurred more in Non-rapid eye movement sleep stage 1 (N1) than N2, N3 and REM sleep (Z = −3.680, $p < 0.001$; Z = −2.746, p = 0.006; Z = −3.490, $p < 0.001$).

Conclusions: The occurrence of deglutition in patients with OSAHS is associated with cortical arousals. Deglutition frequency increased with the severity of apnea; and affected by sleep staging.

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P146 | Non-rapid eye movement oscillatory events in middle-aged and older adults with obstructive sleep apnea

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Objectives/Introduction: Obstructive sleep apnea (OSA) is a sleep disorder characterized by cessations (apnea) or reductions (hypopnea) of airflow due to upper airway obstructions. These respiratory events cause sleep fragmentation and intermittent hypoxemia. OSA was recently shown to increase the risk of dementia, but the mechanisms linking OSA to dementia are not clear and need further investigation. Considering that non-rapid eye movement (NREM) oscillatory events (i.e. sleep slow waves and spindles) are important for memory consolidation and synaptic plasticity, the aim of the present study was to test the hypothesis that OSA is associated with altered sleep slow waves and spindles.

Methods: Our study included 103 middle-aged and older subjects (mean age = 64.2±6.6 years) with an OSA varying from absent to severe (mean apnea-hypopnea index = 20.4±17.8 events/h). They were tested with one night of in-laboratory polysomnography. Spindles and slow waves were automatically detected during N2 and N3 sleep. Partial correlations that included age and sex were performed between slow wave (amplitude, density, duration, slope), electroencephalogram slow wave activity power (0.5 à 4.5 Hz), spindle characteristics (amplitude, density, duration, frequency), N2 and N3 sleep duration and markers of OSA severity (sleep time with oxygen saturation < 90%, apnea-hypopnea index and micro-arousal index).

Results: We found that higher apnea-hypopnea index and micro-arousal index were associated with decreased slow wave amplitude and density (r varying from −0.260 to −0.315, p varying from 0.002 to 0.01). Moreover, increased apnea-hypopnea index and micro-arousal index correlated with lower slow wave activity power (r varying from −0.280 to −0.378, p varying from 0.000 to 0.005) and reduced N2 and N3 sleep duration (r varying from −0.264 to −0.431, p varying from 0.000 to 0.008). No significant correlations were found between spindle characteristics and OSA severity.

Conclusions: Overall, our findings suggest that OSA severity may compromise the regular generation of sleep slow waves in middle-aged and older subjects. Further studies are required to examine whether these changes in slow waves prevent optimal synaptic plasticity and lead to cognitive dysfunctions.

Disclosure: Nothing to disclose.

P147 | The effects of nasal decongestion on obstructive sleep apnea: a detailed analysis

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Objectives/Instruction: Many studies indicated associations between nasal obstruction and sleep disorders. However, the precise nature of the relationship between nasal patency and sleep apnea remains unclear. In this study, we analyzed the specific effects of nasal patency on the sleep quality in obstructive sleep apnea(OSA) patients by applying nasal spray decongestant.

Methods: We perform a randomized, placebo-controlled double blind study on the effects of topical nasal decongestion on sleep architecture, respiratory events, body position and subjective scores in OSA patients with chronic nasal congestion and without obvious pharyngeal narrowing. Ten eligible OSA patients (9 males, 38.5±10.5 years old) were recruited. All participants received specific physical examinations, subjective scale assessments and a two-night polysomnography sduty (by randomly applying oxymetazoline for one night and placebo for another.). Data collected after oxymetazoline or placebo treatments were compared. Results were presented as means±SD or M(P25, P75). Differences between the paired samples were identified by paired t test or Wilcoxon rank test. $p < 0.05$ was considered to be statistically significant.

Results: Compared with placebo, oxymetazoline resulted in a significant reduction in apnea/hyponea index (AHI) (36.43±15.38 vs. 29.39±16.60), mainly affecting non-rapid eye movement(NREM) sleep period (34.34±16.84 vs. 28.35±16.38), rather than rapid eye movement(REM) sleep period. In terms of respiratory events patterns of sleep, the apnea index were significantly decreased (30.74±17.38 vs.22.88±17.96) and the change of hypopnea index did not meet statistical significance. Oxymetazoline was not associated with significant changes in respiratory event duration, mean SpO2 or minimal SpO2 compared with placebo. However, the percentage of sleep time with SpO2 below 90% (TST90) was significantly decreased [placebo 2.27%(0.13%,7.99%) vs. oxymetazoline 0.41%(0%,4.3%)]. After nasal decongestion, it was manifested great improvements in the frequency of postural changes [placebo 2.33 (1.35, 4.12) vs. oxymetazoline 1.17(0.68, 3.34)], AHI in supine position[placebo 56.15 (39.20, 63.2) vs. oxymetazoline 39.70(32.00, 51.10)], and arousal index(placebo 26.85±15.08 vs. oxymetazoline 16.69±13.00) in patients with OSA, whereas AHI in non-supine position did not significantly improved.

Conclusions: Nasal patency participates in the pathogenesis of OSA by affecting the respiratory pattern of NREM sleep,especially in supine position. Improvement of nasal patency can lead to an uninterrupted sleep and a reduced times of sleep-turning.

Disclosure: Nothing to disclose.

P148 | Association of restless legs syndrome with depression, anxiety, and insomnia in patients with obstructive sleep apnea syndrome

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Objectives/Instruction: An association between obstructive sleep apnea syndrome (OSAS) and restless legs syndrome (RLS) has long been reported. Both syndromes are associated with depression, anxiety, insomnia, and daytime sleepiness. However, these relationships have not been studied extensively, and many questions remain unanswered. This study investigated the prevalence of RLS and its association with depression, anxiety, insomnia, and daytime sleepiness in OSAS patients in Korea.

Methods: The study enrolled 152 Korean OSAS patients Chonnam National University Hospital. The International Restless Legs Syndrome Study Group criteria and International Restless Legs Scale were used to determine the diagnosis and severity of RLS. To assess depression, anxiety, and insomnia, all patients completed the Beck Depression Inventory (BDI), Beck Anxiety Inventory (BAI), Insomnia Severity Index (ISI), and Epworth Sleepiness Scale (ESS).

Results: Overall, 65 (42.6%) patients met least one of the RLS diagnostic criteria, and 17 (11.1%) were diagnosed with RLS. The mean BDI, BAI, and ISI scores were higher in subjects with RLS symptoms compared with those without such symptoms. ESS scores were not significantly associated with RLS symptoms. There were significant positive correlations between RLS severity and BDI ($r_s = 0.341$, $p < 0.001$), BAI ($r_s = 0.322$, $p< 0.001$), and ISI ($r_s=0.369$, $p< 0.001$) scores.

Conclusions: There were significant relationships between RLS symptoms and depression, anxiety, and insomnia. We recommend that patients with OSAS be evaluated for symptoms of RLS.

Disclosure: Nothing to disclose.

P149 | A composite screening method to maximise pick up rate of obstructive sleep apnoea in train drivers

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Objectives/Instruction: Undiagnosed OSA has been implicated in a number of rail crashes and otherl incidents. (1,2) The majority of the UK Occupational Medical services screen for OSA using ESS which is subjective and grossly under-reported (3). We used a combination of screening methods to maximise the pick up rye for OSA in Train Drivers (TD).

Methods: TD were screened and assigned as high risk if they were positive for one of the following: their ESS >10, STOP-Bang (SB)>3, Adjusted Neck Circumference (ANC)>48 and Body Mass Index based on Australian Road OSAS criteria (BMI >35 + risk factor or BMI >40). Drivers were referred for a Home Limited Channel Polygraphy (Type 3) study.

Results: Of the 292 drivers screened during the year, 7 had a pre-existing diagnosis of OSA.

Of the remaining 285, 40 met at least one criteria for the referral for Home PG.

Baseline data for 285 drivers screened versus 40 drivers referred for Home PG were : BMI 29 v 36), STOP-Bang 2.4 v 4.7, Adjusted Neck Circumference 42 v 48 and mean ESS of 3.4 v 4.5

From 40 TD who underwent home PG, 3 out of 3 with ESS >10 were diagnosed with OSA, another 14/23 with high STOP-Bang had OSA, 12/25 with ANC >48 and 13/25 with BMI criteria were positive for OSA.

Of the 40 who had Home PG, 12 had mild OSA, 7 moderate & 5 severe OSA. TOTAL with OSA = 24 New + 7 pre diagnosed= 31/292. 6 result are awaited, and 10 drivers had negative Home PG. This gives a prevalence of at least 10.6%.

24/40 or 60% had a positive sleep study.

Conclusions: ESS is inadequate as the only screening tool for OSA. We recommend using a combination of screening tools allowed us to maximise pick up rate of OSA in train drivers. With 60% pick up rate this approach was effective in our population.

Disclosure: Nothing to disclose.

P150 | Association between obstructive sleep apnea hypopnea syndrome and neutrophyl-to-lymphocyte ratio

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Objectives/Introduction: Currently the *neutrophil-tolymphocyte ratio* (INL) is consider a cheaper and very accessible biomarker of some inflammatory and non-inflammatory diseases. The obstructive sleep apnea-hypopnea syndrome (OSAHS) is a serious public health problem in which found accessible and valid biomarkers is very important.

The aim is study the association between OSAHS and NRL *value.*

Methods: Retrospective study based on hospital data. Clinical records were analyzed for variables such as demographic characteristics, hematological (including NLR), C-reactive protein levels, and polysomnographic parameters. Statistical analyses were following: descriptive analysis, median comparison (with Mann-Withney U and Kruskal-Wallis tests) for association between INL and OSAHS diagnosis/severity, and Receiver Operating Characteristic curve for INL values and polysomnographyc diagnosis. One logistic regression model was performed between OSAHS and INL values.The significance level was 95%.

Results: Fifty-six subjects were included. The 62.5% were diagnosed of OSAHS. Median of NLR levels were 1.40 (range: < 0.25; 6.0]>). Median differences between NLR levels of subjects with and without OSAHS were statistically significant (Mann–Withney U test: p< 0.0001, < 0.65; 1.16>). Severity of OSAHS were associated with NLR levels (Kruskal-Wallis: p< 0.00001). ROC curve determined a NLR cut-off >1.55 (sensitivity: 60%, specificity: 80%, and area under curve (AUC) = 0.68: p< 0.012, < 0.54; 0.80>) to OSAHS diagnosis. Unadjusted logistic regression model determined an OR = 2.48 (p = 0.237, < 1.13; 5.43>). However, this association was lost after being adjusted by age.

Conclusions: The *neutrophyl-to-lymphocyte ratio* is associated to polysomnographic diagnosis of OSAHS and Its severity. The NLR *cut-off* calculated had low sensitivity and acceptable specificity. More studies with prospective designs should be perform to confirm the association between NLR and OSAHS.

Disclosure: Nothing to disclose.

P151 | Effect of obesity on upper airway obstruction during drug-induced sleep endoscopy

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Objectives/Instruction: Through previous studies, relationship between obesity and obstructive sleep apnea (OSA) has been well known. In anatomical aspect, people have been thought that fat deposition in the upper airway leads to pharyngeal airway narrowing, and it causes to increase collapsibility of the upper airway. In our study, we performed drug-induced sleep endoscopy (DISE) to sleep apnea patients, and analyzed the effect of obesity on airway obstruction.

Methods: Subjects included the OSA patients without surgery history and all patients perform the polysomnography (PSG) and DISE for their OSA between April 2014 and July 2015. Demographics, polysomnographic data, DISE results were collected prospectively. The obstruction on DISE was classified as VOTE classification; velum, oropharynx, tongue base, and epiglottis. The severity of obstruction was classified as 0, no obstruction; 1, partial obstruction; 2, complete obstruction. Patients were divided into non-obese and obese group by BMI, and analyzed the factors associating obstruction findings on DISE.

Results: Totally 113 patients were enrolled, male was 101 and female was 12. Among them, non-obese patients (BMI < 25) were 47, and obese (BMI≥25) patients were 66. There was no statistical difference in age between two groups. When dividing patients with totally obstruction of anatomy and patients with none or partially obstruction groups, There is no difference in obstruction of tongue base, and epiglottis between two groups. However, oropharynx total obstruction was more frequently presented in obese patients with statistical significance (p = 0.021). On the other hand, epiglottis partial obstruction on DISE was identified in non-obese group more frequently with statistical significance (p = 0.026). When assessing their tonsil by Friedman grading scale, there is no significant difference in tonsil size between two groups. When using biological regression model, obesity can affect obstruction of the epiglottis with statistical significance (p = 0.005).

Conclusions: There are complex relationship between OSA and obesity. Focusing anatomical aspect of upper airway, obesity can affect the oropharynx area obstruction. On the other hand, non-obese patients show obstruction of the epiglottis more frequently than obese patients. These results can be affect decision of treatment modalities according to obesity, and further large study will be expected.

Disclosure: Nothing to disclose.

P152 | Reliable sleep apnea characterization in adults with suprasternal pressure

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Objectives/Instruction: To determine if recording of suprasternal pressure (SSP) can classify apneas as reliably as respiratory inductance plethysmography (RIP) belts and compare the two methods to classification with esophageal pressure (Pes), the reference method for assessing respiratory effort.

Methods: In addition to polysomnographic recordings that included Pes, SSP was recorded using the PneaVoX technology (CIDELEC, France). 32 patients (25 males, mean age 66.7±15.3 years, and mean BMI 30.1±4.5 kg/m²) were used to compare the classification of detected apneas by 3 methods of respiratory effort evaluation (Pes, RIP belts and SSP). Signals were analyzed randomly and independently from each other by 2 scorers. All recordings were analyzed according to AASM guidelines.

Results: Comparison of apnea characterized by SSP and by Pes showed an agreement of 99.0% for obstructive, 94% for central and 92.1% for mixed apneas and 97.2%, 92.6% and 96.9%, by scorer 1 and scorer 2, respectively. Comparing RIP to Pes, agreement was 98.9% for obstructive, 92.5% for central and 80.5% for mixed apneas and 97.8%, 87% and 83.4%, by scorer 1 and scorer 2, respectively.

Conclusions: Compared to Pes, the golden standard method for respiratory effort evaluation, the SSP method scored slightly better than the RIP belt method. Thus, we conclude that sleep apnea characterization in adults with suprasternal pressure is a reliable method.

Disclosure: The authors received a grant from Cidelec to support the additional effort needed for this study.

P153 | Sleep apnea in Tibetans and Han long-term high altitude residents

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Objectives/Instruction: Obstructive sleep apnea (OSA) is associated with adverse health outcomes in lowlanders. The propensity to OSA may be modified by ethnic and environmental influences. We compared the prevalence of sleep apnea between Tibetans and Han long-term residents at high altitude.

Methods: 86 consecutive long-term residents (>5 y) of Shangri-La, 3200m, China, referred for evaluation of snoring or witnessed apnea underwent clinical and questionnaire evaluation and polysomnography (PSG) at the local hospital at 3200m.

Results: In 42 Tibetans, 38 men, median age 50 y, body mass index (BMI) 25.1 kg/m², forced expiratory volume in 1s (FEV1) 93%pred., the apnea/hypopnea index (AHI) was 55.3/h. In 44 Hans, 32 men, age 47 y, BMI 24.4 kg/m², FEV1 98%pred., the AHI was 25.8/h (p< 0.001 vs. Tibetans). In multiple regression analysis controlling for age, sex, BMI, Epworth sleepiness score (ESS) and several other known predictors of OSA, the AHI was positively correlated with Tibetan vs. Han ethnicity (coefficient +19.8/h, 95%CI +8.4 to +31.3, p = 0.001). Moreover, in 40 men, 20 Tibetans and 20 Hans, matched for age, BMI and ESS, the AHI in Tibetans was higher than in Hans (47.0 vs. 29.4/h, p = 0.028). In 36 men, 18 Tibetans and 18 Hans, matched for age, BMI and AHI, ESS was similar (6.5 vs. 5.5, p = 0.628). The mean nocturnal oxygen saturation (SpO2) was lower [median 85% (quartiles 83; 88) vs. 89% (87; 90)] and the apnea duration longer [22sec (20; 24) vs. 18sec (17; 20) sec] in Tibetan vs. Han (p< 0.0001, both instances).

Conclusions: Our data suggest that long-term residents at high altitude of Tibetan ethnicity have a greater prevalence of sleep apnea than Han Chinese, possibly due to differences in control of ventilation.

Disclosure: Nothing to disclose.

P154 | Study on endogenous cannabinoid receptors CB_1 of bone metabolism in chronic intermittent hypoxia rat model

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Objectives/Instruction: To investigate the mechanism of CB_1R during the bone damage caused by chronic intermittent hypoxia (CIH).

Methods: 48 rats were randomly divided into six groups with 8 rats in each: two control groups (CG) [rats exposed to normal air for four weeks (4W) (CG1) and for 6 weeks (6W) (CG2) respectively]; rats exposed to intermittent hypoxia (IH) for 4W (IH1group)and 6W (IH2 group) respectively; rats exposed to the same IH enviroment but received intraperitoneal injection of CB_1 antagonist (rimonabant) at the dosage of 1.5mg/kg/d prior to IH modeling (treatment group 1 and treatment group 2). To detect the activity of serum β-CTX by using enzyme-linked immunosorbent method (ELISA) and CB_1R by immunohistochemistry. Morphological changes were observed by hematoxylin-eosin staining (HE).

Results: In CG1 and CG2 the bone cell morphology was normal and the trabecular structure was complete. However, the bone cells in IHG 1 displayed with mild edema and inflammatory cells infiltration as well as reduced trabecular bone quantity; while in IHG2 such changes were more severe. Compared with CG1 and CG2, TRAP and CB_1R was gradually and significantly elevated from IH1 group to IH2 group with a significant difference among groups (all $p < 0.05$). Compared with IH group, β-CTX in the HI group was statistically lower at the same time point of treatment groups. (all $p < 0.05$). Pearson correlation analysis showed that there was a positive correlation between the CB_1R and the TRAP activity.

Conclusions: IH could lead to the disorder of ECS, the bone metabolic and bone structure abnormality. Such a bone damage could became more severe with the extension of IH exposure time and could be improved with the use of CB_1R antagonist (rimonabant) intervention.

Disclosure: Nothing to disclose.

P155 | Epworth sleepiness scale and maintenance of wakefulness test in patients with obstructive sleep apnoea

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Objectives/Instruction: Excessive daytime sleepiness (EDS) is a frequent symptom of patients with obstructive sleep apnoea (OSA). EDS is a high-risk factor for road accidents. In a clinical setting, OSA patients require assessment for EDS. This is generally undertaken by subjective questionnaire Epworth Sleepiness Scale (ESS). This method of assessing sleepiness is susceptible to reporting bias, particularly by professional drivers who may seek to underestimate severity. On the other hand objective testing is expensive, time consuming and not well suited to large scale evaluations. Probably the most commonly performed objective test for assessing EDS is the maintenance of wakefulness test (MWT), which in no respect replicates real-life driving situations.

The aim of the study was to evaluate objective and subjective aspects of EDS in untreated patients with different levels of OSA severity.

Methods: 106 untreated OSA patients with different levels of OSA were studied regarding night sleep and EDS. The criterion for severity was the apnea hypopnea index (AHI). Patients were classified as: normal (AHI < 5), mild (AHI 5-15), moderate (AHI 15–30) and severe OSA (AHI >30). Full night polisomnography was performed. Next day patients underwent 20-min MWT testing and completed the ESS.

Results: Based on the AHI, 17 patients were normal (median Epworth and MWT values: 12 and 20), 22 had mild OSA (median ESS and MWT values: 13 and 20), 19 had moderate OSA (median ESS and MWT values: 11 and 20) and 48 patients had severe OSA (median ESS and MWT values: 12.5 and 14). There was no correlation between AHI and ESS in all of the groups. Weak correlation existed between AHI and MWT in severe OSA patients (Spearman r: −0.2806, $p = 0.0534$). There was weak correlation between ESS and MWT in patients with mild (Spearman r: −0.3909, $p = 0.0721$) and moderate OSA (Spearman r: −0.3974, $p = 0.0920$). However none of the correlations were statistically significant.

Conclusions: All patients with untreated OSA had abnormal ESS, while MWT was normal in all groups. However, we did not find statistically significant correlations between severity of OSA and subjective evaluation and objective measurements of EDS.

Disclosure: Nothing to disclose.

INSOMNIA 1

P156 | Sex-difference in insomnia symptom in a Korean nation-wide population-based sample

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Objectives/Instruction: Insomnia is the most common sleep disorder with significant psychiatric/physical comorbidities in the general population. Sex, age, mood, lifestyle factors and medical conditions are known predictors of insomnia. The aim of this study is to investigate whether socioeconomic and demographic factors are associated with sex differences in insomnia and insomnia subtypes in South Korea.

Methods: The present study used data from the Korean-Headache Sleep Study (KHSS), a nationwide, cross-sectional study with a structured questionnaire on headache and sleep among all Koreans aged 19 to 69 years conducted by trained interviewers. The Insomnia Severity Index (ISI) was used to diagnose and classify insomnia and its subtypes (cutoff value: 10). Other questionnaires included the Pittsburgh Sleep Quality Index (PSQI), Goldberg Anxiety Scale (GAS) and Patient Health Questionnaire-9 (PHQ-9) to measure sleep quality, anxiety and depression.

Results: A total of 2695 participants completed the survey (50.1% female; 49.9% male). 715 (26.5%) of the participants were classified as suffering from poor sleep quality. The overall prevalence of insomnia symptoms was 10.7%, including difficulty in initiating sleep (DIS) (6.8%), difficulty in maintaining sleep (DMS) (6.5%) and early morning awakening (EMA) (6.5%), and these symptoms were more prevalent in women than in men. Multivariate analysis showed that female sex, shorter sleep time and psychiatric complications such as anxiety and depression were found to be independent predictors for insomnia symptoms and subtypes. Lower education level and older age were associated with higher risk of EMA. After adjusting for covariates among these factors, female sex remained a significant risk factor for insomnia symptoms and its subtypes.

Conclusions: Approximately one-tenth of the sample from the Korean general population had insomnia symptoms. The prevalence of insomnia symptoms was higher in women than in men. Among the subtypes of insomnia symptoms, DIS, DMS and EMA were more prevalent in women than men. Sex is an independent factor for insomnia symptoms.

Disclosure: Nothing to disclose.

P157 | The compliances of doxepin for the treatment of insomnia in real world

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Objectives/Instruction: Doxepin is the only approved antidepressant for the treatment of insomnia. Low-dose doxepin acts as a selective antagonist for histamine H1 receptor, which facilitates sleep without the risk of dependence or abuse. However, to our knowledge, there is no studies focusing on compliance of patients treating with doxepin in real world. Therefore, we analyzed 2-months discontinuation rate of doxepin for treating insomnia, according to the type of prescribing doxepin and the reasons of discontinuation for the establishment of prescribing strategies.

Methods: We reviewed medical records of 534 outpatients prescribed low-dose doxepin, with diagnosis of insomnia in St. Vincent's hospital between June, 2016 and May, 2017. The medication history of sedatives and the type of prescription, such as prescribing doxepin initially, switching from other medications or adding doxepin on previous sedatives, were collected and the data were available from 201 subjects. Then, Kruskal-Wallis test was performed for comparing the discontinuation rate of groups depending on the prescribing type and chi-square test was used through the comparison of reasons for discontinuation between groups. All significance levels were set to 0.05.

Results: 64.2% among 201 subjects were taking sedatives. And 35.8% of samples have been prescribed doxepin as the initial treatment and groups of switching to doxepin and adding doxepin on prior medications were 8.5% and 55.7%, respectively. At 2 months follow-up, 113 subjects (56.2%) discontinued doxepin and the most frequent reason of discontinuation were lost to follow up (36.3%). The rate of discontinuation was highest in the sedatives-naïve group (69.4%), and different from those of sedatives-switching group (52.9%) and doxepin-adding group (48.2%) with a p-value of 0.018. Lost to follow up was the main reason of discontinuation in sedatives-naive group (48.0%) and sedatives-switching group (33.3%) and the main reason of discontinuation in doxepin-adding group was lack of efficacy (37.0%).

Conclusions: This study has shown the difference of discontinuation rate and the reason of discontinuation depending on the type of the type of prescribing doxepin in real world. Therefore, appropriate strategies applying doxepin for the treatment of insomnia should be needed for each groups.

Disclosure: Nothing to disclose.

P158 | Clinical trial, using chronobiological sensors, from a chronoregulator and sleep inducer supplement

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Objectives/Introduction: Primary insomnia (DSM-IV-TR) is caused by stress or worries during the day. Consequences are difficulties in falling asleep and sleep maintenance.

The diagnosis is traditionally done through anamnesis, but actigraphy is an innovative and valuable tool that can provide objective data about sleep over long periods of time.

The treatment with anxiolytic-sedative phytotherapic ingredients and other food supplements may be appropriate in primary insomnia, which can help to reduce stress and sleep quality.

In this study, the use of a food supplement for treating patients suffering from primary insomnia was evaluated. The supplement was a multicomponent based on hypnotic-sedative natural products (valerian, passionflower, poppy) in a delayed release form, and melatonin as a chronoregulator. Sleep monitoring was done by a novel multichannel and multivariable chronobiological sensor (actigraphy, as well as position and endogenous temperature of the patient).

Methods: We studied 18 patients (8 men-10 women, mean age=54 years), who met the inclusion criteria (ICD-10-CM-code: F51-02).

The methodology of the study consisted in a first basal week study of sleep, using chronobiological sensors (KW-5, Kronowise) and a battery of subjective questionnaires. Subsequently, the multicomponent supplement was orally administered daily during a week, controlling their sleep with the same sensors. At the end of the treatment, the subjective assessment tests have also been administered. The baseline and treatment results were compared by the paired samples *t-Student test*.

Results: By means of the circadian records, we obtain sleep parameters before and after the treatment. We observed a statistically significant variation of the latency (19.6–15.3; $p = 0.019$), awakenings during the 7 nights (20.7–16.6; $p = 0.002$), sleep efficiency (86.6–91.1, $p = 0.02$), and nocturnal distal temperature (34.6–34.9, $p = 0.046$), as an endogen marker of sleep dept. Pittsburgh variation (8.9–6.6, $p = 0.005$) and ISI test (12.7–9.6, $p = 0.003$) were significant.

Conclusions: Therefore, mild-moderate primary insomnia can be treated effectively with a natural plant-based treatment such as the one presented in this study, in combination with healthy hygiene routines. This treatment allows an improvement in the efficiency of sleep, latency, number of awakenings and subjective perception of sleep.

Disclosure: Nothing to disclose.

P159 | Predictors of effect for brief behavioral therapy for chronic insomnia

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Objectives/Instruction: A practical doctor still faces the problem of choice of treatment method as between CBT-I (cognitive-behavioral therapy of insomnia) that requires special training and noticeable time expenditures and pharmacotherapy associated with adverse effects and drug addiction. Although CBT-I remains preferable and most recommended method, it has low response rate (60%) according to Morin (2009). In the meantime shortened and simplified approaches have been developing in order to make CBT-I more accessible.

The objective of the present stude was to determine anthropometric, psychological and polysomnographic predictors of effectiveness of brief behavioral therapy (BBT-I).

Methods: 42 adults (14 males, 28 females, from 18 to 90 years, mean age 54 ± 14.9) meeting International Classification of Sleep Disorder-3, criteria of chronic insomnia participated in the study. Participants passed 2-week courses of treatment by BBT-I and zopiclone assigned in different orders with 2-week washout period between the courses. Primary outcome measure was determined as change of Insomnia Severity Index (ISI) between pre- and post treatment for each treatment course. Criterion of response was defined as the reduction of ISI score >7 points from baseline. Baseline measures administered to determine predictors of response were: clinical examination, Beck Depression Inventory, State-trait anxiety inventory, Big Five Questionnaire, Dysfunctional beliefs about sleep scale, Sleep hygiene index, 1-night Polysomnography.

Results: After BBT-I phase 32% of participants (n=13) met the response criteria. After the zopiclon phase 5 participants (12%) met the response criteria. Comparison of anthropometric variables of responders and nonresponders for BBT-I demonstrated that former were younger (42.4±15.7 vs. 54.7±12.7 years, $p = 0.01$), had higher ISI score (21.5 ± 2.4 vs 17.5 ± 4.9, $p = 0.008$), higher percentage of 1 stage NREM-sleep (5.5 ± 4.8 vs 3.1 ± 1.8%, $p = 0.02$) and lower levels of empathic ability (43.5±3.8 vs 47.7 ± 5.0, $p = 0.01$), self-control of emotions (29.5 ± 5.4 vs 36.0±8.6, $p = 0.02$) and impulsivity (33.1 ± 6.2 vs 40.0 ± 7.3, $p = 0.005$) than nonresponders. Anthropometric, psychometric and polysomnographic variables of responders on zopiclone showed no statistically significant difference with nonresponders.

Conclusions: Response rate was low both for BBT-I and for zopiclone. Supposed factors of BBT-I effectiveness such as younger age and higher ISI score provide clinicians easily identifiable predictors of behavioral treatment success.

Disclosure: Nothing to disclose.

P160 | Risk of common cold in patients with nonapnea sleep disorders: a retrospective cohort study

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Objectives/Instruction: Evidence describing the associaton among nonapnea sleep disorders (NSDs), hypnotic (benzodiazepines [BZDs] or zolpidem) use, and the risk of common cold is insufficient. The present study investigated the potential effects of NSDs and hypnotic use on the risk of common cold in patients with NSDs.

Methods: This population-based retrospective cohort study used the data from the Taiwan National Health Insurance Research Database on patients who received NSD treatment between 1998 and 2011. In total, 59,476 patients with NSDs were included in the study cohort, and the reference cohort comprised 59,476 propensity score-matched patients. We conducted a Poisson regression analysis to assess the risk of common cold.

Results: The overall incidence of common cold in the NSD cohort was significantly higher than that in the reference cohort (39.0 vs 21.9 per 10 person-years). Overall, the NSD cohort exhibited a higher risk of common cold than the reference cohort, with a considerably increasing incidence rate ratio (IRR) (IRR = 1.78, 95% confidence interval [CI] = 1.75–1.81). Compared with the patients of the reference cohort without hypnotic use, those of the NSD cohort with BZD and zolpidem use had 2.34 and 1.99-fold risk of common cold (95% CI = 2.30–2.38 and 1.95–2.03, respectively).

Conclusions: NSDs and hypnotic use were associated with a higher risk of common cold.

Disclosure: Nothing to disclose.

P161 | Brain functional MRI (fMRI) study of fragrance inhalation. Any impact on sleep/wake/reward-related brain areas?

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Objectives/Instruction: The purpose of this study was to determine whether there is a neural system preferentially activated in response to olfactory stimulation using fragrances claimed to have an impact on well-being and sleep. We selected for an fMRI investigation two commercially available mixtures of fragrances (lavender, chamomile, patchouli, vetiver etc…)("Oriental" and "DeepSleep") and compared them to a control odor, which is often used in olfactory research (Phenylethylalcohol - PEA).

Methods: 30 normal-weight healthy individuals (15 men, 15 women, 20-35 years) having normal olfaction were recruited in a randomized controlled study. Fragrances were presented via an expiration-triggered (computer-controlled) olfactometer in a randomized order to both nostrils. Each odor was presented in two runs (total 6 runs) with about 10 on-off alternating blocks. After each odor presentation, the participants rated the respective odorant's intensity and pleasantness.

Results: All fragrances resulted in a significant activation of olfactory relevant areas, such as the orbitofrontal cortex, amygdala, insula and piriform cortex. However, compared to control, "Oriental" was related to enhanced BOLD signal change in the right and left caudate and a cluster which bordered the right thalamus. "Deepsleep", on the other hand, resulted in larger BOLD signal change in the thalamus and middle frontal gyrus as compared to the control. Women seemed especially reactive to "Deepsleep" as compared to men.
Additional connectivity analysis revealed that the primary olfactory cortex (piriform cortex) was significantly positively connected to other olfactory and emotionally relevant brain areas, such as the hippocampus, anterior insula and amygdala. This was the case in both fragrances and in the control odor. However, in "Deepsleep" a positive connectivity was observed between the piriform cortex and the frontal operculum and a negative connectivity to the superior temporal sulcus. Those connectivities differed significantly from the control condition. No differences were observed between "Oriental" and control.

Conclusions: The fragrances selectively activated specific brain areas which are related to reward processing in the case of "Oriental" and socio-emotional processing in the case of "Deepsleep". The results suggest that different odor mixtures may relate to specific behavioral alterations. fMRI can provide a model of neuronal mechanisms in response to fragrance stimulations.

Disclosure: Study funded by This Works.

P162 | A pilot study on a possible impact of aromas on sleep quality in subjects with mild to moderate insomnia

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Objectives/Instruction: Pilot study aimed to test method and investigate impact of fragrances claimed to improve sleep.

Methods: Twelve participants (Insomnia Severity Index 17+/- 2) entered a double-blind 3-week period home study assessing efficacy of two commercial mixed fragrances (lavender, chamomile, patchouli, vetiver…) "Oriental" ("C") and "ProSleep-Deepsleep" ("F") compared to a "placebo" ("D" - synthetic lavender fragrance). Subjects, continuously monitored with actigraphy, filled daily a sleep diary, VAS questionnaires (sleep quality), Karolinska Sleepiness Scale (KSS).
Aromas were randomly assigned (counter-balanced order). Subjects slept first 3 nights as usual. The next 4 nights, they sprayed the first aroma on the pillowcase before bedtime, evaluating their experiences at the end of the period. Following few "washing" nights they slept 4 nights with a second aroma, the same procedure continued with the 3d aroma, changing pillow for each aroma. Parametric statistics were used for actigraphy, KSS, and sleep quality measures, non-parametric for questionnaire data.

Results: In subjective evaluation (obtained from 9 subjects) "C" rated better than "F", for measures of sleep quality ($p < 0.001$). Reduced alertness (KSS) was found comparing the baseline sleep to sleep with "F" (mean difference = 1.62, P = 0.029). In 50% of subjects, impact of aromas lasted 1-2 days. No clear preference for an aroma. 80% preferred sleeping with an aroma rather than no aroma. None of the aromas affected dreams. Occasional headache and dry mouth were reported.

For actigraphy, reliable data were obtained from 6 women and 2 men (41 ± 4 years). With the placebo there was a decrease in number of immobile phases (5.57; t = 3.78, df = 7, p = 0.007) and more wake time (%) than "F" (mean difference = 158.8, p = 0.046).

With "F" there was less activity during sleep than with "D" (mean difference = −6563, $p < 0.001$) and "C" (mean difference = 9556, p = 0.030).

Conclusions: This pilot study showed validity of the methodology and an impact of the aromas differing for each fragrance, but decreasing after few days. There was discrepancy between subjective evaluation ("Oriental" rated significantly better than "Prosleep") and actigraphy (less time awake with "Prosleep").

Disclosure: Study founded by This Works.

P163 | Comparison of lemborexant with zolpidem extended release and placebo: topline results from a phase 3 study in subjects 55 years and older with insomnia

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Objectives/Introduction: We report results from a Phase 3 study comparing the dual orexin receptor antagonist, lemborexant (LEM), to zolpidem tartrate extended release (ZOL) and placebo (PBO) in subjects ≥55 years with insomnia.

Methods: Randomized, double-blind, double-dummy, parallel-group design. Subjects received PBO, ZOL (6.25mg), or LEM (5 mg or 10 mg) for 1 month at bedtime. Eligible subjects were diagnosed as having insomnia disorder (DSM-5) confirmed by sleep history, sleep diary, and polysomnography (PSG), including baseline wake after sleep onset (WASO) ≥ 60 min. Paired PSGs at Baseline, the first 2 (Nights 1/2) and last 2 (Month 1) nights of treatment were analyzed for latency to persistent sleep (LPS), WASO, and WASO in the second half of the night (WASO2H).

Results: Of 3537 subjects screened, 1006 randomized (869F/137M, mean 64 yrs) and 962 (96%) completed. Mean placebo-corrected change from baseline (minutes) at Nights 1/2 were: LPS: LEM5 -10, LEM10 -13, ZOL -6; WASO: LEM5 -33, LEM10 -42, ZOL -27; WASO2H: LEM5 -22, LEM10 -28, ZOL -15. All comparisons of LEM5 and LEM10 to both PBO and ZOL were statistically significant at $p < 0.01$. Mean placebo-corrected change from baseline (minutes) at Month 1 were LPS: LEM5 -12, LEM10 -13, ZOL +1; WASO: LEM5 -24, LEM10 -25, ZOL -16; WASO2H: LEM5 -16, LEM10 -18, ZOL -10. All comparisons of LEM5 and LEM10 to both PBO and ZOL were statistically significant at $p < 0.01$. There were 6 subjects with serious adverse events (4 ZOL; 2 LEM5), none treatment-related. Non-serious AEs were mostly mild or moderate in severity. The most common AEs (>5% in any active treatment group and >PBO) were headache and somnolence.

Conclusions: Lemborexant improved both sleep onset (LPS) and sleep maintenance (WASO) compared to both PBO and ZOL, statistically significantly and with clinically meaningful benefit. Lemborexant also improved sleep maintenance in the latter half of the night in these older individuals with sleep maintenance difficulties. Results of this Phase 3 pivotal trial are encouraging and support continued development of lemborexant for the treatment of insomnia disorder.

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P164 | Activity tracker as a self-help device in insomnia — an intervention study

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Objectives/Instruction: Negative self-perceptions and adverse behavioural coping are sustaining factors in chronic insomnia. Sleep logs are used to support behavioural changes and awareness of sleep patterns in patients with insomnia. Activity trackers, increasingly popular as self-help devices, produce more objective follow-up data about sleep for the patients.

Methods: Clinical sleep consultation patients (N = 81, mean age 39 years, 36 males and 45 females) suffering from persistent insomnia were randomized to two groups. Cases wore activity trackers as wristbands and simultaneously filled in sleep logs for two weeks, while controls only filled in sleep logs. Insomnia symptoms (measured by Insomnia severity index) and life quality (measured by 15D quality of life questionnaire) were assessed before and after the two weeks of follow-up. The patients' experiences about activity tracking were collected by a questionnaire.

Results: Insomnia symptoms were statistically highly significantly reduced in the group wearing activity trackers ($p < 0.0005$) and their life quality was statistically significantly increased (p = 0.014). There were no statistically significant changes in the control group. Subjective

benefits of the activity tracking were reported by 59% of the patients, no effects by 26% and adverse effects by 8%. A change in health behaviour during activity tracking was reported by 34% of the patients.

Conclusions: Activity tracking can be useful for some patients with chronic insomnia. It offers more objective information about one's sleep pattern than sleep logs, and it seems to motivate patients to behavioural changes, e.g. to increase daytime physical activity. Relieving of insomnia symptoms is probably mediated by physical exercise and new perceptions about sleep.

Disclosure: Nothing to disclose.

P165 | Altered wake resting-state brain activity in insomnia detected with high-density EEG: frequency- and time-domain approaches

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Objectives/Introduction: Insomnia Disorder (ID) is defined not only by subjective sleep complaints, but also by accompanying complaints about daytime functioning. Finding the neural correlates of daytime complaints could thus be of value in understanding the underlying pathophysiology of ID. In a series of wake resting-state studies, we aimed to utilize the high spatiotemporal resolution of high density EEG (HD-EEG) to detect neural correlates of daytime complaints in ID, using both frequency- and time-domain approaches.

Methods: 256-channel HD-EEG with simultaneous lead II ECG was recorded from 32 people with ID and 32 age- and sex-matched controls during evening wakeful rest of 5-min duration with eyes closed. Relative spectral power at each frequency from 0.5 to 45 Hz was estimated with Welch's method. Two time-domain analyses were carried out: Heartbeat-evoked potential (HEP) was obtained by averaging EEG segments time-locked to ECG R-waves. Duration and occurrence indices of 4 microstate classes were computed through k-means clustering of momentary EEG topographies. All derived measures were compared between groups by means of nonparametric statistics.

Results: As compared to controls, people with ID showed spatially widespread relative power increase within the beta frequency range, centered at 19 Hz (cluster permutation test: $p < 0.03$). People with ID, but not controls, showed a late positive component in their HEP, occurring frontally 376–500 ms after the ECG R-wave (cluster permutation test: $p < 0.02$). Microstate class B, previously suggested to be related to experiencing comfort, was deficiently expressed in people with ID – the global explained variance and the mean duration of class B microstates were lower as compared to controls (Wilcoxon rank-sum test: $p = 0.001$ and 0.006, respectively).

Conclusions: Frequency- and time-domain analyses of HD-EEG have revealed multiple subtly altered spontaneous electrophysiological processes in ID, which may involve heightened cortical arousal, hypersensitivity to interoceptive inputs, and deficits in experiencing comfort. The findings are in line with previous questionnaire, experience sampling, and task-based studies.

Disclosure: Nothing to disclose.

P166 | Weekly changes in sleep and insomnia symptoms during acute treatment of persistent insomnia with behavioural or pharmacological therapy

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Objectives/Introduction: Cognitive-behavioural therapy (CBT) and medication are the main treatment options for persistent insomnia. The objective of this study was to explore weekly sleep changes during acute treatment with behavioural therapy or medication.

Methods: This study reports secondary analyses from a two-site (Québec, Canada; Denver, USA) randomized controlled trial. Participants were adults with persistent insomnia who were randomized to a 6-week treatment involving behavioural therapy (BT) or zolpidem (ZOL). Participants completed a daily sleep diary and the Insomnia Severity Index (ISI) on a weekly basis. Linear mixed models were computed to examine group (BT, ZOL) × time (baseline, six treatment weeks) interactions on the ISI score and sleep diary parameters: sleep onset latency (SOL), wake after sleep onset (WASO), total wake time (TWT), total sleep time (TST), sleep efficiency (SE), and sleep quality (SQ).

Results: The sample size was 211 participants (45.6 ± 14.9 years; 63% women). Significant group × time interactions were found for ISI (p=.001), TWT ($p < 0.001$), TST ($p < 0.001$), SE ($p = 0.003$), and SQ ($p = 0.016$), but not for SOL ($p = 0.139$) or WASO ($p = 0.082$). Contrasts revealed that: (1) the improvement on the ISI was greater for ZOL vs. BT from week 1 to week 2 (-4.4 vs. -2.1), with a lower ISI score for ZOL in week 2 (12.2 vs. 14.0); (2) the improvement in TST and SQ was greater in ZOL vs. BT from baseline to week 1 (+45.5 vs. -32.7 min; +0.5 vs. +0.2), with a longer TST for ZOL in weeks 1-6 (410.9-423.4 min vs. 332.6-368.5 min) and a better SQ in week 1 (3.2 vs. 2.9); and (3) the improvement in TWT and SE was greater for BT vs. ZOL from week 1 to week 2 (-17.7 vs. +1.8 min; +4.1 vs. +0.1%), with a shorter TWT for BT in weeks 2-6 (67.6-76.4 vs. 90.9-104.0 min).

Conclusions: Results suggest that throughout a six-week treatment regimen, ZOL was associated with increased TST, and BT with reduced TWT. Other sleep parameters changed more rapidly with ZOL or BT but the absolute differences tended to disappear toward the end of treatment. Future studies should investigate how these changes evolve over time.

Disclosure: C.M. Morin has received honorarium to serve as a consultant on an advisory board for Philips and as speaker for Merck. This study was supported by a National Institute of Mental Health grant (MH91053).

P168 | Cognitive and behavioural therapies in the treatment of insomnia: a systematic meta-analysis of all the literature

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Objectives/Instruction: Insomnia is a major public health problem considering its high prevalence, impact on daily life, comorbidity with other disorders and societal costs. Cognitive behavioral treatment for insomnia (CBTI) is currently considered to be the preferred treatment. However, no meta-analysis exists of all studies using at least one component of CBTI for insomnia, which also uses modern techniques to pool data and to analyze subgroups of patients.

Methods: We carried out a comprehensive literature search and combined terms indicative of insomnia (e.g., insomnia, sleep initiation and maintenance disorders) with those of psychological treatment (e.g., psychotherapy, behavior therapy). Studies were included if

1. they were a randomized controlled trial (RCT)
2. investigating CBTI or at least one component of it
3. among adults
4. with insomnia
5. in comparison with a non-active control group and
6. reporting on sleep diary outcomes.

We extracted data on patient-, treatment- and study variables. Overall effects were calculated as well as univariate and multivariate effects for different subgroups.

Results: We included 87 RCTs, comparing 118 treatments. Overall, the interventions had significant effects on: insomnia severity index (g=0.98), sleep efficiency (g=0.71), Pittsburgh sleep quality index (g=0.65), wake after sleep onset (g=0.63), sleep onset latency (g=0.57), number of awakenings (g=0.29) and sleep quality (g=0.40). The smallest effect was on total sleep time (g=0.16). Face-to- face treatments of at least four sessions seem to be more effective than self-help interventions or face-to-face interventions with fewer sessions. Otherwise the results seem to be quite robust (similar for patients with or without comorbid disease, younger or older patients, using or not using sleep medication).

Conclusions: We conclude that CBTI, either its components or the full package, is effective in the treatment of insomnia.

Disclosure: Nothing to disclose.

P169 | Usage transitions between natural products, over-the-counter and prescription sleep aids: a longitudinal cross-lagged analysis

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Objectives/Introduction: Natural products (NP), over-the-counter (OTC) and prescription (Rx) sleep aids are commonly used for managing insomnia symptoms. However, little is known about the transition patterns between different agents or how prior exposure to one agent might influence subsequent sleep aid choice. Therefore, the aim of this study was to map out the temporal patterns between NP, OTC and Rx use in a Canadian population-based sample.

Methods: Data were derived from a longitudinal study on the natural history of insomnia across seven time points, over five years. Participants were 3416 adults (mean age = 49.7±14.7 years old; 62% women) who reported their NP, OTC and Rx use in the previous 12 months. Longitudinal cross-lagged analyses were conducted to explore sleep aid usage patterns at two consecutive time-points (i.e., T-1 and T). Missing data from a total of 18515 observations were excluded from analysis (T-1 ≈ 20%, T ≈ 1%). Usage differences were computed using the X^2 test. The impact of prior exposure was expressed as a relative risk (RR) with 95% confidence intervals (95% CI). Sampling weights were applied to all analyses to adjust for partial non-response.

Results: Participants' prior exposure to NP, OTC and Rx sleep aids was associated with differences in their subsequent choice of agent ($p < 0.0001$). Compared to non-users, the RR (95% CI) for subsequent NP use was: 11.90 (10.87, 13.16) for NP users, 2.87 (2.54, 3.25) for OTC users and 1.75 (1.56, 1.96) for Rx users. Similarly, the RR (95% CI) for subsequent OTC use was 14.08 (12.82, 15.87) for OTC users, 2.88 (2.52, 3.30) for NP users and 1.65 (1.45, 1.91) for Rx users. For subsequent Rx use, the RR (95% CI) was 16.67 (15.38, 18.18) for Rx users, 1.74 (1.52, 1.90) for OTC users and 1.58 (1.44, 1.75) for NP users.

Conclusions: Observed temporal patterns in sleep aid use defy current assumptions of a step-wise progression from NP/OTC to Rx use. Findings further highlight a relatively stable usage trajectory where the same agent is much more likely to be continued, suggesting a role for mediating factors in the selection of sleep aids.

Disclosure: Research supported by the Canadian Institutes of Health Research (MOP#115103) and FRQNT, Québec, Canada.

P170 | Therapist-guided Internet-delivered cognitive behavioral therapy for comorbid insomnia and depression, compared to depression treatment and placebo - a randomized trial

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Objectives/Instruction: Comorbid insomnia and depression is common, but seldom adequately treated. Cognitive behavioral therapy (CBT) for depression is recommended for these patients in most guidelines, but the most common treatment is antidepressants, sometimes combined with sleep medication. Insomnia treatment only (CBT-i), seems more effective than CBT for depression only, in treating comorbid insomnia and depression, but effects might be enhanced if the methods were combined. This trial tries a new combination treatment, encompassing methods from both CBT-i and CBT for depression. The new treatment is compared to CBT for depression with a placebo intervention for insomnia, representing the best-case treatment as usual. The hypothesis is that a combined CBT for insomnia and depression is more effective than CBT for depression with placebo.

Methods: The setting is the Internet Psychiatry Clinic, part of the Stockholm County public health care, Sweden. Participants are 140 adults diagnosed by psychiatrists with insomnia and major depression, randomized to either CBT for insomnia and depression, or CBT for depression with placebo intervention for insomnia. The treatments are 12 weeks long, delivered via the Internet and psychologist-guided. Post-treatment assessments are both self-rated and performed face-to-face by psychiatrists blind to treatment condition. Follow-ups are done after 6 months and 3 years. Primary outcome measures are Insomnia Severity Index and Montgomery Åsberg Depression Rating Scale - Self rated. Secondary outcomes are diagnoses, clinical improvement, sleep diary, objective sleep data (actigraphy), neurocognitive functioning measured with computerized tests and other psychological measures (behaviors, attitudes, stress, worry, anxiety).

Results: By the date of submission of this abstract, 136 participants have been included and treated, inclusion continues during the spring of 2018. Primary outcome results pre-post for 140 participants will be processed and presented at the conference. Analyses will be done using hierarchical linear mixed effect modeling and a p-value of .05.

Conclusions: At the conference, preliminary conclusions will be made about whether the hypothesis is confirmed or rejected, based on short term data (pre-post).

Disclosure: Nothing to disclose.

P171 | Evaluation of functional capacity through the 6-minute Walk Test in adults with insomnia assisted in basic health units - observational study

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Objectives / Introduction: Insomnia is one of the most common sleep disorders, characterized by difficulty in initiating and / or maintaining sleep and by daytime symptoms that impair the occupational functioning, interfering in the daily activities of the individuals, and may even cause physical incapacity. Therefore, the need to evaluate such repercussions becomes important in the search for further clarification on the subject, and the 6-Minute Walk Test (TC6M) is a good evaluation tool.

The objective of this study was to evaluate functional capacity in adult patients with insomnia assisted in Basic Health Units (BHUs) of Divinópolis, Minas Gerais, Brazil.

Methods: The study was a cross-sectional observational study, carried out with a consecutive sample of convenience, recruited from BHUs in the city of Divinópolis, being approved by the Ethics Committee in Research with Humans of the university, under protocol number 1,475,521/2016. All patients underwent 6MWT after being clinically evaluated and responding to the Insomnia Severity Index (ISI) questionnaire, with the presence of insomnia being necessary to perform the same.

Results: The sample consisted of 42 patients, 78.5% female, mean age 55.7 ± 17.4 years and body mass index of 25.4 ± 4.7 kg / m². Of these, 59.5% of the patients presented mild insomnia, 26.1% moderate insomnia and 14.2% severe insomnia.

Regarding the distance covered in the 6MWT and the insomnia severity, the average distance traveled was 422.5 ± 118.0 meters, 459.7 ± 123.2 meters, 345.9 ± 43.9 meters respectively of the groups with mild, moderate and severe insomnia. Patients with severe insomnia had a shorter walking distance compared to patients with mild insomnia (p = 0.030) and moderate insomnia (p = 0.007), with a statistically significant difference.

In addition to being statistically significant, it can be stated that there was a clinical difference between the distances traveled, as suggested by the study by Bohannon and Crouch (2016), in which a difference greater than 30.5 meters in the 6MWT is considered clinically significant.

Conclusions: The severity of insomnia in this population interfered directly with the distance covered in the 6MWT and, therefore, in the functional capacity of these patients.

Disclosure: Nothing to disclose.

P172 | Mismatch between subjective perception and objective findings on sleep time in insomnia patients

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Objectives/Instruction: Polysomnography in insomnia patients has often revealed a mismatch between the subjective perception and the objective findings of sleep time. We aimed to examine this mismatch and investigate the characteristics associated with the mismatch in insomnia patients.

Methods: In 121 insomnia patients, findings of nocturnal polysomnography, responses to a subjective questionnaire after sleep, and medical records were reviewed. The patients were classified into two groups-total sleep time (TST) underestimation group (N=56) and TST non-underestimation group (N=65)-depending on the presence of a 2-h difference between the subjective and the objective TSTs. The demographic characteristics, type of insomnia, use of sleep-promoting medication, polysomnography findings, and subjective reports were compared between the two groups.

Results: Nocturnal polysomnography showed significantly longer TST($p<0.001$) and shorter sleep latency ($p< 0.001$) than the subjectively reported values. In comparison with the TST non-underestimation group, the TST underestimation group were significantly older ($p=0.043$) more likely to have longer TST($p=0.012$), shorter sleep latency ($p=0.002$), and a smaller proportion of slow-wave sleep ($p<0.001$) in the polysomnographic analysis and more likely to show shorter TST($p<0.001$) and shallower sleep($p<0.001$) in the subjectively reported values.

Conclusions: We found a significant mismatch between the subjective perception and the objective findings of sleep time as determined using polysomnography in insomnia patients. Underestimation of sleep time may be more closely associated with the proportion of slow-wave sleep, which reflects sleep depth, than with objective TST.

Disclosure: Nothing to disclose.

P173 | Associations of heart rate variability with insomnia and the influence of sleep apnea (SA)

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Objectives/Instruction: Insomnia is proposed to be a condition of "hyperarousal". However, a recent systematic review found little evidence of autonomic dysfunction in insomnia (Dodds et al, 2017). Population-based studies determining the relationship of insomnia with autonomic function, measured by heart rate variability (HRV) are scarce. The aim of this study was to determine the relationship of HRV with insomnia in a population-based sample of men. We also considered insomnia comorbid with sleep apnea (COMISA).

Methods: The Men Androgen Inflammation Lifestyle Environment and Stress (MAILES) Study conducted home-based full polysomnography (PSG, Embletta X100) in 837 men aged ≥40y. Insomnia (ICSD-3 criteria) was assessed by questionnaire. Time domain HRV measures (HR, average heart rate; SDNN, standard deviation of normal-to-normal RR-intervals; RMSSD, root mean-square of successive differences of N-N intervals) were calculated from the PSG ECG channel (non-rapid eye movement (N-REM):n=761, REM sleep: n=671). To compute respiratory sinus arrhythmia (RSA), inspiratory onsets were automatically detected from RIP signals to obtain the magnitude of phase-averaged RR modulation. Linear regression models determined associations of HRV with 1) insomnia (dichotomous, with/without SA) and 2) COMISA components (entered as dummy variables) adjusted for age, smoking, body mass index, blood pressure and apnea-hypopnea index (models with overall insomnia only). Unstandardised B coefficients (SE) are presented.

Results: Overall insomnia prevalence was 12.2% (n=93), insomnia alone occurred in 5.5% (n=41) and COMISA in 6.7% (n=50). There were no significant associations of insomnia or COMISA components with HR, SDNN, or RMSSD. Compared to men without insomnia, overall insomnia was associated with significant reductions in RSA [NREM: -4.5 (1.8) p=0.014; REM: -4.8 (1.6), p=0.002]. COMISA was associated with decreased RSA [NREM: -4.6 (2.5), p=0.067; REM: -4.8 (2.2) p=0.030] compared to men with neither insomnia nor SA, whereas men with only insomnia showed non-significant decreases in RSA [NREM: -3.8 (2.8), p=0.17; REM: -4.2 (2.3), p=0.062].

Conclusions: In community-dwelling men, insomnia showed inconsistent associations with HRV measures. However, insomnia, particularly when comorbid with sleep apnea was associated with reductions in HRV directly linked to respirations (RSA), consistent with autonomic dysregulation potentially more reflective of OSA than insomnia. Further work in larger samples is required.

Disclosure: Nothing to disclose.

INSOMNIA 2

P174 | The significance of nocturnal blood pressure change in insomnia patients

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Objectives/Instruction: Insomnia is a prevalent sleep disorder that is associated with cardiovascular disease and its precursors,

such as hypertension and blood pressure (BP) non-dipping. Previous studies have suggested that the underlying mechanism by which insomnia is associated with hypertension is physiological hyperarousal. Several studies have suggested that insomnia is a state of 24-hour hyperarousal and other studies have suggested night-time hypervigilance.

Methods: Polysomnographic findings, pre-test (evening) BP values, post-test (morning) BP values and clinical data of 1185 subjects were analyzed. Subjects were divided into six groups based on respiratory disturbance index (RDI), periodic limb movements in sleep (PLMS) and insomnia: reference (simple snoring, PLMS≤15 and RDI < 5), insomnia (PLMS≤15, RDI < 5 and insomniac symptoms), high PLMS (PLMS>15 and RDI < 5), mild (5≤RDI< 15), moderate (15≤RDI< 30) and severe obstructive sleep apnea (OSA) (RDI≥30). Pre and post-test systolic blood pressure (SBP) and diastolic blood pressure were compared among the six groups used repeated measure ANOVA. We adjusted for age, gender, body mass index (BMI) and hypertension medication.

Results: There was significant difference between six groups in age and BMI, not in gender. Insomnia group had lowest sleep efficiency among six groups. (%, mean±SD; insomnia, 79.3±13.1 vs. reference, 85.2±12.5; mild OSA, 83.2±12.3; moderate OSA, 84.0±10.2; severe OSA, 82.9±11.9; high PLMS, 80.3±12.0, p=0.008) Severe OSA group had highest pre-test (evening) SBP (mmHg, mean±SD; 143.7±17.8) and insomnia group had lowest post-test (morning) SBP. (mmHg, mean ± SD; 125.7±17.8) Adjusting for age, gender, BMI and hypertension medication, the mean decrease of SBP in insomnia group was most prominent. (△SBP, mmHg, mean±SD; insomnia, 14.1±14.5 vs. reference, 6.7±11.7; mild OSA, 9.3±16.6; moderate OSA, 7.8±15.4; severe OSA, 4.8±16.6; high PLMS, 7.3±19.3, $p < 0.001$).

Conclusions: SBP of insomnia group decreased most drastically among the six groups. Although insomnia patients had the lowest sleep efficiency, they slept almost 80% of the test time. These results suggest that, insomnia is a state of night-time hypervigilance and improving night-time sleep may reduce sympathetic hyperactivity.

Disclosure: Nothing to disclose.

P175 | Differences exist in metabolic rate in insomnia compared to healthy sleepers: evidence of physiological hyperarousal in insomnia

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Objectives/Instruction: The hyperarousal concept of insomnia has been proposed to be the cardinal feature of the disorder. Research has shown increased cognitive and physiological activation of body systems in insomnia patients during either the night or day compared to healthy sleeping controls. However, findings are not consistent and evidence of physiological dysfunction over 24 hours is limited. We sought to determine if whole-body metabolic rate is increased in insomnia.

Methods: A systematic review was conducted. PubMed, Web of Science, CINAHL, PsycINFO, EMBASE and Scopus databases were searched for observational and interventional studies measuring metabolic rate (*oxygen consumption measured using calorimetry*) in insomnia. Metabolic rates in adults (18+years) were extracted for insomnia and healthy-sleeping controls for each study.

Results: The primary search identified 1506 records with 963 abstracts after duplicate removal. 35 full-text articles meeting inclusion criteria were reviewed. Four articles were included in the final review. A total of 75 participants (n=44 insomnia; n=31 controls) had metabolic measurements. One study reported increased oxygen consumption (O_2) across 24-h in insomnia (300 ml/min) vs. healthy-sleeping controls (266 ml/min), and another revealing increased daytime O_2 in insomnia (266 vs 256 ml/min: controls). In contrast, when determined at a single timepoint (~8am) there was no difference in O_2 between insomnia patients and controls. The fourth study revealed lorazepam reduced O_2 during the night compared to no drug in insomnia patients only.

Conclusions: Overall it appears that metabolic rate is increased across 24 hours in insomnia. However, these increases in metabolic rate in insomnia were minor compared to good-sleeping controls and the clinical significance is not clear. Larger, methodologically robust studies are required to confirm these findings and the effect of any increase in metabolic rate on sleep-wake disturbances or pathophysiology.

Disclosure: Nothing to disclose.

P176 | Acceptability, tolerability, and potential efficacy of cognitive behavioural therapy for Insomnia Disorder subtypes defined by polysomnography: a retrospective cohort study

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Objectives/Introduction: In this retrospective cohort study, we describe acceptability, tolerability and potential efficacy of cognitive behavioural therapy (CBT) in Insomnia Disorder subtypes, derived from polysomnography (PSG): insomnia with normal-sleep duration (I-NSD) and insomnia with short-sleep duration (I-SSD).

Methods: All research volunteers were offered access to digital CBT, single component sleep restriction therapy and face-to-face group CBT. Follow-up occurred at three months post-treatment using the insomnia severity index (ISI).

Results: 96 participants (61 females, mean age of 41 years) were grouped into either normal-sleep (n=53) or short-sleep (n=43). CBT was acceptable to 63% of participants (normal-sleep=31, short-sleep=29), with 28 completing therapy (tolerability: normal-sleep=11, short-sleep=17). For potential efficacy, 39 (normal-sleep=20, short-sleep=19) out of 96 participants (41%) completed a follow-up ISI assessment. In this reduced sample, mean (SD) ISI scores decreased across both groups (normal-sleep: 18.0 (4.0) to 10.7 (4.6); short-sleep: 16.5 (5.5) to 11.0 (6.3); both $p < 0.01$). Those with normal-sleep were more likely to respond (≥6-point ISI reduction) to CBT compared to short-sleep (70%, $n = 14/20$ vs. 37%, $n = 7/19$ respectively, $p = 0.038$). In this cohort, 60 (63%) of participants attempted CBT and of those 28 (47%) completed therapy.

Conclusions: Results may be comparable to clinical participants with implications for the successful translation of CBT for insomnia.

Disclosure: This was not an industry supported study. Sleepio® provided digital cognitive behavioural therapy for insomnia to the study without cost. The authors made all decisions regarding publication and reporting of these results: Sleepio® did not play any role in these decisions. Dr. Miller receives a salary from Big Health (Big Health Ltd., Sleepio®). Dr. Espie is the co-founder and Clinical and Scientific Director of the CBT programme (Big Health Ltd., Sleepio®). All other authors report no conflicts of interest.

P177 | Feasibility and preliminary efficacy of brief behavioural treatment for insomnia after brain injury: a case series

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Objectives/Introduction: Brain injury is one of the leading causes of death and disability worldwide with sleep disturbances reported to be part of the sequelae of symptoms following the injury. Specifically, insomnia symptoms, such as problems falling or staying asleep, are reported by as many as 50% of individuals' post-brain-injury (Mazwi, Fusco, & Zafonte, 2015), with 30% meeting the diagnostic criteria for an insomnia syndrome. This study investigated the feasibility and preliminary efficacy of Brief Behavioural Treatment for Insomnia (BBTI; Buysse et al, 2011) in a community sample of brain injury patients.

Methods: Six participants (age range 49 to 70 years, males) were recruited via Headway (Brain Injury Charity) to participate in a 4 session BBT-I intervention including a month and two month follow up. Participants reported sleep disturbances and also screened with the Sleep Condition Indicator (Espie et al, 2014). Participants responded to a semi-structured clinical interview in addition to measures of depression and anxiety (HADS; Zigmond and Snaith 1983) and sleep quality (PSQI; Buysse et al, 1989). A sleep diary was recorded throughout the BBT-I and at the 2 follow up points.

Results: Visual analyses of the sleep diary data were performed on a case-by-case basis and statistically confirmed using Kendall's Tau-b. More specifically decreasing Total Wake Time ($p < 0.001$) and Sleep Efficiency ($p < 0.001$) that were sustain at both follow ups. Additional changes in measures of insomnia symptoms and depression were evident in the cases that exhibited response to the intervention. Additionally, participants rated the intervention high on acceptability as a treatment.

Conclusions: Results from our study provide convincing preliminary evidence of Brief Behavioural Treatment for Insomnia (BBTI) being not only feasible to use in individuals with brain injury but also generally efficacious in alleviating both the post-brain-injury insomnia symptoms and the coexisting mental health complaints.

Disclosure: Nothing to disclose.

P178 | Insomnia symptoms predicts peri-partum psychopathology, stress reactivity and suicidality

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Objectives/Instruction: Depression and anxiety symptoms are commonly experienced by women during the peri-partum period and may have negative consequences on mothers and newborns. Changes in sleep quality and especially insomnia are also typical throughout pregnancy and have been associated with adverse outcomes including peri-partum psychopathology. On this basis reasoning that identifying women at high risk of developing insomnia may have important clinical implications on maternal-fetal outcomes, we aimed to study stress-related sleep reactivity, as a risk factor to developing insomnia, and its association with peri-partum psychopathology in pregnant women.

Methods: Sixty-two pregnant women (mean age 33.6±3 years, 20.6±0.6 weeks of pregnancy) were evaluated during their routine visit at the Gynecological Unit of the University of Pisa, Italy, using the Insomnia Severity Index (ISI) for insomnia symptoms, the Ford Insomnia Response to Stress Test for sleep-reactivity (FIRST), the Perceived Stress scale (PPS) for perceived stress, Edinburgh Postnatal Depression Scale (EPDS) for peri-partum depressive symptoms, Zung Self Rating Anxiety Scale (SAS) for anxiety symptoms.Item number 10 of the EPDS was used to evaluate sucidality. T test was used to calculate differences in means between women with insomnia symptoms vs non insomnia symtpoms. Unilinear/multiple and logistic regressions have been performed to study correlations between variables.

Results: Pregnant women with insomnia symptoms were the 27.8% and insomnia symptoms were correlated with greater perceives stress and stress related sleep reactivity (respectively PSS:

r=0.47, $p < 0.001$, FIRST $r = 0.38$, $p = 0.002$), greater depressive, anxiety symptoms and suicidality (respectively EPDS: r=0.31, p=0.01, SAS r=0.30 p=0.01, item 10 EPDS r: 0.2, p=0.03).

Conclusions: Pregnant women with greater insomnia symptoms may suffer from greater psychopathology such as anxiety, depressive symptoms and suicidality. They may also suffer from dysregulation in perception and reactivity to stress. It should be of importance to evaluate insomnia symptoms during pregnancy to prevent and treat insomnia, psychopathology and their negative consequences on maternal-fetal outcomes.

Disclosure: Nothing to disclose.

P179 | A systematic review and network meta-analysis of complementary and alternative interventions for insomnia

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Objectives/Introduction: Patients with insomnia disorder often use Complementary and Alternative Interventions (CAI) as over-the-counter (OTC) antihistamines, aromatherapy, foot reflexology, homeopathy, meditative movement therapies, moxibustion, music therapy and yoga. The National Institute of Health (NIH, 2005) convened that there is insufficient evidence to support these interventions. The aim of this study was to evaluate the efficacy of CAIs through a systematic review and network meta-analysis of randomized trials .

Methods: PubMed, CINHAL, PsycInfo, and PsycArticles were searched from 1980 to End 2015. Twenty-seven randomized control trials were included evaluating CAI's efficacy in patients with insomnia disorder according to international diagnostic criteria. Six classes of treatment (dietary supplements, exercise, light, melatonin, mindfulness, valerian) and two classes of control conditions (waiting list, placebo) were identified in the network. Risk of biases was assessed through a checklist based on the Cochrane Collaboration′s tool. Outcomes were grouped in two main concepts: subjective sleep quality (based on sleep efficiency index reported in sleep diaries or, if this was not available, questionnaires) and objective sleep quality (based on sleep efficiency index obtained through polysomnography or, if this was not available, actigraphy). Cohen′s d at 95% confidence interval (CI) was calculated to assess the effect sizes of each treatment class as compared with waiting list.

Results: Risk of bias assessment indicated a possible high risk of selection bias in our sample of studies. No significant effect was found for any of the six CAI treatment evaluated neither on subjective nor objective sleep quality (for all comparisons in the network $p > 0.05$).

Conclusions: We conclude that currently there is insufficient or negative evidence to support CAI intervention for insomnia disorder. There is a call for ameliorating the availability of evidence-based therapies, as cognitive-behavior therapy for insomnia.

Disclosure: Nothing to disclose.

P180 | Does preoperative insomnia explain persistent pain after breast cancer treatments?

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Objectives/Introduction: Persistent pain is a common ramification of breast cancer treatments, especially breast surgery, that impairs patients' quality of life significantly. Several risk factors for persistent postoperative pain in general have been identified, such as previous pain and operation type, but these factors explain only a small proportion of the development and maintenance of persistent post-treatment pain. In recent years, sleep has received growing interest as a potential modifiable risk factor for pain for its diverse effects on physical and mental health.

Methods: This study was part of a larger, prospective study conducted at the Breast Surgery Unit, Helsinki University Hospital and aimed to examine preoperative insomnia as a risk factor for persistent post-treatment pain 12 months after breast cancer surgery. Insomnia was categorized as absence of insomnia, occasional insomnia, and nightly insomnia. Probability of moderate to severe pain (vs. no or mild pain) was modeled using binary logistic regression. Potential confounders in the fully adjusted model were age, body mass index, previous chronic pain, preoperative pain in the operative area, axillary operation type, smoking, depressive symptoms, and menopausal symptoms. Also, the relationship between preoperative insomnia and preoperative pain was studied.

Results: According to logistic regression analysis on 698 women, the risk of preoperative pain was 2.32-fold [95% confidence interval (CI) 1.02-5.28, p=.045] after full adjustments among patients with nightly insomnia compared with patients without insomnia. In the crude model, nightly insomnia was associated with 2.26-fold (95% CI 1.34–3.80, $p = 0.002$) risk of persistent post-treatment pain. However, after full adjustments that association failed to reach statistical significance and was largely explained by menopausal symptoms.

Conclusions: This study does not give support for preoperative insomnia as an independent risk factor for persistent post-treatment pain in breast cancer patients. The findings suggest that preoperative insomnia is tightly associated with preoperative pain, but other factors appear to play a more prominent role in the transition to persistent pain. More longitudinal research is needed on the subject with

validated insomnia questionnaires as well as on the role of menopausal symptoms in pain persistence among breast cancer patients.

Disclosure: Nothing to disclose.

P181 | First Georgian digital cognitive behavioral therapy (CBT) version for patients with insomnia. Primary data on medical efficacy and adherence

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Objectives/Instruction: Up to 20000-40000 people in Georgia may need medical help for insomnia. Cognitive Behavioral Therapy of insomnia (CBT-i) currently is not implemented in Georgia. Aim of our study was to evaluate innovative Georgian internet delivered CBT version for insomnia (ICBT-i) by means of therapeutic efficacy, compliance and ease to handle.

Methods: Thirty six patients: 22 women and 14 men, aged from 19 to 64 years diagnosed with insomnia were enrolled into the preliminary assessment of Georgian digital CBT program. Inclusion criteria: age 18 >, access to the internet, enough experience in using electronic devices. Each patient had face to face meeting with the investigator, who explained how to use the program. All patients got therapists support via e-mail or telephone during the ICBT. Clinical efficacy was evaluated by means of the Insomnia Severity Index (ISI) before the ICBT and 1 month after completion. Compliance was checked by number, dates and duration of visiting the web page and completed modules. Ease to handle of the CBT program was rated by patients in a special review field.

Results: Seventeen (47%) out of 36 patients accomplished full ICBT-i course. Mean ISI in this group dropped from 19.1 to 7.9 ($p < 0.05$), showing significant therapeutic effect immediately after the CBT. Twelve patients dropped out from the first module (33%). Reasons for stopping the CBT-i were: problems with using PC (4 patients older than 50 years), bad compliance - 7 patients. Seven more patients (20%) stopped at the sleep restriction module, finding difficult accomplish sleep restriction related tasks. Feedback regarding ease to handle the ICBT-I showed that patients would prefer to have simpler explanations and less text to read. In general, patients find it understandable and simple to use. Majority of patients above 50 years (62%), regardless of adherence, would prefer face-to face sessions to ICBT.

Conclusions: These data suggest that Georgian ICBT-i version is a promising therapeutic tool, comparable with international analogues by means of efficacy and adherence. Further study involving high amount of patients and long term follow up are required for final assessment of therapeutic efficacy and sustainability of results.

Disclosure: Source of funding: Shota Rustaveli Georgian National Science Foundaiton (SRNSF) Applied Research Grant

P182 | Sleep disturbance and the risk for cognitive decline: assessment of visual attention components in patients with insomnia

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Objectives/Instruction: Chronic primary insomnia (CPI) is a highly prevalent sleep disorder in subjects >50 years of age and related to psychological distress. As both sleep deprivation and increased stress susceptibility have been shown to represent risk factors for neurodegeneration, CPI patients may be subject to a higher probability for developing progressive cognitive impairment. In fact, in patients with CPI, lower sleep quality has been found to be associated with hippocampal atrophy and cognitive decline. Similar brain and cognitive changes prevail in patients with mild cognitive impairment (MCI), who bear an increased risk for developing dementia. Our own previous work in MCI patients, applying the conceptual framework of the 'theory of visual attention' (TVA), has identified an elevated perceptual threshold in comparison to age-matched healthy participants in a whole report task.

Methods: In the present study we assessed a sample of 16 CPI patients and and sex matched controls with TVA-based whole report to test the hypothesis that CPI patients also show a significant increase of the perceptual threshold.

Results: Compared to a healthy control group, we found no significant differences with respect to TVA-based parameters of processing capacity. However, within the patient group, the perceptual threshold values were significantly related to the subjective evaluation of insomnia severity (ISI questionnaire). Also, higher threshold values in CPI patients were significantly correlated to polysomnography indices, i.e. sleep efficiency index, and arousal index.

Conclusions: TVA-based assessment of visual processing capacity may be able to identify CPI patients with an increased risk for cognitive decline.

Disclosure: Nothing to disclose.

P184 | Residual symptoms after remission of insomnia: associations with relapse over 4 years

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Objectives/Instruction: Chronic insomnia tends to "wax and wane" over a lifetime. The presence of residual insomnia symptoms is common, even among remitted individuals. Yet, little is known about the nature of these residual symptoms and their association with future relapse.

Methods: A population-based dataset on the natural history of insomnia (Canada, 2008-2013) was used for this secondary analysis.

Residual insomnia symptoms were investigated in those who had baseline insomnia symptoms/syndrome and achieved full remission within one year. Then, cox regressions were used to determine the hazard ratio (HR) of each residual symptom for relapse in the following 4 years. Residual symptoms were examined with an extended version of the Insomnia Severity Index (ISI), which incorporates seven additional items on sleep quality and specific sleep-related daytime impairments. In addition, Beck Depression Inventory II (BDI-II) was controlled for in investigating risks of insomnia relapse.

Results: A total of 434 participants were included in this study (mean age= 48.1 years old, range=18-94; 65.9% female). The most frequently reported residual nighttime symptoms (ISI item $\geq$ 2 on a 0-4 scale) at remission were "poor sleep quality" (SQ: 39.2%), followed by "difficulty maintaining sleep" (DMS: 27%). The most common residual daytime impairments were fatigue (24.7%), impaired mood (23%) and impaired cognition (22.6%). After controlling for concurrent depressive symptoms and physical diseases, women (95% CI HR: 1.07–1.58), those with residual DMS (95% CI HR: 1.07–1.58), poor SQ (95% CI HR: 1.08–1.62) and impairments on cognitive functions (95% CI HR: 1.06–1.62) were associated with significant risks for an insomnia relapse. Moreover, residual SQ and cognition impairment predicted relapse independently of DMS and depressive symptoms.

Conclusions: A wide range of residual symptoms exists in individuals with remitted insomnia. Notably, residual DMS is the most common nighttime symptom and it is also the only nighttime symptom associated with insomnia relapse. Additionally, an emphasis on one's perceived poor sleep quality and cognitive impairments attributed to sleep is required, as they are also related to future relapse.

Disclosure: XWJ, HI, SBB, JS, ML and CMM do not have any conflict of interest to disclose. This study was supported by a Canadian Institutes of Health Research grant (42504).

P186 | Associations between rumination about insomnia and cognitive inhibition

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Objectives/Instruction: According to cognitive models of insomnia disorder, rumination about lack of sleep and its diurnal consequences plays a crucial role in maintaining insomnia. Meta-analytic evidence shows that general and depressive rumination is related to poor cognitive inhibition. Interestingly, there is evidence of inhibitory impairments in insomnia. Despite this evidence, no studies so far investigated the relationship between cognitive inhibition and insomnia-specific rumination. The aim of this study was to explore whether poor cognitive inhibition is associated with symptom-focused rumination in a sample of individuals with a diagnosis of insomnia disorder.

Methods: The study was approved by the Departmental Institutional Review Board. Thirty young adults (22.67 ± 3.68 years, 73.3% females) diagnosed with insomnia disorder signed an informed consent and took part in the study. Insomnia condition was established using clinical interview, standardized questionnaires and sleep diary. Self-reported measures of depression, emotion regulation, and rumination about the daytime consequences of insomnia were collected. Cognitive inhibition was assessed using a Task Switching paradigm in a laboratory setting. Time of assessment was always set in the morning to control for potential confounding role of circadian effects. Hierarchical multiple regression analysis was computed with insomnia rumination as dependent variable and depression in the first step and cognitive reappraisal in the second step as control variables and reaction times (RTs) for the cognitive inhibition index of the Task Switching in the third step.

Results: Hierarchical regression analysis revealed a significant equation model ($F_{(1,28)}$ = 14.660, $p < 0.001$; R^2 = 0.628, R^2 change = 0.099) with higher depression (b = 0.781, $p < 0.001$), cognitive reappraisal (b = 0.329, p = 0.016), and poorer cognitive inhibition (b = -0.334, p = 0.014) predicting higher rumination about daytime consequences of insomnia.

Conclusions: Rumination about symptoms of insomnia in a clinical sample is associated with impaired inhibitory capacities above and beyond the role played by traditional predictors such as depression and emotion regulation strategies. If replicated, present preliminary results suggest the need to target cognitive inhibition deficits in insomnia treatment.

Disclosure: Nothing to disclose.

P187 | The effect of cognitive behavioural therapy for insomnia on quality of life outcomes: a meta-analysis of randomised controlled trials

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Objectives/Introduction: Insomnia is the most common sleep disorder, affecting 10–12% of the adult population. It profoundly impairs daytime functioning and confers risk for the development and exacerbation of mental and physical illness. The primary motivation to seek treatment among individuals with insomnia is the perceived impact of sleep loss on daytime functioning and quality of life. While cognitive behavioural therapy for insomnia (CBT-I) has been shown to engender long-term sleep improvements little is known about effects on quality of life (QoL). We conducted the first systematic meta-analysis to quantify the magnitude and reliability of CBT-I on QoL outcomes.

Methods: PubMed, EMBASE, Cochrane Library, MEDLINE, PsycINFO and PsycARTICLES databases were searched for English-

language articles without restriction on publication period. We included 15 randomised controlled trials comparing treatment for insomnia (total of 655 patients) with a control arm (total of 591 patients) in adult samples. Studies were included if the treatment for insomnia incorporated at least two of the five most widely accepted components of CBT-I (cognitive therapy, stimulus control, sleep restriction, sleep hygiene, relaxation) and a standardised measure of QoL or health-related QoL. All CBT-I delivery modalities (e.g. face-to-face, web based) and treatment durations were considered. Hedges's g at 95% confidence interval (CI) was calculated to assess effect size of CBT-I compared to the control arm. General QoL (n = 5 studies) as well as mental QoL (n=10 studies) and physical QoL (n = 7 studies) were analysed respectively.

Results: Significant but small effect sizes were found for general QoL (g = 0.353 (CI: 0.140–0.565; p = 0.001)) and mental QoL (g = 0.238 (CI: 0.107–0.369; $p < 0.001$)) while there was no reliable effect for physical QoL (g = 0.111 (CI: −0.050 to 0.273; p = 0.177)).

Conclusions: Meta-analysis of randomised controlled trials revealed an improvement with small effect size in general QoL and mental QoL after CBT-I compared to the control arm. However, physical QoL appeared to demonstrate no significant benefit from CBT-I intervention.

Disclosure: Nothing to disclose.

P188 | Insomnia in the Baependi heart cohort study

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Objectives/Introduction: Insomnia is a common health problem, contributing to behavioural and medical issues. Thus, it has significant socioeconomic costs and impact on lifetime morbidity. However, it is often overlooked despite its prevalence in developed countries where sleep is impaired by technology and light pollution. Little is known about insomnia in less urbanised populations. Baependi is a rural town in the Brazilian heartland, which has been known to maintain day-night sleep cycles according to natural daylight availability, in spite of electrification. We aim to investigate insomnia in the family-based Baependi population using the Brazilian Portuguese version of the Insomnia Severity Index (ISI) questionnaire.

Methods: Statistical and descriptive regression analysis was done on the Baependi dataset using R software. To fully take advantage of this dataset, heritability analysis is being performed in this population. Also, genome-wide array data from the Baependi project will be interrogated for associations with polymorphisms previously related with insomnia symptoms.

Results: 662 eligible participants were identified. Regression analysis indicates that 16% of the participants score can be categorised as suffering from 'clinical insomnia' based on the ISI, with the average total score of 9.4±4.8 (SD), a score corresponding 'subthreshold insomnia' on the ISI scale. More females score above the threshold clinical insomnia score (15/28), 19.4% of females in the dataset compared to 11% of males. Overall 8.4% had severe problems falling asleep, 5.7% had trouble waking up too early, and 6.2% found that their sleep problem interferes in their daily functioning. Interestingly 25.7% of overall sample were dissatisfied with their current sleeping pattern. Variables investigated in this dataset also showed a significant positive correlation between ISI scores and Beck's Depression Inventory (EDB) scores ($p = 5.6 \times 10^{-16)}$, while showing a negative correlation between the ISI scores and the Morningness-Eveningness Questionnaire (MEQ) scores ($p = 8.3 \times 10^{-3}$).

Conclusions: A distinctive aspect of this research is that there are few other studies that have administered ISI in a population-based cohort. Therefore, prevalence of insomnia using ISI is not actually known. Analysis using ISI in this dataset has laid some foundations to understanding insomnia in a population that has maintained sleep cycles according to natural daylight.

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P189 | Trazodone lowers blood pressure levels in patients with chronic insomnia: a longitudinal, electronic health record study

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Objectives/Introduction: Insomnia has been associated with an increased risk for hypertension, especially in those sleeping objectively less than 6 hours. We sought to observe the effects of trazodone on blood pressure (BP) over time independent of antihypertensive medication in a clinical sample.

Methods: The electronic medical record at Penn State Hershey Sleep Research & Treatment Center was searched using i2b2, which extracted 42 patients with a diagnosis of insomnia disorder prescribed trazodone (47.6±12.8y, 57.1% female, 30.0±5.7 kg/m2 BMI). Exclusion criteria included a diagnosis of sleep apnoea, CPAP use,

and prescription of anti-hypertensive medications after being prescribed trazodone. Mean arterial blood pressure (MAP) was calculated from systolic and diastolic BP at pre-treatment (MAP0) and at three (MAP3) and six (MAP6) months of follow-up. Data were analysed using repeated-measures t-test and ANCOVA, with sex, age, BMI, and time-to-follow-up as covariates.

Results: There were no significant changes in MAP (ΔMAP) in the overall sample. However, unadjusted analyses showed that in patients with normal BP levels (< 120/80 mmHg, n = 13) at pre-treatment MAP levels did not significantly change over time (3.0±1.7 mmHg in ΔMAP0-MAP6 p = 0.113), while they did among patients who had elevated BP (≥ 120/80 mmHg, n = 23) at pre-treatment (−5.8±1.9 mmHg in ΔMAP0-MAP6, p = 0.006). Compared to those with normal BP levels, patients who had elevated BP at pre-treatment had a significant decrease in multivariable-adjusted MAP after 6 months of follow-up (3.8±1.9 vs. −6.4±1.6 mmHg in ΔMAP0-MAP6, $p < 0.001$).

Conclusions: Our data suggest that trazodone has the potential to lower BP levels in patients with chronic insomnia above and beyond current treatment with anti-hypertensive medication. Randomized controlled trials should examine this question in patients with insomnia and objective short sleep duration, who are more likely to present with comorbid hypertension.

Disclosure: Nothing to disclose.

P190 | Preventing cardiovascular diseases in insomnia patients through CBT-I?

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Objectives/Instruction: Insomnia, cardiovascular disease (CVD) and hypertension are linked with each other in various ways. Insomnia is a risk factor for CVD (Sofi et al. 2014), sleep continuity disturbances are associated with an increased risk for hypertension (Meng et al. 2013), and hypertension is again a risk factor for CVD. So far, no studies have investigated the preventive effect of insomnia treatment on CVD. Thus, this study investigated the preventive effect of cognitive behavioural therapy for insomnia (CBT-I), the first-line treatment for insomnia, on hypertension. In detail, we investigated whether CBT-I reduces blood pressure in insomnia patients.

Methods: Forty-six patients (17 males, 29 females; 41.0 ± 14.5 years) diagnosed with insomnia according to DSM-5 criteria took part in a clinical trial at the Clinic for Psychiatry and Psychotherapy in Freiburg (Germany) between 2015 and 2017. After baseline measurement patients were randomized into either the treatment group or the waiting list control group. The intervention consisted of weekly individual sessions of CBT-I over 8 weeks. Baseline- and post-treatment measurement included 24h blood pressure measurement and assessment of sleep using the Insomnia Severity Index. Group differences were analysed using a two-way ANOVA with the between-subject factor group (treatment vs. waiting list) and the within-subject factor time (baseline vs. post).

Results: The interaction effect group × time was neither significant for systolic blood pressure (F(1,42) = 0.02, p = 0.901) nor for diastolic blood pressure (F(1,42) = 2.27, p = 0.139) indicating that there was no effect of CBT-I on blood pressure. Regarding insomnia severity, we found that there was a significant group × time interaction in so far as symptom improvement was larger in the treatment group compared to the waiting list group (F = 31.34; $p < 0.001$).

Conclusions: Results indicate that CBT-I, though improving the severity of insomnia, does not have an effect on blood pressure. Future studies should investigate if other treatments have an impact on blood pressure to reduce the risk of CVD in insomnia patients.

Disclosure: Nothing to disclose.

P191 | Social rhythm regularity moderates the relationship between sleep disruption and depressive symptoms in individuals with post-traumatic stress disorder and major depression

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Objectives/Instruction: Approximately half of individuals with post-traumatic stress disorder (PTSD) are also diagnosed with major depressive disorder (MDD), of which sleep disturbance is a frequent symptom. Sleep disturbance is associated with increased likelihood of depression relapse, poor depression treatment response, and suicidality. These negative associations highlight the need for a greater understanding of how sleep influences depression, particularly among individuals also experiencing the symptoms of PTSD. Given the strong evidence of circadian rhythm disturbance in MDD, there may be chronobiological influences on the degree to which sleep disturbance influences depression in those with PTSD and MDD. The present study examined the relationship between social rhythm regularity, or consistency of daily habitual behaviors, which is theoretically linked to circadian rhythms, sleep disruption and depressive symptoms in a sample of military Veterans with comorbid PTSD and MDD.

Methods: Cross-sectional data were obtained from 58 male Veterans who met DSM-IV criteria for PTSD and MDD. Participants completed the Social Rhythm Metric (SRM), which assessed the degree to which participants completed 17 different types of activities on a regular basis (i.e., +/- 45 minutes of habitual time). Depression severity was measured with the Hamilton Depression Rating Scale with

the sleep items removed from analysis. Sleep disturbance was reflected by minutes awake after sleep onset (WASO) via daily sleep diary. Moderation analyses were conducted via linear regression.

Results: In the linear model, SRM scores did not significantly predict depressive symptoms. The interaction of WASO and SRM significantly predicted depressive symptoms (p = .03) and the main effect of increased WASO was a significant predictor of increased depression (p = .01) Results demonstrated that WASO is a significant predictor of depression only at low levels of social rhythm regularity.

Conclusions: Social rhythm regularity may represent a risk/resilience factor for individuals with PTSD and comorbid depression. Findings highlight the importance of exploring the intersection of sleep and social/circadian rhythms in depression.

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HYPERSOMNIA 1

P192 | Clinical autonomic dysfunctions in narcolepsy type 1: a case-control study

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Objectives/Introduction: Narcolepsy type 1 (NT1) is a rare sleep disease caused by the selective destruction of orexin neurons that project to cerebral areas involved in central autonomic control. Clinical autonomic abnormalities have been described in NT1, however, large-scale assessment of autonomic symptoms has never been systematically performed. Once being diagnosed, patients need life-long treatments (psychostimulants and anticataplectic drugs) known to have an influence on autonomic regulation; as other potential confounders such as obesity. Our objectives are: (1) to compare autonomic symptoms using the validated SCOPA-AUT questionnaire in untreated NT1 patients to healthy controls, taking into account potential confounders (2) to study the effect of treatment intake on SCOPA-AUT results in NT1.

Methods: The SCOPA-AUT questionnaire that evaluates gastrointestinal, urinary, cardiovascular, thermoregulatory, pupillomotor and sexual dysfunction, was completed by 81 consecutive drug-free NT1 patients (49 men, 39.3 ± 15.5y.o.) from the National Reference Centre for Narcolepsy, France, and 92 healthy controls (40 men, 42.6 ± 18.1y.o.). Body Mass Index (BMI), and clinical characteristics were collected in all participants. Biological and neurophysiological data were recorded in patients. A subgroup of 59 NT1 patients completed the questionnaire a second time, after 3 months at least of stable medication intake.

Results: Compared to controls, NT1 patients were more frequently male (60% vs. 43%, p = 0.03) and obese (BMI=27.1 ± 4.8 vs. 23.6 ± 3.4, $p < 0.001$) with no difference for age. The total autonomic SCOPA-AUT score of NT1 was higher than controls (12.7 ± 6.7 vs 6.4 ± 5.9, $p < 0.0001$), even after adjustment for BMI and gender. Patients experienced more problems than controls in every domains of the scale, in crude and adjusted models ($p < 0.001$). The most striking differences emerged in the sexual and thermoregulatory domains ($p < 0.0001$). Among patients evaluated twice, the total autonomic SCOPA-AUT score did not differ (12.6 ± 6.9 when untreated and 13.3 ± 7.7 when treated), neither did each subdomain of the scale.

Conclusions: The presence of autonomic nervous system impairment in NT1 patients is confirmed by a validated scale assessment, with sexual and thermoregulatory dysfunctions being severely affected compared to controls, requiring further investigations. The absence of effect of medications for NT1 is in favour of a trait (more than a state) dysfunction.

Disclosure: Nothing to disclose.

P193 | The story continues: narcoplepsy spectrum occurring several years post ASO3-adjuvanted H1N1 vaccination in young Irish siblings

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Objectives/Introduction: Genetic and environmental factors play a role in the pathogenesis of narcolepsy. Recent studies highlight a higher than previously reported risk of narcolepsy among first degree relatives. The natural history of narcolepsy following administration of the ASO3-adjuvanted H1N1 pandemic influenza vaccine has been well described.

Methods: We present the characteristics and clinical features of 3 families (A, B & C) with an evolving spectrum of sleep disorders following Pandemrix© vaccination.

Results: From approximately 100 cases of Pandemrix©-related narcolepsy, 3 family clusters of sleep disorders were identified. Each family's index patient presented with symptoms within weeks of vaccination and was diagnosed with narcolepsy type 1. It became apparent that many of their siblings were developing symptoms of sleep disorders several years later than the index cases. All siblings received Pandemrix© in 2009-2011. All siblings carried the HLA DQB1*06:02 haplotype. Hypocretin levels were < 50pg/mL in the 3 index cases and in sibling 1 of Family A, corresponding with the

presence of narcolepsy with cataplexy. Hypocretin was normal in Family B & not yet tested in Family C.

Sleep studies in sibling 1 of Family A were diagnostic of narcolepsy (nocturnal sleep onset rapid eye movement (SOREM); Mean Sleep Latency Test (MSLT) mean sleep latency (MSL) 2 minutes, 4 SOREMs). In sibling 1 of Family B, an equivocal study in 2015 (normal MSL, 2 SOREMs) became diagnostic in 2017 (nocturnal SOREM; MSLT MSL 6 minutes, 3 SOREMs). In sibling 2 of Family B an initial study in 2017 showed MSL of 11.5 minutes and 2 SOREMs but on follow-up in 2018 showed a MSL of 11 minutes and no SOREMs. In sibling 1 of family C, equivocal studies in 2014 showed normal MSL with 3 SOREMs, but in 2017 showed MSL of 10.5 minutes and 2 SOREMs. Sibling 2 of Family C, also had an equivocal study in 2017 (MSL 14.5 minutes, 3 SOREMs).

Conclusions: A narcolepsy spectrum was found to cluster in multiple siblings within Irish families. Parents are more likely to be aware of sleep-wake abnormalities in other siblings giving the opportunity to study possible narcolepsy endophenotypes which may evolve into the disorder.

Disclosure: Nothing to disclose.

P194 | Sodium oxybate treatment of narcolepsy in pediatric patients: effects on sleep architecture

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Objectives / Introduction: A double-blind, placebo-controlled, randomized-withdrawal study with extended open-label evaluation of sodium oxybate for treatment of pediatric narcolepsy was conducted. This analysis evaluated the effects of sodium oxybate (SXB) on sleep architecture in study participants.

Methods: Participants with narcolepsy with cataplexy, aged 7–16 who were on SXB or were SXB-naïve were eligible. After screening, SXB-naïve participants were titrated on SXB to an optimal dose, then entered a stable dose period (SD) for 2 weeks. Participants on SXB treatment at screening entered the SD at their usual dose. SD was followed by a 2-week double-blind, placebo-controlled, randomized-withdrawal period (DB); participants were randomized to either placebo or to continued SXB. Following the DB, participants entered an open-label safety period (OL) for ≤48 weeks. For SXB-naïve participants, nocturnal polysomnography (PSG) was performed during screening prior to initiating SXB, at the end of SD on their optimal SXB dose, and at study end on their usual dose. For participants on SXB treatment at study entry, PSG was performed at screening and end of study, both on SXB. Safety evaluation included assessment of treatment-emergent adverse events (TEAEs).

Results: As 2/10/17: 106 participants were enrolled; 46 completed 1 year. In SXB-naïve participants, PSG changes from screening (no drug) to end of SD (optimal SXB dose) included decreased total number of arousals, (median [Q1,Q3] change = −36 [−53.0, −20.0]), N1% (−3.1% [−8.0, −0.4]) and REM% (−7.2% [−12.3, −2.8]); and increased N3% (10.6% [3.5,18.2]); N2% was unchanged. Further decreases in arousals were seen from end of SD to the end of study (−8.5 [−17.0, 5.0]) in SXB-naive participants. In participants on SXB at entry, sleep architecture generally did not change from screening to the end of study. The most common TEAEs (> 10%) were enuresis, nausea, vomiting, headache, and decreased weight.

Conclusions: SXB treatment-related changes in sleep architecture (reduced arousals, REM and N1; increased N3; stable N2) in pediatric narcolepsy patients were similar to changes previously observed in adults with narcolepsy. The safety profile was consistent with adult studies and no new safety concerns were identified.

Support: Jazz Pharmaceuticals:

Disclosure: YD is a consultant for and has participated in advisory boards for Jazz Pharmaceuticals, UCB Pharma, Flamel Technologies, Theranexus, and Bioprojet; RKB is a shareholder, a Board of Directors member, Chief Medical Officer, and an employee of SleepMed Inc; is a Board of Directors member for First Community Corporation, SC, and National Sleep Foundation; has received consulting fees from Aerial BioPharma, LLC, Jazz Pharmaceuticals, Inc., ApniCure, UCB, and Teva; has received research support from Actelion, Boehringer Ingelheim, GSK, Jazz Pharmaceuticals, Inc., Vanda, Merck, Novo Nordisk, Pfizer, Schwarz, Sepracor, XenoPort, Eisai, Ventus, Philips, ResMed, ApniCure, Sensory Medical, J&J, Apnex, and Fisher Paykel; and has been a speakers' bureau member for Teva, Jazz Pharmaceuticals, Inc., UCB, Vanda, Merck, and XenoPort; JB is a part-time employee of Jazz Pharmaceuticals and shareholder of Jazz Pharmaceuticals plc.; RP and GW are full-time employees of Jazz Pharmaceuticals, who, in the course of this employment, has received stock options exercisable for, and other stock awards of, ordinary shares of Jazz Pharmaceuticals, plc; EM has received research support from Jazz Pharmaceuticals, Merck, and Glaxo Smith Kline (GSK), has consulted for Novo Nordisk and Reset Pharmaceuticals, and is on the speakers′ bureau for Vox Media.

P195 | Upper airway resistance syndrome with a small mandible is not rare among Japanese female

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Objectives/Instruction: The authors report a case of a patient with hypersomnia. She had a small face and a small mandible, which narrowed her respiratory tract and caused upper airway resistance syndrome.

Methods: Case description: An 18-year-old female student was seen by the presenter, the psychiatrist of the university health administration facility, at the time of medical checkup for first-year students. She was a very pretty girl with a small face and a small mandible. She complained that she felt sleepy all day long although she slept about 7 hr every night. She fell asleep easily in the train and in the bus every morning. She also fell asleep in class very often. She was diagnosed with hypersomnia and was recommended to go to see a specialist of sleep disorder. However, her mother disagreed with the idea and she lost the chance of being treated. Three years later, when she was a fourth-year student, she came to the health administration facility of her university to see the psychiatrist, again. She said her hypersomnia was getting worse and she slept more than 12 hr each night but fell asleep in every class.

Results: She was referred to a specialist of sleep disorder. According to the doctor, after being monitored by a portable device, she was diagnosed with upper airway resistance syndrome. Her symptoms of hypersomnia slowly improved with using an oral application and by orthodontics.

Conclusions: In Japan, women with a small face and a small mandible are not rare. Medical doctors involved in primary care as to doctors in health administration facilities need to have basic knowledge of upper airway resistance syndrome so that they can find patients with it and lead them to improve their quality of life by appropriate treatment.

Disclosure: Nothing to disclose.

P196 | Detection of microsleep episodes with machine learning tools

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Objectives / Introduction: Microsleep episodes (MSE) are brief episodes of sleep, mostly defined to be shorter than 15s. MSE often occur because of insufficient sleep in healthy individuals or due to disease related excessive daytime sleepiness in patients. MSE lead to lapses in consciousness during which individuals often fail to respond to sensory stimuli. This may become dangerous, especially in situations that demand high attention such as driving or monitoring tasks. Thus, the identification of early signs of sleepiness and sleep (i.e. MSE) is of considerable clinical and practical relevance. Under laboratory condition, the maintenance of wakefulness test (MWT) is the gold standard for assessing vigilance but MSE, characterized by a slowing of EEG activity, are not analysed so far in most sleep centres.

Methods: We analysed MWT recordings of 30 patients referred to the Sleep-Wake-Epilepsy-Centre. MSE were scored by experts rather restrictively, defined by the occurrence of theta dominance on ≥1 occipital lead lasting 1-15s, while the eyes were ≥ 80% closed. To visualize oscillatory activity, we calculated spectrograms (autoregressive model of order 16) of 1-s epochs moved in 200-ms steps through the data and derived seven features: power in delta, theta, alpha and beta bands, ratio theta/(alpha+beta), quantified eye movements, and median frequency. Three algorithms were used for MSE classification: support vector machine (SVM), random forest (RF), and an artificial neural network (long short-term memory [LSTM] network). Data of 20 patients were used for the training of the classifiers, and 10 for testing.

Results: MSE were successfully identified with a high sensitivity (SVM 0.91, RF 0.90 and LSTM 0.82) and high specificity (0.96, 0.98 and 0.98). The RF classifier allowed to quantify the importance of the features and revealed that median frequency was most relevant.

Conclusions: The automatic detection of MSE was successful for our EEG-based definition of MSE, with good performance of all three algorithms applied. Inclusion of additional features and derivations may be beneficial, as well as a deep learning approach with raw EEG data.

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Disclosure: Nothing to disclose.

P197 | Solriamfetol (JZP-110) in the treatment of excessive sleepiness in narcolepsy and obstructive sleep apnoea: maintenance of wakefulness test results across the day

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Objectives/Introduction: Phase 3 trials in adults with narcolepsy or obstructive sleep apnoea (OSA) demonstrated robust wake-promoting effects of solriamfetol on a 40-min Maintenance of Wakefulness Test (MWT). The subsequent analyses reported here were

performed to evaluate the time course of solriamfetol on each MWT trial after morning dosing.

Methods: Participants were randomised to receive placebo or solriamfetol 37.5 (OSA only), 75, 150, or 300mg. As pre-specified, only doses efficacious for both coprimary endpoints (MWT overall sleep latency and Epworth Sleepiness Scale score at week 12) were further tested at each MWT trial (MWT1: 1-hr post-dose, MWT2-5: 2-hr consecutive intervals post-dose; total time: ≈ 9 hr post-dose). The first trial with significant change (*$p < 0.05$) was identified and testing to the next trial was performed until non-significance or MWT5 was reached.

Results: In general, efficacious doses of solriamfetol showed a significant change from baseline on each of the 5 individual MWT trials at week 12, with the exception of 37.5 mg for OSA and 75 mg for narcolepsy. In participants with narcolepsy, solriamfetol 150mg and 300mg demonstrated significant least squares (LS) mean change (standard error) from baseline to week 12 at each time trial from MWT1 (150mg 9.9* [1.7], 300mg 9.9* [1.8], placebo -0.6 [1.7]) to MWT5 (150mg 9.3* [1.9], 300mg 12.2* [2.0], placebo 3.1 [1.8]). In participants with OSA, solriamfetol 75mg, 150mg, and 300mg demonstrated significant LS mean change from baseline to week 12 at each time trial from MWT1 (75mg 5.8* [1.8], 150 mg 10.9* [1.3], 300mg 12.5* [1.4], placebo −0.4 [1.3]) to MWT5 (75 mg 7.8* [1.8], 150 mg 8.1* [1.3], 300 mg 7.6* [1.4], placebo 0.2 [1.4]). Common treatment-emergent adverse events in both narcolepsy and OSA populations included headache, nausea, decreased appetite, anxiety, and nasopharyngitis, and were mild to moderate.

Conclusions: Treatment with solriamfetol (75 mg in OSA, and 150 and 300 mg in OSA and narcolepsy) was associated with sustained improvements in wakefulness, from 1 hr to 9 hr after morning dosing. Safety and tolerability in both populations were consistent with previous studies of solriamfetol.

Disclosure: PK Schweitzer: research funding from Jazz Pharmaceuticals (Jazz), Philips Respironics, NightBalance. KP Strohl: site principal investigator (PI) for Inspire Medical Systems; Jazz PI; received consultancy fees from Sommetrics, GSK, and Seven Dreamers. A Malhotra: officer of American Thoracic Society, relinquished outside personal income since 2012; ResMed provided philanthropic donation to UC San Diego to support sleep center. R Rosenberg: consultancy fees from Eisai; honoraria/served on Merck speakers' bureau; research funding from Jazz, Merck, Actelion, Eisai, Philips Respironics; Jazz advisory-board member. RB Sangal: research grants from Shire, Jazz, Eisai; served on Merck speakers' bureau. PC Zee: research support from Merck, Philips Respironics, Jazz, Eisai. R Thomas: holds patent for/receives royalties from license for ECG-based method to phenotype sleep quality/apnoea (MyCardio, LLC); provides sleep medicine consulting to GLG Councils. D Chen, J Li, LP Carter, L Lee: employees of Jazz Pharmaceuticals, have received stock options exercisable for/other awards of ordinary shares of Jazz plc. J Black: part-time employee of Jazz; shareholder of Jazz plc. MJ Thorpy: research/grant support/consultancy fees from Jazz, Merck, Teva Pharmaceutical Industries Ltd; Jazz and Cephalon/Teva speakers' bureaus.

P198 | A 5-year post-authorization safety study (PASS) relative to Wakix® (pitolisant) use and its long-term safety in narcolepsy with or without cataplexy in routine medical practice

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Objectives/Instruction: Wakix®, the first histamine H3 receptor inverse agonist obtained the European Marketing Authorization (MA) in 2016 for the indication "In adults for the treatment of narcolepsy with or without cataplexy" approved by the EMA/CHMP. The CHMP requested a long-term observational PASS to document the long-term safety of Wakix® in routine medical practice (RMP).

Methods: This international, non-interventional, open-label long-term PASS is planned to follow up 300 patients for 5 years. Pitolisant is prescribed on RMP according to the MA before and independently of the decision to enroll the patients in the countries where Wakix® is commercialized. Investigators are sleep specialists in charge of narcolepsy patients. Primary objectives are both safety (report of adverse events (AEs)) and description of Wakix® use, narcolepsy management, patient characteristics. Among secondary objectives: assessment of narcolepsy and depression with different tools. A yearly report has to be done and here is the First Report 1 year after the first patient recruited.

Results: On 17 January 2018, 12 active investigators in 3 countries recruited 98 patients (56 in Germany, 40 in Italy, 2 in France), 84 of them have completed inclusion data, 56 have filled the self-assessment questionnaire at baseline. The main endpoint showed 6 adverse events (no serious) in 3 patients: 1 patient with arthralgia, headache and nausea at day 17 after Wakix administration, 1 patient with tiredness (day 87), 1 patient with arthralgia in both knees.

The baseline characteristics showed a mean age of 38.5 year-old, 48.8% male, with a narcolepsy diagnosed 5.7 years before recruitment, which was confirmed by Polysomnography and MSLT in 85.7%. 73.8% of patients present cataplexy, 63.1% hallucinations, 53.6% depression. Mean ESS was 15.4 and 82.1% was > 10. Concomitant narcoleptic treatment was prescribed for 52% of patients: sleepiness treatments 22.6% of patients, cataplexy treatments 16.7%, sleepiness and cataplexy treatments 22.6%.

Conclusions: Because this is the beginning of the study with few follow-up visits, this first report showed essentially the first 98 patients baseline characteristics and a very few adverse events rate. The follow-up of these patients needs to be continued in order to confirm the good safety profile of Wakix.

Disclosure: Giuseppe Plazzi, Ulf Kallweit are consultants of Bioprojet; Christian Caussé, Yves Joulin, Catherine Scart-Grès, Isabelle Lecomte are employees of Bioprojet. Jeanne-Marie Lecomte and Jean-Charles Schwartz are founders of Bioprojet which sponsors this study.

P199 | Effects of solriamfetol on primary OSA therapy use in a 12-week phase 3 trial

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Objectives/Introduction: In obstructive sleep apnoea (OSA), excessive sleepiness (ES) is common and is reported to persist in 13–65% of patients despite primary therapy use. Solriamfetol, a selective dopamine/norepinephrine reuptake inhibitor, demonstrated efficacy for the treatment of ES in OSA in a 12-week, placebo-controlled phase 3 study. This analysis evaluated whether solriamfetol treatment alters use of primary OSA therapy.

Methods: Participants with OSA and ES were randomised to placebo or solriamfetol 37.5, 75, 150, or 300mg once daily. Study inclusion required current or prior use of primary OSA therapy, including positive airway pressure (PAP) therapy, oral appliance, or surgical intervention. Participants were only excluded based on primary therapy use if they had refused to try a primary therapy. Participants using a device (e.g., PAP, oral appliance) were instructed to maintain consistent use throughout the study. Use was recorded by electronically downloadable data or by diary, and measured by percentage of nights/week that participants used therapy (for devices with or without downloadable data), percentage of nights/week that participants used therapy ≥ 50%/night (no downloadable data), and number of hours/night that participants used therapy (downloadable data).

Results: The efficacy population comprised 459 participants (placebo, *n* = 114; solriamfetol combined, *n* = 345). Baseline mean percentage of nights, percentage of nights ≥ 50%/night, and number of hours/night that participants used therapy was similar for the placebo (88.8% [*n* = 69], 93.2% [*n* = 24], and 6.6 hr/night [*n* = 43], respectively) and all solriamfetol treatment groups (solriamfetol combined: 89.9% [*n* = 218], 91.2% [*n* = 84], and 6.6 hr/night [*n* = 133], respectively). There were clinically insignificant changes (mean [standard deviation]) from baseline to end of study (weeks 9–12) as measured by percentage of nights/week (placebo [*n* = 69], 0.8 [12.1]; solriamfetol [n=218], 1.1 [12.0]), percentage of nights/week with use ≥50%/night (placebo [*n* = 24], 2.7 [19.4]; solriamfetol [*n* = 84], 2.2 [13.7]), and hr/night (placebo [*n* = 43], −0.3 [0.9]; solriamfetol [*n* = 133], −0.3 [1.2]). The most common treatment-emergent adverse events observed with solriamfetol were headache, nausea, decreased appetite, anxiety, and nasopharyngitis.

Conclusions: These data support the finding that treatment of ES with solriamfetol did not impact primary OSA therapy use in a controlled setting. Safety and tolerability of solriamfetol were consistent with previous studies.

Support: Jazz Pharmaceuticals.

Disclosure: G Mayer: honoraria, Paul Ehrlich Institute, Germany; speakers' bureaus, UCB Pharma, Sanofi, Bioprojet; board member European Narcolepsy Network. PK Schweitzer: research funding Jazz Pharmaceuticals (Jazz), Philips Respironics, NightBalance. R Rosenberg: consultancy fees Eisai; honoraria Merck; research funding Jazz, Merck, Actelion, Eisai, Philips Respironics; speakers' bureau Merck; board member Jazz. A Malhotra: principal investigator (PI) Jazz; receives no outside personal income as recent officer of American Thoracic Society; ResMed provided philanthropic donation to UCSD to support sleep center. GK Zammit: grants/research, Adare, Alder, Astellas, AstraZeneca, Avadel, Balance Therapeutics, BioMarin, Cavion, CHDI, Corbus, Eisai, Flamel, Janssen, Jazz, Luye, Merck, Neurocrine Biosciences, Novartis, Purdue, Sage, Sunovion, Vanda; consultancy fees, Actelion, Eisai, Idorsia, Merck; honoraria Merck; holds ownership interest in Clinilabs, Inc, Clinilabs IPA, Inc, Home Sleep and Respiratory Care, Nationwide Sleep Testing. M Gotfried: honoraria, GSK, Boehringer Ingelheim; research funding, GSK, Boehringer Ingelheim, Sanofi, Jazz, Eisai; speakers' bureau, Boehringer Ingelheim. P Chandler, M Baladi, and D Menno: employees of Jazz who receive stock options exercisable for/other stock awards of ordinary shares Jazz Pharmaceuticals plc during employment. KP Strohl: advisory board member, PI for Jazz; site PI for Inspire Medical Systems; consultancy fees, Sommetrics, GSK (Galvani Bioelectronics), Seven Dreamers.

P200 | Uncontrollable cataplexies: have a look to the cervical spine

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Objectives/Instruction: Cataplexy is defined as episodes of sudden loss of voluntary muscle tone triggered by emotions generally lasting < 2 min. Cataplexy is most commonly associated with and considered pathognomonic for narcolepsy. The single pharmacotherapy indicated and recommended in first-line for cataplexy is sodium oxybate. There is no consensus for second-line treatment when cataplexies are not controlled.

Methods: Case report of two patients with uncontrolled cataplexies related to narcolepsy.

Results: Patients are male, aged 62 and 68 years old. They both have a HLA DR15 / DQ0602 phenotype. They have at least one episode of cataplexy per day. Both have benefited from a combination of arousing and anti-cataplectic treatment (SSRI, Sodium Oxybate) but these treatments were not able to control cataplexies even after a dose escalation.

Alternative causes of cataplexies or cataplexy-like were searched. Physical exam showed cervical stiffness. Cervical spine MRI revealed inversion of cervical spine curvature and important staged

discopathies with cervical canal stenosis. Specific management of cervical pathology was proposed in addition to the treatment of narcolepsy and cataplexy. This was efficient and we observed a better control of cataplexy.

In a very particular way, one patient described that he usually limited cataplexies frequency by walking practice.

Conclusions: In patients with uncontrolled cataplexies under Sodium Oxybate, cervical spine pathologies should be considered, especially if cervical spine is stiff or patient reports an improvement with changing posture or walking.

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https://www.ncbi.nlm.nih.gov/pubmed/26715865
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5611768/
https://www.ncbi.nlm.nih.gov/pubmed/1115663 (Sleep attacks–apparent relationship to atlantoaxial dislocation)

Disclosure: Nothing to disclose.

P201 | Test-retest validity of the Epworth Sleepiness Scale within a substantial short time frame

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Objectives/Instruction: The Epwoth Sleepiness Scale (ESS) is a widely used, validated questionnaire towards effectively examining the patients' sleepiness in a range of different situations. Test-retest validity is an important aspect of a questionnaire of which, according to only a few studies, was found to be low in the case of ESS. All these studies applied long intervals between the tests thereby increasing the possibility of fundamental change in circumstances which in turn affect the reliability of the test.

The aim of the present study was to investigate the test-retest validity of the ESS in a short time frame to provide stability of the test circumstances. We also compared the originally used (Pearson's correlation) and current, accepted (Lin's concordance coefficient) statistical methods of test-retest evaluation.

Methods: Using ESS questionarie we examined one-hundred unselected patients consecutively referred to the sleep lab. Test-retest paradigm was used with the interval of 1 hr between the tests. To determine the validity of the ESS we used the Lin's concordance coefficient and Pearson's correlation.

Results: The Lin's concordance coefficient was found to be low (0.748) while the Pearson's correlation (0.76) revealed good reliability.

Conclusions: Our result provides a clear evidence about the poor test-retest validity of the ESS determined by the current statistical method, despite the examination protocol excludes changes of test circumstances. This result underlines the careful and cautious application of the ESS in the routine clinical practice.

Disclosure: Nothing to disclose.

P202 | Predictors of daytime sleepiness improvement in a population-based 5-year longitudinal study

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Objectives/Instruction: Excessive daytime sleepiness (EDS) is highly prevalent in the general population and preventive measures are essential for health promotion. This study examined the predictors of daytime sleepiness (DS) improvement in a longitudinal community study of 2167 adults over 5 years.

Methods: DS was assessed at baseline and at each follow-up wave (1, 2, 3, 4 and 5 years) by the Epworth Sleepiness Scale (ESS). Sustained of DS improvement was defined as a 4-point ESS decrease without no further increase of more than 3 points in the subsequent follow-up. Transient DS reduction was defined as a fluctuation between a 4-point ESS decrease and an increase during the follow-up. Insomnia, sleep duration, sleep medication, and socio-demographic, lifestyle, health and psychological measures were self-rated at each time point. Exposures that appeared or changed during the follow-up of subjects were taken into account as time-dependent covariates in the Cox proportional hazard models. The covariate was valued the year prior to the DS decline and the relative change between the year of the event and the year prior to the DS decline. Significance level was set at $p < 0.05$.

Results: Overall, 184 (9%) participants reported a transient DS improvement during the follow-up and 587 (28%) a sustained DS improvement till the end of the study. Compared to subjects without DS reduction, an increase in sleep duration and a decrease in depression severity were independently associated with a transient DS improvement whereas living alone, a decrease in insomnia, in depressive, in pain severity symptoms were independent predictors of sustained DS improvement. Compared to subjects with a transient DS, those with a sustained DS improvement were younger, living alone, took one-two coffee cups per day, reported less insomnia and depressive symptoms, gained less weight and reported less endocrine and metabolic diseases.

Conclusions: The beneficial effects of sleep duration increase and improved depressive symptoms on transient DS should be taken into account in the prevention of DS because they are clearly identifiable modifiable factors. Improvement of insomnia, depressive and pain symptom severity on sustained DS should also be considered.

Disclosure: CM has served as speaker for Merck and consultant on advisory board for Phillips. YD has received funds for speaking and board engagements with UCB pharma, Jazz, and Bioprojet, without competing financial interests related to the manuscript.

P203 | Quality of life, functional evaluation, and work productivity in patients with narcolepsy: results from a phase 3 study of solriamfetol (JZP-110)

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Objectives / Introduction: Solriamfetol is a selective dopamine/norepinephrine reuptake inhibitor with robust wake-promoting effects. In a phase 3 study, solriamfetol significantly improved wakefulness and decreased excessive sleepiness in adults with narcolepsy. Health-related quality of life (HRQoL) measures were assessed as secondary endpoints.

Methods: Participants with narcolepsy were randomised to solriamfetol 75 mg, 150 mg, 300 mg, or placebo for 12 weeks. HRQoL measures included the Functional Outcomes of Sleep Questionnaire short version (FOSQ-10), Work Productivity and Activity Impairment questionnaire for Specific Health Problems (WPAI:SHP), and 36-Item Short Form Health Survey version 2 (SF-36v2). Least squares mean (standard error) (LS mean [SE]) changes from baseline to week 12 were calculated for each measure. Reported *P* values are nominal. Safety and tolerability were also assessed.

Results: The modified-intent-to-treat population was comprised of 231 participants (solriamfetol 75 mg, 150 mg, and 300 mg, n = 59, 55, and 59, respectively; placebo, n = 58). Baseline demographics were similar across treatment groups. Solriamfetol 300 mg improved the FOSQ-10 score (LS mean [SE]: 300 mg, 3.01 [0.42]; placebo, 1.56 [0.40]; $p < 0.05$). Solriamfetol 150 mg reduced percent overall work impairment on the WPAI:SHP (LS mean [SE]: 150 mg, −19.77 [5.04]; placebo, −4.28 [5.00]; $p< 0.05$) and reduced percent activity impairment at 150 and 300 mg (LS mean [SE]: 300 mg, -21.27 [3.55]; 150 mg, −17.84 [3.35]; placebo, −7.79 [3.42]; $p< 0.05$). Improvements in SF-36v2 domains were seen for role physical score (LS mean [SE]: 300 mg, 6.46 [1.21]; placebo, 2.38 [1.14]; $p < 0.05$), general health score (LS mean [SE]: 75 mg, 2.42 [0.84]; placebo, -0.20 [0.81]; $p < 0.05$), and vitality score (LS mean [SE]: 300 mg, 4.96 [1.19]; 150 mg, 5.83 [1.12]; 75 mg, 4.68 [1.15]; placebo, 1.04 [1.12]; $p < 0.05$). The most common treatment-emergent adverse events were headache, nausea, decreased appetite, nasopharyngitis, dry mouth, and anxiety.

Conclusions: Solriamfetol improved functioning and HRQoL at 300 mg, particularly on the SF-36v2 vitality (all doses) and role physical domains. Impairment at work was improved with solriamfetol 150 mg. Activity impairment outside of work was improved with solriamfetol 150 and 300 mg. Safety and tolerability were consistent with previous solriamfetol studies.

Support: Jazz Pharmaceuticals.

Disclosure: H Emsellem: research funding from Jazz Pharmaceuticals (Jazz), Flamel (Avadel), Balance Therapeutics,Harmony Biosciences; advisory board member for Harmony. MJ Thorpy: research/grant support and consultancy fees from Jazz, Merck & Co, Inc., Teva Pharmaceutical Industries Ltd; speakers' bureau member for Jazz and Cephalon, Inc. (now Teva). GJ Lammers: consultancy fees and/or honoraria; advisory board member for UCB Pharma, Bioprojet, Theranexus, and Jazz. C Shapiro: research funding from National Institutes of Health, Canadian Institutes of Health Research; speakers' bureau for Jazz. G Mayer: honoraria from Paul Ehrlich Institute, Germany; speakers' bureau for UCB Pharma, Sanofi; board member of European Narcolepsy Network. G Plazzi: research support from UCB Pharma; consulted for UCB Pharma, Jazz, Bioprojet. D Chen, J Li, LP Carter, R Ryan: employees of Jazz who received stock options exercisable for/other stock awards of ordinary shares of Jazz Pharmaceuticals plc during employment. J Black: part-time employee of Jazz and shareholder of Jazz Pharmaceuticals plc. Y Dauvilliers: consultancy fees and/or honoraria and speakers' bureau member and/or advisory board participant for UCB Pharma, Bioprojet, Theranexus, Flamel, Harmony Biosciences, and Jazz.

P204 | A long-term study of the safety and maintenance of efficacy of solriamfetol (JZP-110) for treatment of excessive sleepiness associated with narcolepsy or obstructive sleep apnoea

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Objectives/Introduction: Narcolepsy and obstructive sleep apnoea (OSA) share the common symptom of excessive sleepiness (ES). Solriamfetol, a selective dopamine/norepinephrine reuptake inhibitor, was efficacious for treatment of ES in participants with narcolepsy and OSA in several placebo-controlled studies. This study

evaluated the long-term safety and maintenance of efficacy of solriamfetol.

Methods: Eligible participants had narcolepsy or OSA and had completed a previous solriamfetol study. This study included a 2-week Titration phase followed by a Maintenance phase of up to 50 weeks. After 6 months of treatment, a subgroup of participants entered a 2-week placebo-controlled Randomised Withdrawal (RW) phase. Change in Epworth Sleepiness Scale (ESS) score from beginning to end of the RW was the primary endpoint; Patient and Clinician Global Impression of Change (PGI-C and CGI-C, respectively) were secondary endpoints. For ESS score, an analysis of covariance (ANCOVA) model was used with change from beginning to end of the RW as the response variable. The model included fixed effects of treatment group, efficacy baseline, and randomisation stratification factor (narcolepsy and OSA).

Results: A total of 643 participants were included in the safety population of the open-label phase (226 narcolepsy; 417 OSA). Of these, 280 participants (placebo, n = 141; solriamfetol, n = 139) comprised the efficacy population in the RW phase. At 6 months, participants randomised to placebo in the RW had an increase of 5.3 (least squares [LS] mean) on the ESS compared with 1.6 in participants randomised to continue solriamfetol ($p < 0.0001$). For both secondary endpoints, greater percentages of participants randomised to placebo were reported as worse at the end of the RW versus the solriamfetol group (both $p < 0.0001$). At 1 year, open-label treatment with solriamfetol demonstrated sustained reductions in mean ESS scores and improvements on PGI-C and CGI-C. The most frequent treatment-emergent adverse events (AEs; ≥5%) with solriamfetol were headache, nausea, nasopharyngitis, insomnia, dry mouth, anxiety, and decreased appetite; 27 (4.2%) participants had ≥1 serious AE.

Conclusions: These findings demonstrate long-term maintenance of efficacy with solriamfetol in the treatment of ES in subjects with narcolepsy or OSA. The safety profile was consistent with prior placebo-controlled studies of solriamfetol.

Support: Jazz Pharmaceuticals.

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P205 | Sodium oxybate treatment of narcolepsy in pediatric patients: long-term efficacy and safety

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Objectives/Introduction: Narcolepsy symptom onset primarily begins in childhood/adolescence. Sodium oxybate (SXB) was evaluated as a treatment for narcolepsy in pediatric patients in a placebo-controlled, randomized-withdrawal study with an open label extension. Efficacy was established during the double-blind, randomized-withdrawal period. Results of the long-term efficacy and safety assessments are reported.

Methods: Children and adolescents with narcolepsy with cataplexy who were on SXB treatment or were SXB-naïve, aged 7-16 were eligible. After a two-week double-blind, placebo-controlled withdrawal period (DB), participants entered an open-label safety period (OL) for a total study duration of up to 1 year. Baseline efficacy assessments occurred when participants were on a stable dose of SXB prior to the DB. Change in weekly number of cataplexy attacks was calculated from daily cataplexy diaries. The Epworth Sleepiness Scale for Children and Adolescents (ESS-CHAD) was utilized to evaluate sleepiness at each visit. Safety evaluations included anxiety, depression, and suicidality assessments, and treatment-emergent adverse events (TEAEs).

Results: As of the 10 February 2017 datacut: 106 were enrolled; 79 completed ≥6 months and 46 completed 1 year. Efficacy for cataplexy and excessive daytime sleepiness (EDS) was maintained during the OL. Median (Q1, Q3) change in weekly number of cataplexy attacks from the stable-dose period (SD) to the last week of OL was 0.0 (-2.25, 4.17), with little change throughout. Similarly, the median (Q1, Q3) change from SD to the last week of OL in ESS-CHAD score was 0.0 (-3.0, 3.0). No increase in anxiety or depression was

observed on the assessments. Two serious TEAEs occurred (acute psychosis and suicidal ideation) with both participants endorsing positive responses on the suicidality assessment. Both events resolved after discontinuing SXB; one participant withdrew from the study (suicidal ideation) and the other resumed SXB at a lower dose without recurrence of the event (psychosis). The most common TEAEs (> 10%) were enuresis, nausea, vomiting, headache, and decreased weight.

Conclusions: SXB demonstrated long-term effectiveness (up to 1-year) in reducing and maintaining reductions in cataplexy and EDS in pediatric patients with narcolepsy. The safety profile was consistent with adult studies and no new safety concerns were identified.

Support: Jazz Pharmaceuticals

Disclosure: ML has received honoraria from Shire and grant support from UCB; GP has participated in advisory boards for UCB and Jazz Pharmaceuticals; YD is a consultant for and has participated in advisory boards for Jazz Pharmaceuticals, UCB Pharma, Flamel Technologies, Theranexus, and Bioprojet; CLR has been a consultant for Jazz Pharmaceuticals and Advance-Medical; CR has served as an advisory board member and unpaid consultant for Jazz Pharmaceuticals; JB is a part-time employee of Jazz Pharmaceuticals and shareholder of Jazz Pharmaceuticals plc.; RP and GW are full-time employees and DG is a former employee of Jazz Pharmaceuticals, who, in the course of this employment, has received stock options exercisable for, and other stock awards of, ordinary shares of Jazz Pharmaceuticals, plc; EM has received research support from Jazz Pharmaceuticals, Merck, and Glaxo Smith Kline (GSK), has consulted for Novo Nordisk and Reset Pharmaceuticals, and is on the speakers ′ bureau for Vox Media.

NEUROLOGICAL DISORDERS 1

P206 | Polysomnographic evaluation of sleep in Chiari type 1 malformation before surgical decision and after surgery

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Objectives/Instruction: Chiari malformation is known to be associated with sleep apnea but others sleep disorders could be identified. We report here our experience of nocturnal polysomnographic performed before surgical decision and after surgery of Chiari type 1 malformation

Methods: Retrospective analysis. Since 2010, we explored patients with Chiari malformation during the pre-operative assessment, and when possible or indicated after surgery. Nocturnal video-polysomnographic were performed in the sleep laboratory. Furthermore, at each evaluation, patient completed Epworth Sleepiness Scale (ESS), Pichot ADA asthenia scale, Pichot Q2DA depression scale and Modified Essay Questions (MEQ).

Results: Seventeen patients were recorded before surgical assessment and 6 after surgery. Mean age was 43 ± 13 years old. All patients have sleep fragmentation by arousals, due to Periodic Limb Movements (PLM) for 11 patients, and significative sleep apneas (mean 18/h) for 6 patients. Mean total sleep time (TST) was 405± 19 mn, under normal data from our sleep lab (mean = 415 ± 2 mn). REM sleep represented only 13% of the TST.

After surgery, we observed an increase of mean TST to 432± 25 mn (vs 385± 44 mn before) and of the REM sleep (17% of the TST vs 13%) for the 6 reevaluated patients. Sleep apnea index decreased from 18 /h to 13/h and PLM appeared to be less frequent.

Considering self-evaluation, only ESS has significative abnormal results with a mean score at 11 ± 3 before surgery. For the 6 patients, all scores decreased after surgery: from 12 ± 2 to 6 ± 3 for ESS, 16 ± 5 to 7 ± 2 for ADA, 8 ± 3 to 3 ± 2 for Q2DA and 4 ± 2 to 1 ± 1 for MEQ.

Conclusions: Our retrospective data showed a higher association with PLM than to apneas in Chiari malformation. Furthermore, sleep architecture parameters were altered. So polygraphy was insufficient to explore sleep and a polysomnographic study has to be preferred.

Use of Epworth Sleepiness Scale questionnaire as a screening tool appeared to be useful for sleepiness evaluation before surgery.

Disclosure: Nothing to disclose.

P207 | Central sleep apnoeas in a female patient with pharmaco-resistant epilepsy and vagus nerve stimulation

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Objectives/Instruction: While vagal nerve stimulation (VNS) can reduce the frequency of seizures in patients with refractory epilepsy, it can also cause side effects involving the upper and lower respiratory tract. VNS has been associated with obstructive apnoeas and only in very few cases central sleep apnoeas (CSA) were found. The pathophysiology of VNS mediated CSA has not been fully elucidated.

21 one-year-old female with mitochondrial cytopathy and pharmaco-resistant epilepsy was evaluated for suspected sleep disordered breathing. Her tonic and sometimes clonic seizures started at the age of 4. At first seizures were present during the day and night. After VNS was implanted at the age of 7, daytime seizures ceased to exist but the night time seizures still persisted. Over the years her cognitive and motor skills have declined. Lately her parents have noticed pauses in breathing during sleep and reported excessive daytime sleepiness (EDS).

Methods: Night polysomnography (PSG) was performed in order to provide detailed analysis of apnoeas and to investigate a suspected

correlation between apnoeas and vagus stimulation. VNS settings during the recording were: an intensity of 2.25 mAmps, frequency of 30 HZ, pulse width 500 microseconds (ms), on-time of 30 s and off-time of 180 s. A lot of epileptic activity on the electroencephalography caused difficulties when defining sleep stages.

Results: PSG showed 22 central apnoeas and 36 central hypopneas. However the patient had additional central hypopneas consisting of episodes of decreased airflow without desaturations. Average SaO2 desaturation was 97% and the lowest SaO2 was 91%. AHI was 11, but hypopneas without desaturation were not included. Heart arrhythmias happened during breathing events.

Practically all of breathing events and heart arrhythmias were periodic and corresponded to VNS stimulation (every 3 minutes). They persisted for the duration of the stimulation (30 s) and came to an end with VNS deactivation.

Conclusions: VNS may cause central apnoeas corresponding to VNS stimulation. PSG should be considered in patients presenting with apnoeas and EDS and adjustment of VNS settings is required.

Disclosure: Nothing to disclose.

P208 | The association between shift work and migraine, tension-type headache and medication-overuse headache - a cross-sectional study among a large population of nurses

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Objectives/Instruction: Shift work is associated with poor sleep, and poor sleep may trigger headache. However, whether there is an association between shift work and headache is unclear. The objective of this study was to investigate possible associations between different types of headache and shift work.

Methods: 1585 nurses with different work schedules (day work, two-shift rotation, night work, three-shift rotation) participated in a cohort study with annual surveys that started in 2008/2009. A comprehensive headache instrument was included in wave 6. Headaches were assessed according to the International Classification of Headache Disorders IIIb. Frequent headache (≥1 day per month), migraine, tension-type headache (TTH), chronic headache (headache > 14 days per month), and medication-overuse headache (MOH, chronic headache + acute headache medication ≥10 days last month) comprised the dependent variables. Adjusted (for sex, age, percentage of full-time equivalent, marital status, children living at home) logistic regression analyses were conducted with work schedule, number of night shifts worked last year, number of quick returns (<11 hr in-between shifts) last year, shift work disorder (SWD), and insomnia disorder as predictors.

Results: Frequent headache, migraine, and chronic headache were significantly associated with SWD (ORs 1.60 to 2.45) and insomnia disorder (ORs 1.55 to 3.03), but not with work schedule, number of night shifts or number of quick returns. TTH was only associated with > 20 night shifts last year
(OR 1.41). MOH was only associated with insomnia disorder (OR 7.62).

Conclusions: We found no association between different types of headache and work schedule. However, TTH was associated with high number of night shifts. Nurses with insomnia disorder and SWD reported higher prevalence of frequent headache, migraine, chronic headache and MOH (only insomnia) compared to nurses not having insomnia disorder and SWD, respectively.

Disclosure: Nothing to disclose.

P209 | Nocturnal eye movements in patients with idiopathic rapid eye movement sleep behaviour disorder and patients with Parkinson's disease

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Objectives/Introduction: Patients with idiopathic rapid eye movement (REM) sleep behaviour disorder (iRBD) have a high risk of converting into α-synucleinopathies due to an early neurodegenerative process involving lower brainstem areas. Eye movements (EMs) are controlled by neurons located in the lower brainstem, midbrain, and frontal areas, and are therefore vulnerable to be affected by an early neurodegeneration. Several studies have reported impairment of the oculomotor function in patients with Parkinson's disease (PD) during wakefulness, but no studies have investigated how neurodegeneration affects EMs during sleep. We aimed to evaluate nocturnal EMs in iRBD and PD hypothesizing that these patients present abnormal EMs during sleep.

Methods: A total of 28 patients with periodic leg movement disorder (PLMD; 15 males; 60.3 ± 11.9 years), 24 with iRBD (17 males; 63.0 ± 10.1 years), 23 with PD without RBD (PD-RBD; 14 males; 61.4 ± 5.4 years), 29 with PD and RBD (PD+RBD; 19 males; 63.3 ± 5.1 years), and 24 controls (11 males; 56.7 ± 9.9 years) were included. A previous validated EM detector was used to automatically detect periods with any kind of EMs in artefact-free epochs between lights off and on. The EM coverage was computed as the percentage of time containing EMs, during stages of wakefulness, N1, N2, N3, and REM sleep. Between-group comparisons were

performed using Wilcoxon-Ranksum tests, and the Benjamini-Hochberg procedure with a false discovery rate of 0.1 was used to control for multiple testing.

Results: We found that PD+RBD had significant less EM coverage during wakefulness compared to controls ($p < 0.001$), and significantly higher EM coverage during N2 compared to controls ($p = 0.003$) and PLMD ($p = 0.004$). Furthermore, PD-RBD showed significantly higher EM coverage during N2 compared to controls ($p < 0.001$) and PLMD ($p = 0.001$). Same trends were observed between iRBD and controls in wakefulness and N2, but were not significant after correction for multiple testing.

Conclusions: Patients with PD+/-RBD reflect abnormal EM coverage during nocturnal wakefulness and N2, suggesting that the disorder is complex and affects various parts of the basal brain. The different profiles of EM coverage in iRBD and PD+/-RBD may mirror different stages of central nervous system involvement across disease progression, a finding to be confirmed by future longitudinal studies.

Disclosure: Nothing to disclose.

P210 | Apathy and depression in Parkinson's disease with parasomnias: gender matters

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Objectives/Instruction: Mood disturbances are common nonmotor symptoms in patients with Parkinson's Disease (PD). However, it remains unclear if these symptoms are related to the disease itself or to disease comorbidities. The aim of the study was to investigate whether the presence of parasomnias in patients with PD is associated with depression and apathy.

Methods: PD patients, who underwent subjective and objective sleep-wake assessments, were grouped according to the presence or not of (any) parasomnia. The diagnosis of parasomnias was based on clinical and polysomnographic data. Apathy was assessed using the 14-item Starkstein Apathy Scale (cut-off ≥14). Depression was assessed using the Hamilton Depression Scale (cut-off ≥9). The ESS, PDQ39, and MMSE were used to evaluate sleepiness, quality of life and cognitive impairment, respectively.

Results: The two groups were statistically comparable with respect to age, gender, years of PD, severity of PD (H&Y), and motor score (UPDRS-III). Apathy prevalence in the group with parasomnias was 53.3% while in the control group without parasomnias was 33.3%. PD patients with parasomnia had significantly higher apathy and depression scores than PD patients without parasomnia, attributed mainly to the differences in the female group. Among PD patients with parasomnias, females had significantly higher apathy scores than males but no other differences with respect to motor and non-motor symptoms was found (data not shown). Gender was the only independent predictor of apathy, with women presenting a higher risk compared to men.

Conclusions: The presence of a parasomnia seems to increase the risk of apathy and depression in PD patients and especially in female individuals. Therefore, symptoms of apathy and depression should be taken into consideration in those patients even if they do not meet the diagnostic criteria for a mood disorder. Future studies should focus further on the relationship between gender and other mood features in PD patients with parasomnias.

Disclosure: Nothing to disclose.

P211 | Cheyne-Stokes respiration and the outcome of acute stroke

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Objectives/Instruction: Cheyne-Stokes respiration (CSR) is frequently observed in acute stroke patients. CSR has even been reported to be a poor prognostic factor of cardiac failure. However, the association between the presence of CSR and the outcome of acute stroke is not well established. We aimed to assess whether CSR has a predictive value in acute stroke.

Methods: We investigated the patients who were admitted with acute ischemic stroke and received nocturnal polysomnography. We collected data on demographics, risk factors, etiologic subtypes, and stroke outcome and the parameters associated with respiratory events in polysomnography. The stroke outcome was evaluated with the occurrence of early neurological deterioration (END) and modified Rankin Scale (mRS) at one and three months. We assessed the association between the presence of CSR and the stroke outcome using multivariate logistic regression analysis.

Results: Among 182 patients, 35 (19.2%) showed CSR in polysomnography. Incidence of END was not different between groups according to CSR. MRS at one month and three months was higher in CSR group than non-CSR group. However, the association between CSR and mRS disappeared after adjustment by risk factors, severity and location of stroke using multivariate analysis, whereas the association between obstructive sleep apnea and higher mRS/END persisted after adjustment.

Conclusions: The presence of CSR in acute stroke was associated with poor functional outcome. However, CSR was not an independent factor predicting the outcome of stroke.

Disclosure: Nothing to disclose.

P212 | Clinical utility and diagnostic significance of hepcidin as a biomarker of restless leg syndrome

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Objectives/Instruction: Restless legs syndrome (RLS) is a sensorimotor disorder that often has a impact on sleep quality. However, the etiology and pathophysiology is still unknown yet, albeit numerous researches for the biological basis. Common consensus is its association with iron supported as the following. Not only secondary RLS is related under condition of lack of iron status, but also dopamine agonist is still most effective agent for symptom relief even in primary RLS. Serum ferritin levels, a marker of whole body iron used to be a strong correlation with RLS, but low sensitivity is problematic to diagnosis. Hepcidin is a regulatory hormone handling iron absorption, recycling, tissue storage. Deficit of hepcidin involves mishandling iron metabolism and may lead to decreased availability of iron even in brain. In the current case-control study, we aim to investigate clinical utility of hepcidin as a biomarker in RLS compared to the healthy control.

Methods: We recruited 24 drug-naïve patients who met criteria for RLS using IRLSSSG and 16 healthy subjects since April 2017 - November 2017. Using face-to face interview, at the first visit, we obtained sociodemographic characteristics, sleep profiles such as habitual sleep duration, sleep quality, daytime sleepiness, and insomnia. We also obtained information about mood status and quality of life questionnaire. Blood test and electrophysiologic test was performed. Serum hapcidin was analyzed by ELISA kit at first visit in both groups and 3month later during dopamine agnonist medication in patients group. sleep factors, mood status and *sever*ity of symptom was answered at 1 month, 3months later.

Results: RLS groups was older than the healthy group (49.4 ±15.3 vs 34.3 ± 4.9 years old) but proportion of gender was not different between two group. Initial hepcidin level was comparable between group (135.9pg/dL vs. 129.0pg/dL; p = 0.69) but hepcidin level was significantly associated with disease severity by the negative direction. (beta=-0.47, p = 0.03).

Conclusions: The pathophysiology of RLS is centered on dopaminergic system dysfunction, altered iron hemostasis and decreased CNS iron. However iron-regulatory hormone. hepcidin can be useful objective tracer for disease severity and effectiveness of pharmacologic treatment even though not significant diagnostic marker.

Disclosure: Nothing to disclose.

P213 | Mild motor abnormalities in 'idiopathic' REM sleep behavior disorder: a diagnostic window to early neurodegeneration

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Objectives/Instruction: Mild motor abnormalities (MMA) can herald the beginning of Parkinson's disease (PD) but their diagnostic value in identifing individuals at risk is limited by multifactorial ageing-related influences on motor function.

Methods: By conducting a systematic assessment of motor function in 20 patients with 'idiopathic' REM sleep behavior disorder (RBD) without parkinsonian motor signs and 20 healthy controls, we characterized MMA in different motor domains, addressed further determinants of motor function, and determined the diagnostic value of new and established quantitative motor tests in prodromal PD-related disease.

Results: Patients with RBD showed MMA in perceptual motor speed (falling stick test), trunk movement coordination (bend, twist and touch test) and dynamic balance (straight line walk test) without alterations in simple motor speed (alternate tap test), dexterity (grooved pegboard), static balance (force plate) and gait (timed up and go test). The fallings stick test showed the highest diagnostic accuracy in identifying subjects with RBD [area under the receiver operating characteristic curve (ROC-AUC) 0.85, $P \leq 0.001$]. Multivariate analysis revealed physical activity and age as additional determinants of motor test performance.

Conclusions: RBD comprises a wide spectrum of MMA which cannot be verified by established tests for motor speed, gait, and balance. The fallings stick test, a new screening test for perceptual motor speed, provides high diagnostic potential to identify subjects at neurodegenerative risk before parkinsonian motor signs become apparent. Normative data for physical activity and age need to be obtained to ensure correct interpretation of motor test results in prodromal PD-related disease.

Disclosure: Nothing to disclose.

P214 | Sleep disturbances, fatigue, anxiety and depression in multiple sclerosis (MS): results of the German SLEEP-MS Survey

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Objectives/Instruction: Sleep disturbances, fatigue, anxiety and depression are major determinants of quality of life in chronic disease. A systematic analysis of frequency and interrelated associations of these conditions in MS is lacking.

Methods: German nationwide survey in 26 centerts o determine prevalence of sleep disturbances, fatigue, anxiety and depression in MS.

Results: Analysis included 2052 patients (616 males and 1436 females) with MS: RRMS>2y, *n* = 1279 (62%); RRMS< 2y, n=299 (15%); SPMS, n=356 (17%); PPMS, n=115 (5%). Prevalence of sleep disturbances (Pittsburgh sleep quality questionnaire score ^{3}5) in MS in general was 73%, in RRMS< 2y 60%, RRMS>2y 54%, SPMS 54% and PPMS 58%. Symptoms of fatigue (Modified Fatigue Impact Scale Median-Split^{3}34) were reported by 45% of all MS patients. Anxiety and depression (Hospital Anxiety and Depression Scale, HADS, anxiety subscale^{3}11, depression subscale^{3}11) was present in 60% of all MS patients. For comparison, in the German normal population, prevalence of sleep disturbances is at 10%, anxiety at 7% and depression at 18%. Only sleep disturbances (p= 0.08) and fatigue (p=0.0001) but not age, gender duration, course and severity of MS determined the mental quality of life (mental SF36 subscale) in the multivariate analysis. Sleep quality was not influenced by different kinds of MS-medication.

Conclusions: Sleep disturbances, anxiety and depression are highly prevalent in MS independent of disease stage and subtype. Since impaired sleep quality and fatigue are the major determinants for reduced quality of life special surveillance of these conditions and psycho-social care at early stages of disease is required.

Disclosure: The study was supported by Novartis.

P215 | Long sleep duration is associated with cognitive decline in patients with multi domain mild cognitive impairment

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Objectives/Instruction: The prevalence of Mild Cognitive Impairment (MCI) increases among elderly and is associated with high risk for dementia. Identifying factors that may contribute to the progress of MCI to dementia is critical. The objective of this study was to examine the association of objective sleep with cognitive performance in MCI patients.

Methods: A subsample of 271 participants with a diagnosis of probable Alzheimer's Disease (AD; N=50) or mild cognitive impairment (MCI; N=121), and 100 cognitively intact persons (NI) were recruited from a large population-based cohort in the island of Crete, Greece of 3140 older adults (> 60 years). All participants underwent extensive neuropsychiatric/neuropsychological evaluation and a 3-day 24-h actigraphy. Objective sleep variables and their association with neuropsychological performance were examined across the 3 groups, controlling for demographics, BMI, depression, sleep apnea symptoms, and psychotropic medications.

Results: AD patients had significantly longer night total sleep time (TST) compared to MCI and NI groups. Long night and 24-h TST was associated with performance decrements in multiple neurocognitive domains (sustained attention, visuoconstructive ability, executive function, short-term memory, verbal and visuospatial episodic memory) in the multi domain subtypes of MCI.

Conclusions: Elderly patients with MCI have similar objective sleep duration with normal controls, while AD patients sleep longer. Additionally and interestingly, long sleep duration in patients with multi domain subtypes of MCI is associated with decrements in episodic memory and problem solving ability. It appears that long sleep duration may be an early biologic marker of accelerated cognitive decline within these subtypes of MCI.

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P216 | Sleep slow waves and spindles in the acute stage of a moderate to severe traumatic brain injury

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Objectives/Introduction: We have recently shown that sleep is highly fragmented in hospitalized patients with acute moderate to severe traumatic brain injury (TBI). However, whether these patients have normal electroencephalographic oscillatory events during sleep (i.e. sleep slow waves and spindles) is unknown. This study explores whether sleep spindles and slow waves are altered in a group of non-sedated patients with acute moderate to severe TBI.

Methods: We tested 10 non-sedated patients (age 25±12 yo, 6 males) hospitalized for a moderate to severe TBI. To control for the environmental (e.g. noise, light, medical interventions) and traumatic (e.g. pain, medication) factors, we compared them to a group of 8 patients (age 30±13 yo, 6 males) with orthopedic or spinal cord injury (OSCI) who were hospitalized in the same environment. We used an overnight ambulatory polysomnographic recording at the bedside. Testing occurred 22±14 days post-injury in TBI patients and 19±9 days post-injury in patients with OSCI. After artefact rejection, an automatic algorithm detected spindles and slow waves on C3 electrodes for N2 and N3 sleep, in the first three sleep cycles.

T-tests were used to compare groups for spindle and slow wave characteristics (e.g. density, amplitude, slow wave slope, frequency, slow wave duration).

Results: When inspected visually, no anomalies were found for slow wave and spindle morphology in our sample. However, the TBI group had a lower spindle density compared to OSCI patients for the second sleep cycle (mean of TBI=2.35 ± 0.79 and mean of OSCI=3.19 ± 0.69; t = 2.37; p = 0.031) and a similar trend was found for the first sleep cycle (t = 1.74; p = 0.1). Also, the TBI group had higher slow wave density in the third sleep cycle (mean of TBI=7.62 ± 5.79 and mean of OSCI=2.77 ± 1.29; t = −2.31; p = 0.028). No group differences were found for other slow wave or spindle characteristics.

Conclusions: This exploratory study suggests that subtle changes in the sleep microarchitecture, and more specifically a decrease in spindle density and an increase in slow wave density, could occur in patients with acute moderate to severe TBI. Whether these differences are the reflect of the injury or the recovery process occurring after a moderate to severe TBI will need to be further investigated.

Disclosure: Nothing to disclose.

P217 | Beyond actigraphy: towards a better understanding of increased sleep duration following traumatic brain injury

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Objectives/Introduction: Sleep-wake disturbances (SWD) are a prevalent, disabling and persistent complaints following traumatic brain injury (TBI). An excessive need for sleep and the inability to maintain consolidated wakefulness during the daytime are an important part of the reported SWD. However, due to heterogeneous and complex clinical profiles of TBI survivors, the understanding of sleep pattern changes remains a challenge that limits effective treatment. The present study examined sleep-wake patterns using actigraphy and self-reported questionnaires in adults with chronic TBI, focusing on the influence of injuries severity, common comorbidities and medication use.

Methods: Thirty-four participants with moderate-severe TBI (23M, 30.6±12.3yo) were compared to 34 controls (23M, 31.2±13.0yo) at 1-3 years post-injury. We used a 7-day sleep diary and actigraphy to document sleep-wake patterns. Severity of overall injuries was evaluated based on the Injury Severity Score. Subjective level of sleep quality, sleepiness, fatigue, mood and pain were assessed with self-reported questionnaires. To test the influence of psychoactive medication on sleep-wake pattern, group differences between medicated TBI (n=13), non-medicated TBI and controls were assessed.

Results: Overall, the TBI group reported poorer sleep quality, and greater sleepiness, fatigue, anxiety, depression and pain than controls. On actigraphy, the TBI group had earlier bedtime, more naps, and slept an average of 0.5 ± 0.1 h more over the 24h period than controls ($p < 0.05$). Sleep duration per 24h was more increased in medicated TBI (8.0±0.8h) compared to non-medicated TBI (7.1 ± 0.8 h; $p < 0.05$) and controls (7.0 ± 0.8h; $p < 0.01$). The TBI participants with longer sleep duration tended to report more fatigue (r = 0.31; p = 0.06), but no association was found with comorbidities. More severe injuries were associated with increased sleep duration (r = 0.41;$p < 0.05$), sleepiness (r = 0.34; $p < 0.05$) and fatigue (r = 0.44; p = 0.009). In TBI group, subjective fatigue was correlated with anxiety (r = 0.41; $p < 0.05$) and depression (r = 0.47; p = 0.005), while worse sleep quality was positively associated with pain intensity (r = 0.67; $p < 0.001$).

Conclusions: Our results showed that adults with chronic TBI have several complaints regarding their sleep and daytime functioning. Increased sleep duration appears to be specific to a subgroup of TBI patients who use psychoactive medication. Future studies should aim at identifying patients at risk of persistent SWD in order to develop efficient early interventions.

Disclosure: Nothing to disclose.

P218 | The sleep spindles in the middle cerebral artery acute stroke

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Objectives/Instruction: Sleep spindles are elements of sleep microstructure characteristic of the N2 stage. These graphs depend on the integrity of thalamocortical circuits. Studies evaluating sleep spindles (SS) in hemispheric strokes are rare.

Objective: To identify the alterations in the frequency band of sleep spindles in the acute phase of middle cerebral artery stroke (MCA).

Methods: Successive sample of patients with MCA acute stroke, NIHSS> 4 on admission, absence of benzodiazepines, EEG (system 10–10) ≥ 72h of stroke with ≥ 5 min sleep N2 and signed informed consent. Variable studied: relative power of the slow (11-13Hz) and fast (13-15Hz) spindles frequency bands in the two cerebral hemispheres in frontal, fronto-center and center-parietal leads (FFT of 10 samples of 30 seconds of phase N2 without artifacts or micro-awakenings). We compared the two hemispheres with T-test for paired samples or Wilcoxon signed rank $p > 0.05$ (SPSS 20).

Results: 5 MCA acute stroke patients (2 left, 3 right), aged 69-83 years. In the total sample, the relative power of the fast and slow

spindle bands were significantly smaller in the injured hemisphere at the three studied locations (slow spindles 0.0232 ± 0.01 - 0.0387 ± 0.019; fast spindles 0.0281 ± 002 - 0, 0358 ± 0.05) compared to the uninjured (slow spindles 0.0369 ± 0.02 - 0.0495 ± 0.02; fast spindles 0.0415 ± 0.02-0.0544 ± 0.025) ($p < 0.000$).

Conclusions: The quantitative evaluation of N2 sleep EEG in the MCA acute phase confirms a decrease in the frequency bands of fast and slow spindles in the injured hemisphere. These frequency bands are involved in the processing of declarative and motor memories during sleep, so this data may be of prognostic importance. Future developments of this work include the widening of the sample and correlation of this change with the prognosis of patients with acute stroke.

Disclosure: Nothing to disclose.

P219 | Alternations of sleep in patients with severe disorders of consciousness

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Objectives/Introduction: Patients with severe Disorder of Consciousness (DOC) following brain injury show reflexive responses to stimulation, eye movements and behavioural signs of sleep wake-cycles, with signs of purposeful or voluntary behaviour being weak and inconsistent (Minimally Consciousness State (MCS)) or completely lacking (Unresponsive Wakefulness Syndrome (UWS)). The challenges in differential diagnosis lead to a high number of misdiagnosis. By investigating the presence and distribution of sleep stages, as an objective marker, the reliability of diagnostic evaluation might be improved. Here we aimed at comparing sleep stage characteristics between patients during a full 24h cycle.

Methods: We recorded 24-h continuous polysomnographic recordings (PSG) in 32 DOC Patients (16 UWS, 16 MCS) and 10 fully conscious quadriplegic patients (Controls) in their usual hospital environment. The recordings were sleep staged by three experienced raters according to adapted Rechtschaffen & Kales (1968) criteria. Comparisons between patient groups concerning sleep during day-time (8am-8pm), night-time (8pm-8am), and the total recording period were calculated using univariate ANOVAs followed by post-hoc comparisons.

Results: Looking at overall sleep/wake states, patient groups differed in their time spent awake during night-time ($F(2,39) = 6.50$, $p = .004$), with UWS patients spending more time awake ($M = 538.85$ min, $SD = 162.89$ min) than Controls ($M = 346.70$ min, $SD = 92.50$ min). However, over the total recording period no group differences in time spent awake were found.

Looking at the distribution of single sleep stages, the time spent in each sleep stage differed between the patient groups especially at night-time, revealing higher amounts of S1 sleep in MCS compared to UWS patients ($F(2,39)=3.93$, $p=.028$), higher amounts of S2 sleep in Controls compared to UWS patients ($F(2,39)=4.09$, $p=.025$) and less REM sleep both in UWS and MCS patients compared to Controls ($F(2,39)=9.43$, $p< .001$).

Over the total recording period, MCS patients ($M=101.41$min, $SD=67.23$min) spent more time in S1 sleep compared to UWS patients ($M=51.97$min, $SD=42.50$min; $F(2,39)=3.36$, $p=.045$) and UWS patients ($M=11.73$min,$SD=18.76$min) spent less time in REM sleep than Controls ($M=55.95$min, $SD=28.67$min); $F(2,39)=7.41$, $p=.002$).

Conclusions: Differences between patients concerning sleep stages and overall time spent awake/asleep occurred mainly at night-time. The findings demonstrate severe sleep disturbance in DOC and support the necessity of long-time PSG in patient evaluation.

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P220 | Circadian distribution of behavioural signs of sleep and wakefulness in patients with disorders of consciousness

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Objectives/Introduction: The state of severe Disorder of Consciousness (DOC) is distinguishable from coma by the appearance of reflexive responses to stimulation, eye movements and behavioural signs of sleep wake-cycles (eyes open/closed). Signs of awareness manifested in purposeful or voluntary behaviour are weak and inconsistent (Minimally Consciousness State (MCS)) or completely lacking (Unresponsive Wakefulness Syndrome (UWS)). We aimed at assessing circadian changes in the level of arousal on the behavioural and electrophysiological level.

Methods: In the present study 42 patients (16 UWS, 16 MCS, 10 controls) were enrolled. A 24-h EEG and video recording was performed. Behavioural sleep was operationalized as the amount of eyes closed and evaluated based on the video recordings (120 classifications per hour). Comparisons between the amount of behavioural sleep during day-time (8 am - 8 pm) and night-time (8 pm - 8am) between groups were calculated by means of repeated measures ANOVA followed by pairwise comparisons.

Results: The overall frequency of eyes-closed and eyes-open epochs was close to 50/50% and was not significantly different between groups ($p > 0.99$). However, the groups differed in the presence of eyes-closed epochs during the night-time and day-time,

F (2, 39) = 4.24, p = .02. In the controls, eyes-closed epochs were more frequent during night-time compared to day-time (t (9) = −3.11, p = 0.01), whereas in both groups of DOC patients, UWS (t (15) = −1.30, p = 0.21) and MCS (t (15) = −1.55, p = 0.14), there was no difference between night and day in the amount of behavioural sleep.

Conclusions: These findings highlight differences between patients with severe disorders of consciousness and conscious patients concerning sleep-wake cycle. As a next step in data processing, it is planned to investigate changes in spectral power during day and night as well as during periods of behavioural sleep and behavioural wakefulness.

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P222 | Prospective, home-based assessment of subjective sleep quality in Parkinson's disease

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Objectives/Introduction: Insomnia is still an overlooked issue in routine clinical management of patients with Parkinson's Disease (PD). Prospective evaluation of insomnia symptoms by mean of sleep diaries is a mainstay of insomnia assessment and management. In fact, retrospective information might be biased by subjects' recall. This might be essential in patients with PD, who might show subclinical cognitive dysfunction. Our group has developed an app for tablets named *Sleep Fit*. It allows ecological momentary assessment of sleep and motor symptoms by mean of prospective, repeated sampling of patients' symptoms, to minimize recall bias and maximize ecological validity. We investigated the correspondence between subjective sleep quality prospectively assessed by mean of *Sleep Fit* or retrospectively by mean of a structured questionnaire, in PD patients.

Methods: Subjective sleep quality was assessed in 42 consecutive patients (9 females, 67 ± 9.8 year-old) with mild to moderate idiopathic PD prospectively, at home, on morning awakening for 2 weeks, by mean of a Visual Analogue Scale assessing overall sleep quality of the previous night (sq-VAS) integrated into *Sleep Fit*. The Pittsburgh Sleep Quality Index (PSQI) was then retrospectively administered at day 14 at clinical consultation. The overall agreement between prospectively and retrospectively collected information was calculated for the PSQI total score and PSQI component 1 ("subjective sleep quality") as the normalized difference per patient. We also evaluated this agreement for different temporal frames within the two weeks to estimate potential recency effect of patients' recall. The correlation between agreement and demographics was also explored.

Results: Overall sleep quality estimated by the sq-VAS scale showed good agreement both with PSQI total score (20.9%) and PSQI component 1 (22.9%). However, in single subjects this agreement varied considerably, ranging from 0.5 to 52.4% for PSQI total score and from 0.0 to 66.7% for PSQI component 1. No evidence of recency effect was found.

Conclusions: Although the agreement between prospective and retrospective assessments of subjective sleep quality was overall good, a subgroup of PD patients seemed not to accurately report their subjective sleep quality at retrospective evaluation. *Sleep Fit* might be helpful to overcome this pitfall in clinical practice.

Disclosure: Nothing to disclose.

PSYCHIATRIC & BEHAVIOURAL DISORDERS 1

P223 | Sleep disturbances associated with post traumatic stress disorder: presentation and polysomnographic features in a population of patients admitted to a sleep laboratory

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Objectives/Instruction: Post-traumatic stress disorder (PTSD) is a mental health condition that is triggered in some people by exposure to a traumatic event. Sleep disturbance was identified as a core feature in recent research. In this study we assess sleep complaints and objective sleep parameters in patients with PTSD admitted to a sleep laboratory.

Methods: Retrospective study of patients with a diagnosis of PTSD who were referred for full polysomnography (PSG) in a sleep service as part of the investigation of a sleep disturbance. Demographic data, presenting complaints, PSG parameters, subjective and objective levels of sleepiness, sleep diary, medication and diagnoses were recorded.

Results: The studied sample included 30 patients, 46.7% female 53.3% male, mean age 45 years, (SD 15), mean BMI 28 (SD 4.7) kg/m^2.

13 patients presented with excess daytime sleepiness or fatigue, 11 with parasomnia, 5 with poor sleep and 1 patient with nightmare disorder.

21 had a diagnosis of depression, 12 reported insomnia and 20 nightmares. 63.3% received antidepressants.

Mean total sleep time (TST) in sleep diary was 6.5 hr. Mean Epworth score was 10 (SD 6.5).

PSG parameters expressed in mean, SD were: Sleep latency (SL) 26.3 (35.8) min, TST 390 (130) min, sleep efficiency (SE) for time in

bed 77.6 (16.2)%, SE for sleep period of time 80.5 (16.7)%, stages 1 and 2: 48 (13.5)%, REM 17 (15.5)% slow wave sleep 13 (9.5)%, apnoea hypopnea index 7.6 (9.2)/h, periodic limb movement (PLM) index 19.5 (29.9)/h. Mean SL in multiple sleep latency test was 11.7 (4.6) min. Parasomnias were recorded in 7 cases.

After PSG, 8 patients were diagnosed with PLM disorder, 9 with parasomnia, 6 with sleep apnoea, 3 with insomnia and 5 had no sleep disorder identified. The presence of PLM during sleep did not correlate with the usage of antidepressants.

Conclusions: Both sleep onset and sleep maintenance insomnia were evidenced in objective and subjective tests. Nightmares were frequent. Sleep apnoea was present in 50% (33.3% mild) and significant PLM during sleep in 36.7%. Whether disturbed sleep is secondary to, or a core feature of PTSD remains an area for further research.

Disclosure: Nothing to disclose.

P224 | The impact of sleep disturbances and mental health outcomes on burnout in firefighters and the mediating role of sleep during overnight work: a cross-sectional study

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Objectives/Introduction: Sleep and mental health disturbances are prevalent among firefighters, but their association with burnout, and the extent to which sleep attained during overnight work contributes to these relationships is unknown. The current study investigated whether firefighters' sleep disorder risk and mental health outcomes are associated with burnout, and explored the mediating role of sleep at work in these relationships. A secondary aim was to investigate associations between habitual sleep characteristics and burnout.

Methods: Burnout levels were assessed in North American firefighters (n = 6,307) using the Maslach Burnout Inventory (i.e., emotional exhaustion, depersonalisation, personal accomplishment). Firefighters also self-reported mental health disorders (depression, anxiety, post-traumatic stress disorder; PTSD) and habitual sleep characteristics (sleep duration, sleepiness, sleep deficit) and were screened for common sleep disorders (insomnia, obstructive sleep apnoea, shift work disorder, restless legs syndrome).

Results: Firefighters screening positive for a sleep disorder, particularly insomnia, had an increased risk of emotional exhaustion (adjusted odds ratio 3.78, 95% CI 2.97–4.79, $p < 0.0001$), depersonalisation (2.15, 1.71–2.71, $p < 0.0001$) and low personal accomplishment (2.16, 1.75–2.66, $p < 0.0001$). Firefighters self-reporting a current diagnosis of PTSD, anxiety or depression were at greater risk of emotional exhaustion (PTSD 4.88, 3.27–7.29; Anxiety 4.17, 3.11–5.60; Depression 3.61, 2.84–4.59; all $p < 0.0001$). Shorter sleep during overnight work mediated the impact of having a sleep disorder and mental health condition on high burnout ($p < 0.0001$). Sleepiness and sleep deficit (difference between self-reported required and actual sleep), even in firefighters without sleep disorder risk, were associated with emotional exhaustion (Sleepiness 2.32, 1.77–3.03; Sleep deficit 2.09, 1.59–2.74; both $p < 0.0001$), depersonalisation (Sleepiness 1.65, 1.34–2.03, $p < 0.0001$; Sleep deficit 1.29, 1.06–1.57, $p = 0.011$) and low personal accomplishment (Sleepiness 1.25, 1.07–1.47, $p = 0.0006$; Sleep deficit 1.17, 1.01–1.35, $p = 0.036$).

Conclusions: Sleep disorders and mental health outcomes were significantly associated with an increased risk of burnout in firefighters, and these associations were mediated by short sleep during overnight work. These results demonstrate how sleep and mental health disturbances influence burnout in firefighters, and highlight the need to examine the effectiveness of occupational interventions that maximise sleep opportunities during overnight work to reduce burnout risk in vulnerable personnel.

Disclosure: Alexander P. Wolkow, Laura K. Barger, Conor S. O′ Brien, Jason P. Sullivan, Salim Qadri, Steven W. Lockley, Charles A. Czeisler and Shantha M.W. Rajaratnam report no conflicts of interest directly related to the content reported in this abstract. Laura K. Barger reports research support from Cephalon, NFL charities, Sysco and San Francisco Bar Pilots. Laura K. Barger has received consulting/lecture fees or served as a board member for Alertness Solution, Ceridian, Davis Joint Unified School Board, San Jose State University Foundation, Pugot Sound Pilots, Sygma and Torvec. Steven W. Lockley holds a process patent for 'Systems and methods for determining and/or controlling sleep quality', which is assigned to the Brigham and Women′s Hospital per Hospital policy. Steven W. Lockley has also served as a paid expert for legal proceedings related to light, sleep and health. Steven W. Lockley is a Program Leader for the CRC for Alertness, Safety and Productivity, Australia. Charles A. Czeisler reports grants from Cephalon Inc., grants from Mary Ann & Stanley Snider via Combined Jewish Philanthropies, grants from National Football League Charities, grants from Optum, grants from Philips Respironics, Inc., grants from ResMed Foundation, grants from San Francisco Bar Pilots, grants from Schneider Inc., grants from Sysco, grants from Cephalon, Inc, grants from Jazz Pharmaceuticals, grants from Takeda Pharmaceuticals, grants from Teva Pharmaceuticals Industries, Ltd, grants from Sanofi-Aventis, Inc, grants from Sepracor, Inc, grants from Wake Up Narcolepsy, personal fees from Bose Corporation, personal fees from Boston Celtics, personal fees from Boston Red Sox, personal fees from Columbia River Bar Pilots, personal fees from Institute of Digital Media and Child Development, personal fees from Klarman Family Foundation, personal fees from Samsung Electronics, personal fees from Quest Diagnostics, Inc, personal fees from Vanda Pharmaceuticals, personal fees from American Academy of Sleep Medicine (AADSM), personal fees from CurtCo Media Labs LLC, personal fees from Global Council on

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P225 | Sleep quality and its association with dysfunctional beliefs and health outcome in a sample of a Nigerian community

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Objectives/Instruction: Sleep-related cognition has been consistently reported to maintain insomnia, and this influence may be culture/context-specific. This study aimed at evaluating sleep quality and its association with dysfunctional beliefs and general health outcome in a Nigerian community sample. It also assessed the correlates of poor sleep quality among them.

Methods: It was a cross-sectional study in which 267 respondents were evaluated for sleep quality, dysfunctional beliefs/attitudes, daytime sleepiness, sleep hygiene and general health outcome using the Pittsburgh Sleep Quality Index (PSQI), 16- item Dysfunctional Beliefs and Attitudes about Sleep (DBAS-16) Scale, Epworth Sleepiness Scale, Sleep Hygiene Index (SHI) and the 12- item Short-Form Health Survey (SF-12) respectively.

Results: The mean age (SD) of the respondents was 46.2 (16.6) years (Male = 41.6%). The prevalence of poor sleep quality was 41.2%. The gender ($\chi^2 = 6.03$, $p = 0.01$), relationship status ($\chi^2 = 11.434$ $p = 0.01$) and type of relationship ($\chi^2 = 8.64$, $p = 0.01$) had significant associations with sleep quality. The global PSQI score had significant positive correlations with the respondents' age ($r = 0.27$, $p < 0.01$), number of children ($r = 0.22$, $p < 0.01$), ESS score (0.34, $p < 0.01$), SHI score ($r = 0.16$, $p < 0.01$) and the DBAS score ($r = 0.46$, $p < 0.01$) while it had significant negative correlation with the SF-12 score ($r = -0.51$, $p < 0.01$). Dysfunctional belief was an independent predictor of poor sleep quality ($p < 0.01$).

Conclusions: This study showed that poor sleep quality had moderately strong associations with dysfunctional beliefs/attitudes about sleep and poor general health outcomes. It also suggests that exploring critical beliefs about sleep may be an important step in formulating an effective sleep intervention programme in Nigeria.

Disclosure: Nothing to disclose.

P226 | Fear of sleep as perpetuating factor of trauma-related sleep disturbances

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Objectives/Instruction: Research often shows clinically relevant, residual sleep disturbances after trauma-focused, sleep-focused or even combined treatments in patients with posttraumatic stress disorder (PTSD). Therefore, fear of sleep, has been suggested as additional perpetuating factor for trauma-related sleep disturbances. Fear of sleep is the fear of losing control or being particularly vulnerable during sleep and seems to be specific for trauma-related sleep disturbances and not, for example, for people suffering only from insomnia. However, studies investigating the role fear of sleep plays for trauma-related sleep disturbances and how it is linked to insomnia and nightmares are extremely scarce.

Methods: Therefore, a theoretical model on the links between sleep disturbances, fear of sleep and PTSD will be presented together with preliminary results from an online study ($N = 759$). In the current study, we used self-reported questionnaires and investigated fear of sleep in relation to various aspects of trauma-related sleep disturbances, using correlational analyses as well as hierarchical cluster analyses.

Results: Besides high correlations between all measures in the expected directions, the results indicated four clusters: (1) one healthy group, (2) one group with only sleep disturbances such as insomnia and nightmares, (3) one group with clinically relevant PTSD-symptoms as well as insomnia and nightmares, but low fear of sleep and (4) one small, but very robust group, that is characterized by clinically relevant PTSD-symptoms, insomnia, nightmares and also high levels of fear of sleep.

Conclusions: Altogether, the results emphasize the importance of fear of sleep for trauma-related sleep disturbances. However, it is possible that fear of sleep specifically characterizes a subgroup of people with PTSD, where it might be especially important to adapt current treatment approaches to directly target fear of sleep and associated aspects, such as the fear of loss of control related to falling asleep, in order to improve treatment outcomes.

Disclosure: Nothing to disclose.

P227 | Rapid eye movement sleep abnormalities in female adolescents with borderline personality

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Objectives/Instruction: Rapid Eye Movement (REM) Sleep is hypothesized to play an important role in affective regulation and processing of emotional stimuli. Core features of Borderline Personality (BP) include difficulties in emotional regulation and impulsivity that usually present as early as the adolescence period. Previous studies have shown that adult patients with BP have reduced REM latency, increased REM percentage and density when compared to controls.
The study aimed at detection of sleep abnormalities particularly in REM stage (Total REM duration, REM latency, REM density, and REM distribution) in adolescent females suffering from BP.

Methods: The study was a case control study conducted in a university psychiatry hospital. A convenient sample of 30 adolescent females with BP were compared to 30 age matched healthy females. The patients were diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders, Text Revised (DSM-IV TR) criteria for borderline personality disorder with the exception of the age criterion, using the Structured Clinical Interview according to DSM-IV (SCID-I & II). Pittsburgh Sleep Quality Index (PSQI) and an overnight sleep lab polysomnographic study were applied to both groups. Borderline Personality Questionnaire (BPQ) was used to measure the severity of borderline personality.

Results: Patients with BP were subjectively dissatisfied with the quality of their sleep when compared to controls ($p < 0.001$). Abnormalities in REM sleep in these patients when compared to controls were, higher REM percent (18.96 ± 6.83 vs. 12.79 ± 4.97%, $p < 0.001$), shorter REM latency (85.68 ± 30.42 min vs. 212.55 ± 60.70, $p < 0.001$), higher REM density (7.67 ± 4.16 and 4.23 ± 2.90, $p < 0.001$) and higher number of REM periods in the first half of the night (2.03 ± 0.89 vs. 0.43 ± 0.57, $p = 0.000$). These changes in REM sleep were not associated with the severity of the personality disorder.

Conclusions: Adolescent females with BP suffer from REM sleep abnormalities suggested to be a trait marker for BP.

Disclosure: Nothing to disclose.

P229 | An experience sampling study examining the link between sleep and paranoia in patients with non-affective psychosis

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Objectives/Introduction: Growing evidence suggests a relationship between sleep disturbance and paranoid thinking, in both clinical and non-clinical populations. Research also suggests that this relationship is mediated by levels of negative affect. The aims of this study was to (1) examine whether sleep disturbance also predicts the dimensions of paranoia, including distress, pre-occupation and conviction, (2) to test whether there is a time-lagged, temporal relationship between sleep and paranoia, and whether this is mediated by negative affect and (3) to use novel experience sampling methods to test these relationships in people with non-affective psychosis.

Methods: Momentary assessments of sleep, mood, and paranoia were measured 8 times a day, for 8 days, at semi-random intervals. Multi-level modelling was then used to assess relationships between the variables.

Results: A sample of 20 patients were recruited. There was no relationship between subjective sleep as measured by a sleep diary and paranoia or its dimensions (all p => 0.05). There was no time-lagged, temporal relationship between sleep and paranoia ($p = 0.67$) A sub-set of individuals in the sample was identified who did not report any variation or fluctuations in their measurements.

Conclusions: Sleep disturbances were common in people with non-affective psychosis; however there was no clear link between sleep, and paranoia. Our findings support the treatment of sleep problems in this sample, but not in relation to paranoia.

Disclosure: Nothing to disclose.

P230 | Treating insomnia and depression: using network analysis to explore working mechanisms

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Objectives/Introduction: Insomnia and depression often co-occur. Research shows that Cognitive Behavioral Therapy for Insomnia (CBT-I) not only improves insomnia complaints, but also depressive symptoms. It remains unclear, however, whether the effect of CBT-I on depression occurs *via* improvements in insomnia, or whether CBT-I affects depression symptoms directly.

Methods: We performed a randomized controlled trial in patients with insomnia (i.e. self-reported fulfilling of DSM-5 criteria) and (subclinical) depression (Patient Health Questionnaire-9 > 4). Participants received guided web-based CBT-I or no treatment. We measured insomnia (Insomnia Severity Index) and depression (Patient Health Questionnaire) weekly for 10 weeks. We used network analyses, including treatment allocation as a binary variable, to investigate specific effects of CBT-I on symptoms of insomnia and depression. We evaluated effects of treatment (1) on its conditional dependence relations between treatment and symptoms; (2) on individual symptom severity; (3) on predictability of symptoms in the network (i.e. proportions of variance explained by all other nodes in the network).

Results: Network analysis suggests that in this sample (N = 104),

(1) CBT-I predominantly affects insomnia symptoms, particularly *difficulty maintaining sleep* and *early morning awakenings*. While depressive symptoms also decline, this seems to occur *via* their relations to insomnia symptoms (specifically: sleep complaints) rather than via direct associations to treatment;

(2) insomnia severity symptoms declined most, and

(3) predictability increases over time as a result of treatment, especially in the insomnia symptoms: from on average 29% at baseline to 62% at post-measurement.

Conclusions: This study has introduced the opportunity of using network analysis to explore how CBT-I improves depression and suggests that CBT-I effects insomnia symptoms *first* and depressive symptoms *via* insomnia improvements, illustrated by direct conditional dependencies between treatment and symptoms mostly with insomnia symptoms. Adopting a network approach provides an opportunity for the field to explore how treatments affect separate symptoms of psychological disorders, in existing (trial) datasets and future studies. More clinical research is needed in different and larger samples, and in samples with a clinical diagnosis of depression to strengthen the current findings.

Disclosure: Nothing to disclose.

P232 | Sleep problems and daytime sleepiness in adolescents with and without attention-deficit/hyperactivity disorder

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Objectives/Instruction: Most studies examining sleep and attention-deficit/hyperactivity disorder (ADHD) have focused on school-aged children, with far fewer studies investigating sleep in adolescents with ADHD. The objective of the present study was to examine whether adolescents with ADHD differ from adolescents without ADHD in their sleep and daytime sleepiness as measured with parent and adolescent ratings and actigraphy.

Methods: Participants were 302 young adolescents (ages 12–14 years; 55.3% male; 81.8% White), with approximately half (53.6%) diagnosed with ADHD based on a structured diagnostic interview with the adolescent's parent. Adolescents completed the Sleep Habits Survey (SHS) and Pediatric Daytime Sleepiness Scale (PDSS). Parents completed the Sleep Disturbance Scale for Children (SDSC) and a parent-report version of the PDSS. Participants wore actigraphs for approximately two weeks.

Results: Independent samples t-tests indicated that adolescents with ADHD do not differ on their self-reported weekday bedtime/wake time or sleep duration ($ps > 0.05$) though adolescents with ADHD reported a significantly later bedtime than adolescents without ADHD on weekends ($p = 0.03$, $d = 0.25$). Adolescents with ADHD also reported more sleep/wake problems than adolescents without ADHD ($p = 0.001$, $d = 0.43$), and marginally greater eveningness circadian preference ($p = 0.07$, $d = 0.21$). Parents also reported that adolescents with ADHD have more total sleep disturbances than adolescents without ADHD ($p = 0.001$, $d = 0.76$), with significant group differences found for all SDSC subscales except sleep-disordered breathing. Adolescents with ADHD experience more daytime sleepiness than adolescents without ADHD per both self ($p = 0.002$, $d = 0.36$) and parent ($p < 0.001$, $d = 0.71$) report. All significant effects remained when controlling for participant demographics, pubertal development, comorbid psychiatric diagnoses, and ADHD/sleep medication use. Actigraphy data are currently being processed and scored and will be presented alongside the subjective data at the conference.

Conclusions: Adolescents with ADHD have more subjective sleep problems and daytime sleepiness than their peers across both self and parent ratings. However, adolescents with ADHD do not generally report shorter sleep duration or overall differences in bedtimes/wake times than adolescents without ADHD. It will be important for future research to identify whether predictors and consequences of sleep problems differ for adolescents with and without ADHD.

Disclosure: Nothing to disclose.

P233 | The impact of cytokines on sleep and emotional risk improvement in adolescents with an eveningness chronotype

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Objectives/Instruction: Substantial sleep and wake changes occur during adolescence, which are linked to worse mental health outcomes. The immune system has emerged as a potential contributor to the developmental changes that occur during the adolescent years. This study examined if cytokines moderate the effects of a psychological intervention targeting sleep, circadian dysfunction, and health.

Methods: Adolescents with an eveningness chronotype were randomized to either the Transdiagnostic Sleep and Circadian Intervention for Youth (TranS-C; n = 83) or Psychoeducation (PE; n = 81). Weekday total sleep time (TST), weekday bedtime, and the discrepancy between weekday and weekend TST, bedtime, and waketime were assessed via sleep diary. The circadian measure was the Children's Morningness-Eveningness Preferences scale. Emotional, cognitive, behavioral, social, and physical health composite risk scores were derived from self-report measures. Oral mucosal transudate samples were assayed for interleukin (IL)-6 and tumor necrosis factor (TNF)-α.

Results: From pre-treatment to post-treatment, adolescents with higher TNF-α exhibited reduced weeknight and weekend waketime discrepancy compared to adolescents with lower TNF-α controlling for treatment condition (z = −1.99, p = 0.047). From pre-treatment to post-treatment among participants with higher IL-6, an earlier bedtime was associated with reduced emotional risk controlling for treatment condition (z = 2.23, p = 0.026). Similarly, an earlier bedtime was marginally associated with reduced emotional risk during treatment for participants with higher TNF-α (z = 1.77, p = 0.077).

Conclusions: In this sample of adolescents with an eveningness chronotype, higher TNF-α was associated with less weekday to weekend waketime variability. Furthermore, bedtime improvement was associated with reduced emotional risk during treatment for participants with higher but not lower levels of cytokines. Although cytokines have been implicated in the pathogenesis of inflammatory conditions and major depressive disorder, cytokines may also facilitate neural development by promoting neuron survival and synaptic connectivity. Future studies should further evaluate if cytokine levels influence psychological treatment response among adolescents.

Disclosure: Nothing to disclose.

P234 | Transdiagnostic sleep and circadian intervention for youth with eveningness: do pubertal hormones have a moderating effect?

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Objectives/Instruction: Puberty is a biological event characterized by significant sleep, circadian, and psychological changes that can lead to positive as well as negative developmental outcomes. This study examined if pubertal hormones moderate the effects of a psychological intervention targeting sleep, circadian dysfunction, and health.

Methods: Adolescents with an eveningness chronotype were randomized to either the Transdiagnostic Sleep and Circadian Intervention for Youth (TranS-C; n = 80, 49 female) or Psychoeducation (PE; n = 82, 46 female). Weekday total sleep time and bedtime were assessed via sleep diary. The circadian outcome was the Children's Morningness-Eveningness Preferences scale (CMEP). Emotional, cognitive, behavioral, social, and physical health composite risk scores were derived from self-report measures. Saliva samples were provided to assess testosterone, DHEA, and estradiol (females only).

Results: From pre-treatment to post-treatment, female adolescents in TranS-C with higher estradiol exhibited greater CMEP improvement compared to participants with lower estradiol (z = 2.53, p = 0.011) or participants in PE with higher estradiol (z = 3.64, $p < 0.001$). Male adolescents in TranS-C with higher DHEA exhibited reduced emotional risk from pre-treatment to post-treatment compared to participants with lower DHEA (z = 2.19, p = 0.028) or participants in PE with higher DHEA (z = −2.29, p = 0.022). Although DHEA did not moderate the effect of TranS-C on social risk, male adolescents in PE with higher DHEA exhibited increased social risk during treatment compared to participants with lower DHEA (z = −2.04, p = 0.042).

Conclusions: This study provides evidence that some benefits of TranS-C are greatest among female adolescents with higher levels of estradiol. Higher levels of DHEA in males differentially moderated the effect of TranS-C and PE on health outcomes. Previous research indicates that DHEA attenuates cortisol resulting in more externalizing problems but less internalizing problems, which may explain the differential findings for males with higher DHEA.

Disclosure: Nothing to disclose.

P235 | Proton magnetic resonance spectroscopy of brain in obstructive sleep apnea in Egyptian subjects

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Objectives/Instruction: The overall objective of this work is to study the cerebral metabolic changes in patients with OSA and to determine the usefulness of MRS as an objective method for evaluation of CNS impairment in these patients.

Methods: This study included two groups; group1 fifteen (15) patients diagnosed with obstructive sleep apnea hypopnea syndrome, and group 2 ten (10) healthy volunteers of comparable age. Magnetic resonance spectra were obtained from frontal periventricular white matter. For all subjects, height, body weight, and BMI were assessed. Waist and hip circumference were measured and waist/hip ratio (W/H ratio) was calculated. Overnight polysomnography (PSG) to identify sleep apnea was done. Daytime sleepiness was evaluated by the Epworth Sleepiness Scale. Symptoms of anxiety and depression were measured with the Hospital Anxiety and Depression Scale (HADS).

Results: N-acetylaspartate-to-creatine (NAA/Cr) and choline-to-creatine (Cho/Cr) ratios were significantly lower in the frontal white matter of obstructive sleep apnoea patients when compared to controls. Absolute concentrations of N-acetylaspartate (NAA) and choline (Cho) were also significantly reduced in the frontal white matter of patients with sleep apnoea. Statistically significantly negative correlations existed between AHI and metabolites concentrations and ratios in patients with OSAHS. Significant positive correlations existed in patients with OSAHS between Hospital and depression scale for depression (HAD-D) and AHI ($r = 0.764$, $p = 0.001$), ODI ($r = 0.571$, $p = 0.026$), and ESS ($r = 0.644$, $p = 0.010$) respectively. Significant positive correlations existed in patients with OSAHS between Hospital and depression scale for anxiety (HAD-A) and AHI ($r = 0.753$, $p = 0.001$), and ESS ($r = 0.537$, $p = 0.039$) respectively. *Multivariate Linear* regression model of factors predictive showed AHI as the main predictor factor for choline to creatine ratio in patients with OSAHS with $t = 5.180$, at $p < 0.001$.

Conclusions: OSA patients show abnormal brain metabolites related to neuronal damage due tointermittent chronic hypoxemia. Anxious and depressive symptoms are highly prevalent in patients-with severe untreated OSAS. The severity of depressive and anxious symptoms may be related toexcessive daytime sleepiness and to nocturnal hypoxemia both of which are strongly correlatedto brain metabolites. AHI seems to be the main predictor factor for choline to creatine ratio in patients with OSAHS.

Disclosure: Nothing to disclose.

P236 | Sleep deprivation triggers shared temporal dynamics of time and mood perception in bipolar depression

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Objectives/Introduction: Time perception, which is mediated by circadian and interval clocks, is essential for goal-directed behaviors. Despite the clock abnormalities implicated in bipolar disorder (BD), it remains to be seen whether antidepressant treatments affect the sense of time.

Methods: We studied the diurnal fluctuation of short-term time perception, as a possible marker of antidepressant response to repeated sleep deprivation (SD), combined with light therapy, in 14 consecutively admitted depressed in patients with BD. Patients produced 10 s without clock signal, and rated their mood and alertness using visual analogue scale every 4 hr, and activity changes were measured during treatment.

Results: Over the first SD, produced time (PT) was shortened ($p = 0.020$), while mood ($p = 0.00011$) and alertness ($p = 0.048$) increased. Throughout the treatment, temporal changes in PT showed a concurrent negative cross-correlation with those in mood ($r = -0.72$, $p < 0.05$), while no cross-correlation was found between PT and alertness, indicating that inner time accelerates simultaneously with mood improvement. In addition, temporal changes in PT negatively predicted those in activity ($r = -0.66$, $p < 0.05$), indicating that inner time acceleration precede an activity increase. Strong opposite daily changes were observed for mood (positive change) and PT (negative) at baseline, while after treatment both measures showed a weak negative diurnal variation, as reported in healthy humans ($p = 0.0081$). Nonetheless, depressive cognitive distortions positively correlated with PT after treatment ($r = 0.62$, $p = 0.033$).

Conclusions: The results indicate close phenotypic properties of time and mood perception dynamics, shedding new light on the role of interval timing clock in antidepressant response in BD. Our findings support the view that SD may restore the homeostatic drive, while attenuating the prominent circadian representation of mood which was seen before treatment.

Disclosure: Nothing to disclose.

P237 | Athens Insomnia Scale detects depression with moderate accuracy in three Japanese settings

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Objectives/Instruction: Patients with depression frequently complain of insomnia. Here, we compared the performance of Athens *Insomnia* Scale (*AIS*) in detecting depression in three Japanese settings.

Methods: Subjects were from two clinical settings (first visits: 2015/4/1–2017/9/30) and one working population (analyzed in 2016) from Shiga prefecture, Japan. The two clinical settings were attached to the Department of Psychiatry of a university hospital (U) ($n = 392$) and the Department of Otolaryngology of a city hospital (C) ($n = 325$), respectively. We also analyzed city government employees (W) ($n = 1{,}852$). We used AIS and Patient Health Questionnaire (PHQ-9) to detect insomnia and depression, respectively. Receiver operating characteristic (ROC) curve analysis was performed to compare diagnostic performances of AIS in detecting depression (PHQ-9 ≥ 10) in these settings. The study was approved by the Institutional Review Board.

Results: Areas under the ROC curve (AUC) for detecting depression using AIS were 0.81 (95% confidence interval [CI]: 0.77–0.85, $p < 0.0001$), 0.88 (95% CI: 0.84–0.91, $p < 0.0001$), and 0.88 (95% CI: 0.86–0.89, $p < 0.0001$) in U, C, and W settings, respectively.

Conclusions: The AIS detected depression with moderate accuracy in the three settings. The AUCs were similar for both clinical and working populations. Therefore, AIS may detect depression independent of the settings.

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P238 | Does sleep moderate the relationship between work-life balance and depression differentially in men and women? Findings from the North West Adelaide Health Study

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Objectives/Introduction: Work-life balance is important for workers' mental health. Sleep also affects mental health, but its moderating effect on the relationship between work-life balance and depression has received little attention. Gender differences in this relationship are rarely considered, limiting the specificity of management advice. Our aim was to explore the relationship between work-life balance, job strain and job security, and depression in a sample of Australian adults, and determine whether sleep duration moderates this relationship differentially between genders.

Methods: Data were collected on self-reported work characteristics and sleep duration in 1,024 male and 618 female working adults aged ≥18 years participating in the ongoing North West Adelaide Health Study, a population-based community-dwelling cohort. Conditional PROCESS models determined the moderating effect of sleep duration on the relationship between work-life balance (Australian Work and Life Index) and depression scores (CES-D), adjusted for age and income, with the Johnson-Neyman technique employed to determine the point at which sleep duration significantly moderated this relationship. Significance of $p < 0.01$ was selected due to multiple comparisons.

Results: Reduced overall work-life balance was positively associated with higher depression scores in females (*B* (CI): 17.1 (5.29, 29.0), $p = 0.005$) but not males (1.4 (−12.2, 9.4), $p = 0.799$). This relationship for females was largely explained by overall work-life balance dissatisfaction (23.55 (10.23, 36.9), $p = 0.001$), which was moderated by sleep duration (−3.0 (−4.9, −1.1) < 7.1 hr). In men, the perception of work interfering with responsibilities outside work was associated with depression (25.3 (11.1, 39.5) $p = 0.001$), moderated by sleep duration (−3.0 (−5.0, −0.9) < 7.6 hr). Men perceived work interfered with the ability to maintain connections and friendships (25.0 (10.2, 39.8)), moderated by sleep duration (−2.8 (−5.0, −0.7) < 7.8 hr); but sleep duration did not moderate overall work-life balance dissatisfaction.

Conclusions: The relationship between work-life balance and depression is expressed differentially in men and women with sleep duration moderating some aspects of the relationship. This suggests that while a global score of work-life balance may be useful for identifying risk of depressive symptoms in females, it may not in males. The benefits of sleep interventions may depend on which aspects of work-life balance are perceived to be affected by the worker.

Disclosure: Nothing to disclose.

SLEEP & AGING 1

P239 | Sleep loss and circadian phase modulate cortical connectivity but not neuronal complexity in young and older individuals

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Objectives/Introduction: How the ageing brain reacts to the fine-tuned regulation of sleep homeostasis and circadian processes remains to be fully explored. It is unknown if cortical connectivity and neuronal response complexity change with age, sleep loss and across the circadian cycle. We addressed these issues by recording neuronal response to a transcranial magnetic stimulation (TMS) during 34-hr of wakefulness extension in young and older individuals.

Methods: 13 healthy young (~23 years) and 13 elderly participants (~63 years) followed a 34-hr sleep deprivation protocol under constant routine conditions. They underwent 9 EEG recordings of TMS-evoked potentials over the frontal cortex. After EEG pre-processing and source reconstruction, we determined spatio-temporal distribution of significant sources. Cortical connectivity was inferred from the geodesic sum of the causal interactions between the stimulated area and the rest of the cortex. Neuronal response complexity was derived by applying the Lempel-Ziv compression algorithm on the binary matrix of significant sources and then normalized.

Results: Increasing fatigue with time awake ($p < 0.0001$), and older individuals feeling less sleepy than younger ones ($p = 0.03$) confirm the effect of the sleep deprivation protocol. Mixed effects analyses revealed a significant change in cortical connectivity with time spent awake ($p = 0.03$): following an increase during daytime, a reduction was perceivable from the beginning to the end of the biological night (i.e. circadian phases 0°–165°). A weak tendency for a group effect was detectable ($p = 0.09$). Analysis of the neuronal complexity reveals a non-linear profile, but neither an effect of time spent awake ($p = 0.25$) nor group difference ($p = 0.28$).

Conclusions: These preliminary results confirmed our previous finding that cortical connectivity decreases during the biological night. A weak trait-like effect might be visible with elderly having dampened cortical connectivity than young. No effect of ageing and time spent awake was found for the neuronal complexity.

Disclosure: Nothing to disclose.

P240 | Sleep and circadian timing are associated with subjective and objective memory in older adults with subjective memory impairment - evidence for early targeted interventions

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Objectives/Introduction: Poor sleep and disrupted circadian rhythms are associated with poorer cognitive outcomes in older adults, with and without dementia, suggesting sleep/circadian timing may be modifiable risk factors for preserving cognitive function in later life. Given neurobiological changes precede cognitive dysfunction by several years, early intervention is essential. While subjective memory impairment (SMI) may be a prodromal stage of dementia, little is known about the association between sleep and circadian timing and cognitive outcomes in this at risk group.

Methods: Twenty-four older adults with SMI (M_{age} = 69.97, SD = 5.33) completed the Memory Functioning Questionnaire, underwent a comprehensive neuropsychological assessment, and laboratory based assessment of circadian phase (dim light melatonin onset) and sleep (polysomnography).

Results: Advanced circadian timing was associated with increased subjective memory complaints, specifically the ability to recall past events throughout the lifespan (r = 0.69, p = 0.002), and increased reliance on mnemonic tools in everyday life (r = 0.66, p = 0.004). While circadian timing was not related to objective memory performance on the California Verbal Learning test, minutes spent in slow wave sleep was related to both total learning (r = 0.53, p = 0.009), and the ability to use semantic clustering as a mnemonic device (r = 0.54, p = 0.008).

Conclusions: Our data describe the first evidence for targeting the sleep and circadian system for improved cognitive outcomes in older adults reporting SMI, such that use of mnemonic strategies in SMI was associated to both circadian timing and duration of slow wave sleep. As strategy use decreases in MCI, interventions aimed at improving sleep and circadian timing may be pivotal in delaying objective memory deficits in this group.

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P242 | Postural stability upon being awakened in the middle of the night and in the morning: comparison of lemborexant versus zolpidem extended release

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Objectives/Introduction: Sleep-promoting drugs should facilitate sleep without interfering with postural stability upon awakening. We present results of a study of the dual orexin receptor antagonist lemborexant (LEM) on a measure of postural stability.

Methods: Double-blind, randomized, single-dose, 4-way crossover. Eligible, healthy females (≥55 years) and males (≥ 65 years) had 8 hr polysomnogram at baseline and at each single-dose treatment at bedtime with placebo (PBO), LEM 5 mg (LEM5), LEM 10 mg (LEM10), or zolpidem tartrate extended release 6.25 mg (ZOL). If not already awake, subjects were awakened, preferentially from stage non-REM 2, between 4–4.5 hrs post-bedtime/post-dose (middle of the night; MOTN). At bedside, body sway was measured in units of 1/3° angle of arc using an ataxiameter device for 60 s. Increases from baseline ≥7 were prespecified as clinically meaningful, benchmarked to effects of alcohol at 0.5 g/kg. At 8 hr postdose, body sway was reassessed.

Results: 120 subjects screened, 63 randomized, 56 completed all 4 treatment periods. For MOTN, mean change from baseline in body sway was PBO: −1.8, LEM5: 5.0, LEM10: 7.5, ZOL: 19.6. All statistical comparisons vs. ZOL were $p < 0.0001$, while comparisons of LEM vs. PBO were both $p < 0.02$. ZOL and LEM10 met the clinically meaningful threshold for increase from baseline. At 8 hr, change from baseline was PBO: −1.1, LEM5: 1.3, LEM10: 0.7, ZOL: 5.9. Statistical comparison of ZOL vs. PBO was $p < 0.02$. Neither LEM dose was significantly different vs. PBO or ZOL. No 8 hr post-dose value met the threshold for clinically meaningful increase from baseline.

Conclusions: Postural stability, measured reliably by sensitive ataxiameters, shows ZOL administered at bedtime increased body sway upon a MOTN awakening substantively, almost 3 times above that expected from blood alcohol content near the legal driving limit. In the MOTN, LEM10 also increased body sway to just above this threshold, while LEM5 did not result in clinically meaningful increases in body sway. At approximately 8 hr postdose, neither dose of LEM nor ZOL had meaningful residual next-morning effects on this measure of postural stability. Lemborexant may become a useful alternative to drugs like ZOL that suppress the central nervous system and are associated with risk of falls, particularly in older individuals.

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P243 | Effect of the "humming mask" on sleep perception of healthy elderly

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Objectives/Introduction: The humming mask is a massaging device stimulating the paranasal sinuses through vibration. There were anecdotal reports that sleep benefits from the use of this device. Aim of this open-label pilot study was to investigate the effect of the humming mask on sleep perception in healthy elderly subjects without relevant sleep disorders, but complaining about "bad sleep".

Methods: Eighteen aged subjects (12 female, 6 male, mean age 67 years, 5 < PSQI < 11) were included in the study. As cover task the subjects were instructed to keep dream diaries. After the screening visit the study consisted of two blocks of each one week, ended by a visit. In a cross over design, subjects used the humming mask for 20 min directly before lights of in one block and did not in the other. Primary endpoint was change in the subjective sleep quality as assessed with a modified version of the PSQI. The secondary endpoint was subjective sleep latency as assessed by a sleep diary.

Results: Despite being blind for the studies endpoints, subjects reported improvements in subjective sleep quality (PSQI start: 8.4 ± 1.5, without mask: 7.3 ± 2.4, with mask: 6.4 ± 2.8, RM-ANOVA; F (2,53) = 3.185; p = 0.0070) and reduction in sleep latency (without mask: 35 ± 33 min; with mask: 26 ± 24 min, t-test p = 0.08, tendency) by the use of the humming mask.

Conclusions: Our results support that use of the humming mask improves sleep (perception). There are several limitations of this pilot study. Firstly, only subjective measures were assessed. Secondly, subjects were blinded for the study outcome, but not for the intervention. However, the results of this pilot study encourage to follow-up with a sham controlled, double-blind experiment, including objective assessments. This would be a prerequisite to address the potential mechanisms of action of the humming mask.

Disclosure: The Study was supported by "Nasivent", the producer of the "Humming mask".

P244 | Younger patients are more obese and have a more severe obstructive sleep apnea syndrome

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Objectives/Instruction: The prevalence of obstructive sleep apnea syndrome (OSA) increases with age. We hypothesized that the desaturation variables in patients (pts) below 65 years old (yo) and over 65 yo would differ.

Methods: We analyzed 1,373 consecutive OSA patients (59.13 ± 7.6 yo, 71% male) obtained during nocturnal polysomnography. Data collected (May 2007–December 2017) included body-mass index (BMI), comorbidities, neck and abdominal circumference, as well as polysomnographic data: apnea - hypopnea index (AHI), oxygen desaturation index (ODI) and mean oxygen desaturation (MOD). Descriptive data is reported as mean values and standard deviations (SD), or percentages. The Student's t-test for independent samples was performed. p-values under 0.05 are regarded as statistically significant. Continuous variables were analyzed by the Mann-Whitney U test. For categorical variables, the chi-square test was performed.

Results: They were divided into two groups based on age as followed: group 1, <65 yo (85.6%, 1,176 pts, 70.7% male) and group 2, ≥65 yo (14.4%, 197 pts, 68.5% male). When we compared the two groups, we found significant differences regarding BMI (33.6 ± 7.34 vs. 31.63 ± 6.74, $p < 0.001$), neck circumference (43.74 ± 5.82 vs. 42.99 ± 4.38, $p < 0.03$), ODI (24.33 ± 22.54 vs. 28.28 ± 28.57, $p = 0.035$) and AHI (41.21 ± 28.37 vs. 36.07 ± 21.02, $p = 0.004$). Abdominal circumference (117.06 ± 16.89 vs. 115.57 ± 14.38, $p = 0.23$) or MOD (92.20 ± 7.51 vs. 91.94 ± 7.88, $p = 0.67$) did not differ significantly. Comorbidities such as systemic hypertension (SHT), coronary artery disease (CAD) or stroke were increased in elderly patients, respectively 65% vs. 80.7% ($p < 0.01$) for SHT, 17.8% vs. 37% ($p < 0.001$) for CAD and 2.8% vs. 9.6% ($p < 0.01$) for stroke.

Conclusions: In the present study, younger patients are more obese and have a severe OSA with a high desaturation index and AHI as compared with older patients, who instead have a higher rate of cardiovascular comorbidities.

Disclosure: Nothing to disclose.

P245 | Sleep Disorders in an elderly population and their relationship with cognitive symptoms: an epidemiological survey

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Objectives/Introduction: Disturbed sleep is common in elderly people and has been related to comorbidities. The aim of this study was to evaluate the prevalence of sleep problems and their relationship with chronic disease in an elderly population.

Methods: Subjects were participants of a population-based study of older adults for dementia and mild cognitive impairment screening in Lunigiana. 2,137 subjects (age range 65–85 years, 961 males and 1,176 females) were identified as eligible. All patients underwent a clinical interview and a questionnaire about insomnia, sleepiness, snoring, sleep apnea, other sleep disturbances. In addition, subjects were administered by trained physicians the Mini Mental State Examination (MMSE), the Beck Depression Inventory, the Memory Assessment Clinic-Q (MAC-Q).

Results: The participation rate was 83.5% and 1,784 subjects completed the study: 796 males and 988 females. The mean age of the participating subjects was 70.5 years (SD 3.2). Insomnia symptoms were reported in 63.8% of the population. The most common sleep complaint was "early awakening" reported by nearly half of subjects (46.6%), 200 patients presented an insomnia syndrome (11.2%). Almost one quarter of the subjects (24.6%) presented excessive sleepiness, while snoring affected the 20.5% of the population and sleep apnoea the 3.4%. Legs jerk were reported in 21.2% of the subjects. MMSE as a continuous variable correlated with maintenance insomnia (p = 0.04), daytime consequences of insomnia (p = 0.04), excessive daytime sleepiness (p = 0.03), legs jerks (p = 0.03). Univariate analysis of insomnia syndrome with number of comorbidities shows that having more comorbidities was related with an increased incidence of insomnia syndrome that increase from 8% (no comorbidities) to 21% (3 or more comorbidities) with an OR of 1.25.

Conclusions: Our results confirm that sleep problems are very common in elderly subjects and closely related to medical and psychiatric illnesses. Since mutual influences of nocturnal sleep problems and medical disease have been proposed, comorbid sleep disorders should be fully evaluated by the clinician and should not be under diagnosed and under treated.

Disclosure: Nothing to disclose.

P246 | The effect of retirement on subjective and objective sleep characteristics: the Finnish Retirement and Aging study

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Objectives/Introduction: Previous studies have shown that self-reported sleep duration increases and sleep difficulties decrease after retirement over several years. By using annually collected data, we aimed at specifying the timing of changes in self-reported sleep duration and quality following retirement. Furthermore, this is the first cohort study that examines objectively measured changes in sleep during retirement transition.

Methods: Repeated survey and accelerometer data from the Finnish Retirement and Aging study were used. The study population consisted of 2,053 public sector employees who retired in 2014–2017 and reported their usual sleep duration and quality in surveys. From these participants, a sub-population of those retiring in 2016–2017 (n = 360) were included in the accelerometer measurements, in which total sleep time, sleep efficiency and minutes awake during the night were objectively assessed with a wrist-worn accelerometer (ActiGraph GT3X). Both the surveys and the accelerometer measurement were repeated at least four times around retirement. The changes in sleep around retirement were examined using linear and logistic regression with generalized estimating equations. An alpha level of 0.05 was used throughout the analyses.

Results: Self-reported sleep duration increased by 19 min (95% confidence interval 17–20 min) from the measurement immediately prior to retirement to the measurement immediately after retirement. When prevalence estimates in the measurement immediately after retirement were compared to the measurement immediately before retirement, we observed statistically significant decreases in self-reports on waking up too early in the morning, nonrestorative sleep, sleep loss due to worry, and daytime tiredness. There were no changes in difficulties falling asleep or difficulties maintaining sleep following retirement. We are currently examining the sleep data from 24-hr measurements with wrist-worn accelerometers, and the results concerning the changes in objectively measured sleep following retirement will be presented in the congress.

Conclusions: This longitudinal study suggests that various sleep characteristics change immediately (in 0–3 months) following retirement. Both the removal of work-related stressor as well as the increased leisure time immediately following retirement could account for the changes in sleep, as work can no longer dominate sleeping patterns after retirement.

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P247 | Associations of sleep and functioning with the premature exit from the labour market: repeated measures latent class analysis among midlife and ageing public sector employees

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Objectives/Instruction: To examine the associations between different patterns of categorical change of normal and problematic sleep and health functioning with the risk of premature exit from the labour market.

Methods: We examined participants of the Finnish Helsinki Health Study, who responded to survey questionnaires in 2000–2, 2007 and 2012. At baseline, all were employed by the City of Helsinki. The follow-up surveys provided data about insomnia-related symptoms, health functioning, exit from the labour market, and covariates. Using a person oriented approach, patterns of categorical change of normal and problematic sleep and health functioning were identified by repeated measures latent class analyses (RMLCA). Time-to-event analysis of premature exit between identified RMLCA groups was performed by Cox proportional hazards modelling.

Results: We identified four latent groups of sleep and functioning over time among 5,148 participants with complete data on the variables interest at three time points: (1) poor sleep and moderate functioning (6.2%), (2) good sleep and poor functioning (24.6%), good sleep and good functioning (64.0%, reference), and (3) poor sleep and poor functioning (5.3%). Clear differences were found regarding the risk of premature labour market exit. Members of the latent group 2, had a notably increased risk (HR 4.38, 95% CI 3.44–5.57), but the risk was highest for those belonging to the group 4 (HR 8.10, 95% CI 6.00–10.94). Covariates (sex, age, marital status, education, body mass index, smoking, alcohol use, leisure-time physical activity, limiting long standing illness, and physician diagnosed depression) only somewhat contributed to these associations. No excess risk could be confirmed for people belonging to the group 1.

Conclusions: Poor sleep combined with poor functioning overt time is associated with the highest risk of premature exit from the labour market. However, also people with good sleep are at an increased risk, if they have poor functioning. These results highlight the advantages of person-orientated methods to pinpoint risk groups that can be missed in studies with variable orientated methods. Thus, people with different risk factor combinations need to be considered in the efforts to prevent premature exit from paid employment.

Disclosure: Nothing to disclose.

P248 | Sleep apnea and hypogonadism in Midle-Aged Men: combined method of treatment

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Objectives/Instruction: It is important sleep apnea is risk factor of cardiovascular disease. Especially in Midle-Aged men with hypogonadism.

Purpose: assessment of the effect combined use of CPAP (Constant Positive Airway Pressure) and replacement testosterone therapy on indicators of polysomnography monitoring (PSG) with nocturnal penile tumescences (NPT) and serum testosterone level before and after 3 month therapy.

Methods: We examined 28 men with SOAS and hypogonadism. Mean age – 47.1 ± 7.4 years, BMI – 34.2 ± 3.5 kg/m^2. The polysomnography with nocturnal penile tumescence (NPT). were recorded on a GRASS-TELEFACTOR Twin PSG (Comet®) with amplifier As 40 with integrated modul for sleep SPM-1 (USA) with amplifier for NPT-sensor. NPT-monitoring was carried out by implication of mercuric NPT-sensor. The total testosterone level was 8.5 ± 1.2 vs. 8.2 ± 0.2 nmol/l. All patients were divided into 2 groups: men with therapy only CPAP (n = 14); men with combination therapy - CPAP and Androgel (50 mg 1 times a day) (n = 12). Duration of therapy in both groups was 3 months.

Results: After combination therapy regimen (CPAP and Androgel) in men found increase of total testosterone levels 18.2 ± 3.4 (9.1 ± 1.2 -only CPAP), $p < 0.05$ and improvement in indicators of altered nocturnal penile patternand improvement in indicators of altered nocturnal penile erection episodes (Tup, Tmax, Tm/R, Tup/R, the total number of NPT ($p < 0.05$)) compared with similar parameters in men with only CPAP-therapy. We had noted considerable decrease in IMT at combination therapy regimen –29.2 ± 0.3 vs. 33.4 ± 1.8-only CPAP.

Conclusions: CPAP - therapy and testosterone replacement therapy improves quality of a sleep and wakefulness in Midle-Aged Men with sleep apnea and hypogonadism. Substitution testosterone level is required with CPAP for OSAS patients with aging hypogonadism. CPAP - therapy and testosterone replacement therapy as prevention of cardiovascular diseases in Midle-Aged Men with sleep apnea and hypogonadism.

Disclosure: Nothing to disclose.

P249 | The effects of APOE genotypes on the longitudinal sleep behavior changes in non-demented general population: the Korean Genome and Epidemiology Study

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Objectives/Introduction: Recently, evidence for causal and bidirectional links between sleep disturbance and Alzheimer's disease (AD) pathophysiology continues to grow along with the increasing evidences of sleep-stage dependent toxic metabolite clearance. As the consequence, sleep modulation in elderly population is regarded as one of the potential disease-modifying intervention during the long preclinical phase of AD.

Methods: We analyzed 1,787 subjects with apolipoprotein E (APOE) genotype who scored at least 73 on the Korean Modified Mini-Mental State (K-3MS) examination at the baseline regardless of education level (mean 51.83 ± 6.95 years old, 47.7% female, mean follow up duration 6.83 ± 1.05 years). For all analysis, we first compared participants at lower brain amyloid burden risk (ε2/ε2 or ε2/ε3 genotype, n = 202, 11.3%) or greater risk (ε4 carriers, n = 326, 18.2%) with those neutral for the amyloid burden (ε3/ε3, n = 1,259, 81.8%).

Results: There was no significant APOE group difference in mean time in bed, subjective sleep duration, sleep efficiency in addition to sleep latency both at the baseline and follow-up visit. We assessed their chronotye by MSFsc (Mid-Sleep phase on Free days Corrected for the Sleep deficits during weekdays) and the MSFsc of ε4 carriers were significantly advanced than the other non-carriers at the baseline (p = 0.045). However, the difference become insignificant at the follow-up visit (p = 0.805). With respect to other sleep questionnaires including Epworth Sleepiness Scale (ESS), napping habits, snoring and insomnia, there was no statistically significant difference between groups. The mean value of Mini-Mental State Examination (MMSE) scores at the follow-up visit was 27.75 ± 1.73 and there was no significant APOE genotype group difference.

Conclusions: Our results demonstrated that aging process of circadian rhythms could be different between APOE genotypes. To investigate the reciprocal link between sleep and Aβ pathology along with aging process, not only sleep duration but also sleep pattern including chronotype should be investigated in further studies.

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P250 | Impact of age and napping on actimetry-derived sleep and 24-hr rest-activity indices

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Objectives/Introduction: Sleep appears as a protective factor in models of cognitive and brain aging. However, temporal organisation of sleep and wakefulness over the 24-hr cycle still remains underestimated in these models. Chronic napping is frequent in the older population and might interfere with sleep-wake regulation. Here, we explored age-related changes in actimetry-derived indices of both sleep and sleep-wake fragmentation.

Methods: Actimetry data (Actiwatch plus device, Cambridge Neurotechnology) were collected for 7 days in 24 younger (20–32 years, 16 women) and 21 older participants (58–85 years, 8 women, 9 chronic nappers [naps >20 min/day, >3*week, since >1 year]). Periods of complete inactivity >2 hr were excluded from analyses since the latter presumably reflect actigraph removal. Sleep-wake fragmentation was explored by estimating transition probability to rest during daytime (kAR), transition probability into activity during nighttime (kRA), volume of sleep in the afternoon (fSOD), intra-daily variability (IV) and inter-daily stability (IS).

Results: Significant age-related changes were observed for indices measuring sleep-wake cycle fragmentation (IV, $t(43) = -3.79$, $p < 0.001$) and wake fragmentation (kAR, $t(43) = -3.05$, $p < 0.01$, fSOD, $t(43) = -3.60$, $p < 0.01$). The younger presented lower wake fragmentation compared to both older no-nappers (kAR, $t(34) = -3.41$, $p < 0.01$, fSOD, $t(34) = -2.74$, $p < 0.05$) and nappers (fSOD, $t(31) = -2.69$, $p < 0.05$). Furthermore, sleep-wake cycle fragmentation was lower in younger participants compared to older nappers only (IV, $t(31) = -5.10$, $p < 0.001$). Finally, compared to older no-nappers, older nappers presented higher sleep-wake cycle fragmentation (IV, $t(19) = -3.64$, $p < 0.01$) and lower inter-daily stability (IS, $t(19) = 2.24$, $p < 0.05$).

Conclusions: Overall, our data suggest that the impact of age is more evident in actimetry-derived indices taking into account wake fragmentation during daytime. Nappers presented higher sleep-wake cycle fragmentation compared to no-nappers, while sleep fragmentation did not significantly differ. Future analyses aim at taking into account individually-tailored rest-activity profiles to estimate sleep-wake cycle fragmentation. Finally, whether these indices explain significant part of variance in cognitive ageing remain to be assessed.

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P251 | Sleep, diet and physical activity are associated with inflammation among non-demented community-dwelling elderly

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Objectives/Introduction: Inflammation in elderly is associated with morbidity, including cognitive impairment, and mortality. The aim of this study was to explore modifiable life-style parameters in predicting inflammation among non-demented, community-dwelling elderly.

Methods: A sub-sample of 117 patients with mild cognitive impairment (MCI) and cognitively intact controls (NI) were recruited from a large, population-based cohort in the island of Crete, Greece of 3,140 older adults (>60 years). All participants underwent medical history/physical examination, extensive neuropsychiatric and neuropsychological evaluation, 3-day 24-hr actigraphy, subjective sleep complains, physical activity, and diet patterns based on Principle Component Analysis (PCA). Finally, all participants had a single morning IL-6 and TNFα plasma levels measurement. Associations between inflammatory markers and objective sleep duration (based on highest or lowest 25th percentile), subjective poor sleep, diet patterns and physical inactivity were assessed using multivariate linear regression models, controlling for demographics, MCI diagnosis and depression.

Results: Mean age was 75.6 (SD = 6.9) yrs for MCI patients and 72.4 (SD = 7.6) for the NI group ($p = 0.02$). Peripheral levels of IL-6 (mean ± SD) and TNFα were 1.27 ± 0.71 (pgr/ml) and 1.16 ± 0.53 (pgr/ml), respectively, in patients with MCI and 1.33 ± 1.04 (pgr/ml; $p > 0.7$) and 1.01 ± 0.62 (pgr/ml; $p > 0.2$), respectively, in the NI group. Regression analyses in the total group revealed significant associations between TNFa (Model Adj. $R^2 = 0.136$, $p = 0.002$) and long objective night time sleep duration (B = 0.468, $p = 0.004$), consumption of drinks/snacks (B = 0.139, $p = 0.014$) and marginally significant for low consumption of vegetables/legumes/fish (B = –0.09, $p = 0.09$). Also, IL-6 (Model Adj. $R^2 = 0.112$, $p = 0.003$) was associated with physical inactivity (B = –0.538, $p = 0.001$) and low consumption of vegetables/legumes/fish (B = –0.190, $p = 0.016$).

Conclusions: These data indicate that TNFa and IL-6 plasma levels in non-demented community-dwelling elderly are associated with long objective sleep duration, high carbohydrate and low vegetable/legume/fish diet, and physical inactivity. Combined interventions targeting several life-style parameters, i.e. sleep hygiene, healthier diet and physical activity, may decrease inflammation and improve or delay cognitive decline among elderly.

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HEALTHCARE SERVICES & EDUCATION

P252 | Sleep disorders among hospital employees

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Objectives/Instruction: Sleep disorders are estimated to affect millions of people worldwide, however, both healthcare personnel as well as the general public overlook these sleep disorders. Daytime sleepiness, tiredness, and cognitive impairment that are major consequences of various sleep disorders, are under recognized as well. These disorders would negatively affect the competence of employees that would have a drawback on the productivity of the institution. Hence, sleep disorders are indeed an important epidemiological problem that needs to be addressed. Our aim was to screen University hospital employees for sleep disorders to estimate their prevalence and the size of the problem.

Methods: This was a cross sectional study that was conducted from August till October 2016 at King Abdulaziz University Hospital (KAUH), Jeddah, KSA. Our target population was all KAUH employees. A stratified random sample consisted of 100 of KAUH staff were approached. All subjects were interviewed by trained physicians using a questionnaire. The information collected included socio-demographic characteristics, the Berlin questionnaire to assess the risk of obstructive sleep apnea (OSA), the Epworth Sleepiness Scale to assess excessive daytime sleepiness (EDS), the International RLS Study Group score to diagnose restless legs syndrome (RLS), The Pittsburgh Sleep Quality Index (PSQI) to assess quality of sleep, and Sleep-50 questionnaire designed to detect sleep disorders.

Results: A hundred and sixteen employees were recruited, 56% of them were males with a mean age of 30.9 years. The frequency of sleep disorders in the study sample was as follows: RLS was seen in 6.9%; the risk of OSA was high in one fifth of subjects with male predominance ($p = 0.04$); sleep quality was reported as poor in 93% of subjects; and EDS was reported in 24% of the study population. Interestingly, there was no significant difference between subjects with sleep disorders and those without in terms of sleepiness. When Sleep-50 Subscales questionnaire was used, 32%, 5%, 28%, 71%, and 55% of the study population reported symptoms of narcolepsy, sleepwalking, nightmares, insomnia, and circadian rhythm disorder respectively.

Conclusions: Sleep disorders are very common among employees that would need to be explored to get the necessary healthcare attention.

Disclosure: Nothing to disclose.

P253 | Sleep quality and quantity in Japanese daytime workers in association with the duration of the daily rest period

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Objectives/Instruction: The daily rest period (DRP) is the interval between the end of one workday and the beginning of the following. A sufficient DRP may be necessary for a daytime worker to recover from work. However, little is known about the association between DRP, sleep duration, and sleep quality. This study aimed to examine the correlation between DRP and sleep quantity and quality, in Japanese permanent daytime workers.

Methods: An internet survey was conducted in Japan, in November 2016, and 3,867 permanent daytime workers (mean age 42.7 years, 35% females) were analyzed. The survey gathered information about the usual DRP, the sleep duration on workdays, and the sleep quality (Japanese version of the Pittsburgh Sleep Quality Index; PSQI-J). The participants were categorized into the eight following groups, according to their DRP duration, as follows: "less than 10 hr", "10 hr" (10 hr–10hr 59 min), "11 hr" (11 hr–11hr 59 min), "12 hr" (12 hr–12hr 59 min), "13 hr" (13 hr–13hr 59 min), "14 hr" (14 hr–14hr 59 min), "15 hr" (15 hr–15hr 59 min), and "equal or more than 16 hr".

Results: The sleep duration for Japanese daytime workers in the "less than 10 hr", "10 hr", "11 hr", "12 hr", "13 hr", "14 hr", "15 hr", and "equal or more than 16 hr" DRP groups were found to be 5.3, 5.9, 6.1, 6.3, 6.5, 6.7, 6.7, and 6.9 hr, respectively. The trend analysis revealed a significant linear trend indicating that the shorter the DRP, the shorter the sleep duration ($p < 0.05$). Furthermore, the PSQI-J global scores for the above DRP groups were 7.1, 6.7, 6.7, 6.3, 6.0 (5.999), 5.6, 5.2, and 5.2, respectively. The trend analysis revealed a significant linear trend indicating that the shorter the DRP, the lower the sleep quality ($p < 0.05$), and mean PSQI-J score for workers with a DRP of less than 13 hr was above cutoff point (=6) for the primary insomnia.

Conclusions: This study revealed that a longer DRP is associated with longer sleep durations and better sleep quality in Japanese daytime workers. Daytime workers may require a DRP longer than 11 hr to ensure more than 6 hr of sleep, and a DRP longer than 13 hr to ensure good sleep.

Disclosure: Nothing to disclose.

P254 | Effective intervention methods for developing appropriate sleep habits in children

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Objectives/Instruction: Japanese children are known to have the shortest sleep duration in the world and recently, certain schools have introduced sleep education. However, children's lifestyle habits including sleep are normally taught by parents. Therefore, the delayed bedtime of elementary school children, their parents sleep habits and sleep knowledge was investigated to identify appropriate interventions for developing suitable sleep habits in children.

Methods: The parents of 406 children aged 5–12 years completed a questionnaire distributed in their children's schools. The questionnaire inquired children's and parent's sleep habits and daytime sleepiness, sleep-related behaviors, and parent's sleep knowledge. The children were classified into two groups based on their weekday bedtime: Earlier than 21-hr group ($n = 230$) and Later than 22-hr group ($n = 175$).

Results: The weekday sleep duration shortened ($p < 0.01$) as children grow up. Moreover, the weekday sleep duration differed between the two groups ($p < 0.001$): the earlier bedtime group had 9.35 hr of sleep, whereas the later bedtime group had only 8.18 hr of sleep. The weekend sleep duration did not differ between the ages. However, there were differences between the earlier (9.76 hr) and the later bedtime group (9.07 hr), which were significant ($p < 0.001$). The later bedtime group experienced more daytime sleepiness ($p < 0.001$), lack of sleep ($p < 0.001$) and bad mood at wake-up time ($p < 0.001$) than in the earlier bedtime group. The reason for going to bed or waking up in the later bedtime group was intervention by their family ($p < 0.001$). Correlations between parents and children on weekday and weekend bedtime, weekend rise time, and time of finishing media tools was significant ($p < 0.05$). On the other hand, there were no correlations with parent's knowledge or their life habits and delayed bedtime of children. Approximately 90% of parents correctly understood sleep and sleep-promoting behavior.

Conclusions: Deciding a deadline to finish using media tools, and deciding the bedtime of parents and children with bedtime delays is important. These results also suggest that not only knowledge but also providing motivation to parents is essential.

Disclosure: Nothing to disclose.

P255 | Effects of work arrangement on sleep regimen in creative R&D employees

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Objectives/Instruction: Traditional "nine-to-five" working schedules do not account for employees' individual characteristics. We seek to identify what type of creative R&D employees suffer from the adverse effects of work arrangements on their sleep regimen.

Methods: We present ordinary least squares and ordered probit regression estimates as well as recursive structural equation estimates of the employees' perceived level of sleep regimen distraction by work. The study is based on data from a repeated survey among Estonian creative R&D employees. The sample comprises 153 individuals from eleven entities.

Results: We find evening type people to be significantly more distracted by the adverse effects of work on their sleep regimen. Female employees have a 6% higher probability of perceiving their work to limit strongly their sleep schedule. Employees having flexibility in both their working time and working place feel significantly less impacted by the work driven constraints on their sleep regimen. Employees with a higher creativity intensity of work appear less affected by the limitations that work sets on their sleep, in comparison to employees with a higher share of administrative and other non-creative tasks.

Conclusions: The quality of sleep of evening type as well as female employees being adversely impacted by their working arrangements means potential underutilization of their creative abilities. Granting working time and working place flexibility as well as avoiding allocation excessive administrative duties to creative R&D employees may have a major positive impact on improving their sleep, thus expectedly contributing to the improvement of their wellbeing and work results.

Disclosure: Nothing to disclose.

P256 | Daytime sleepiness: impacts of work organisation

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Objectives/Instruction: The degree to which standard work arrangements, rather than shift work, night work and other abnormal work schedules, affect the daytime sleepiness of employees has attracted limited attention in research. In this paper we investigate how flexible working time, creative intensity of work and other work arrangements affect daytime sleepiness in creative research and development (R&D) employees.

Methods: We present fully observed recursive structural equation estimates and ordinary least squares and probit regression estimates, using data from our original repeated survey of Estonian creative R&D employees on a sample of 150 individuals from eleven entities.

Results: Employees who can use flexible working time exhibited significantly lower levels of daytime sleepiness. The higher their load of administrative and other non-creative work tasks was, the higher the creative employee's daytime sleepiness was. Evening types were significantly sleepier in the daytime than their morning type colleagues, possibly because the standard timing of working does not match the time use preferences of the evening types. The probability of women getting jobs with flexible working time was significantly lower than the probability for men, and the probability they would fall at or above the upper quartile on the daytime sleepiness scale was 22.5 percentage points higher than in men.

Conclusions: Improvements and increased flexibility in work arrangements may reduce daytime sleepiness considerably, and contribute both to improved individual wellbeing and to better use of the potential of employees.

Disclosure: Nothing to disclose.

P257 | The effect of self-care interventions on sleep quality in post coronary artery bypass graft surgery patients

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Objectives/Introduction: Adequate amount and good quality of sleep are basic human needs. Studies in adults have shown that inadequate sleep is associated with metabolic syndrome, diabetes and with cardio-metabolic risk factors,including weight status, cholesterol, and blood pressure. Also, studies show that poor sleep quality is common among patients after coronary artery bypass graft surgery. So, the aim of the current study was to examine the effect of self-care interventions (based on sleep hygiene practices, nutrition and physical activity) on sleep quality in post coronary artery bypass graft surgery (CABG) patients.

Methods: This randomized controlled trial study included a total of 160 post CABG patients. They were divided into two groups randomly; 80 patients were randomized to the self-care interventions group, and 80 to the usual care group. Those in the self-care interventions group had 6 educative sessions on sleep hygiene practice, aerobic exercises, and dietary training and then they had individual consultant sessions about these self-care items monthly three times. Those in the usual care group were instructed to continue their normal life. The patient characteristics form and The Pittsburgh Sleep Quality Index (PSQI) were used for data collection.

Results: Based on Independent Samples *T* Test; the mean PSQI score in the self-care interventions group decreased to 7.13 ± 2.26 after the application of the self-care intervention, while it increased to 9.54 ± 2.14 in the control group. There were not any baseline difference between the two groups in terms of the mean PSQI score $p = 0.91$ before the start of this study, but the difference between the mean PSQI scores in the two groups was statistically high after the application of the self-care interventions ($p =< 0.001$).

Conclusions: Post CABG patients may benefit from participating in self-care interventions for improving their quality of sleep. Additional research in self-care interventions along with cognitive behavioral therapy also may be beneficial.

Disclosure: Nothing to disclose.

P258 | Techniques of developing the diagnostic and treatment skills in sleep apnea in students/interns in Pulmonology Clinic Tirgu Mures, Romania

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Objectives/Instruction: Despite the wide expansion of sleep apnea (SA) study during the faculty of medicine, the knowledges in the field in students/interns are insufficient. At the same time the disease is still late diagnosed or not at all. In Pulmonology Clinic we developed several means to improve the knowledge about SA in students and physicians and to promote an early diagnosis in respiratory sleep disorders (RSD).

Methods: Analyse of methods of achieving skills for correct approach of SA in Pulmonology Clinic.

Results: We tested the knowledge about risk factors, instruments for diagnosis, complications and treatment in RSD using a 20 items questionnaires on 110 Vth-year medicine-students and 38 interns (23 pulmonologists, 15 internal/cardiology specialty) before and after a teaching-session (2 hr course, 6 hr practice). Initially the knowledge concerning SA was dramatic insufficient: 23.7% correct answers (students), 65.7% in physicians (86% in pulmonologists, 33% in internists). We repeated the test after the teaching-sessions and the correct answers became 59% (students) and 92.1% (physicians). Taking into account the above we have emphasized the training in the field. We included in the curriculum of pulmonology the course "Physiological sleep and RSD" for the Vth-year medicine-students with 2 days practical work. They study the sleep diary, the somnolence questionnaires, the risk factors and symptoms of the RSD, the cardioventilatory polygraphy PG and polysomnography PSG (practice and bulletins interpretation), treatment principles including CPAP (Continuous Positive Airways Pressure). For the interns in pulmonology we added weekly case-based learning sessions and once-weekly "hands-on" at the patient's bed (1 year); 50 PG/PSG validations. We organize twice a year post-university workshops for physicians/students (free of charge) in the frame of the "pulmonology cercle". At the same time we deepened relationships with internal medicine, cardiology, diabetes and neurology specialties for an improved SA diagnosis in patients with risk factors or complications.

Conclusions: The stage of pulmonology is the best location for learning solid knowledge in RSD for students and interns of different specialty. The competence in sleep disorders is a "must-have" skill especially for pulmonologist to enlarge the early diagnosis of RSD and diminish the irreversible complications.

Disclosure: Nothing to disclose.

P259 | Parent-based sleep education as a possible intervention for sleep problem in school aged children with autism spectrum disorder

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Objectives/Instruction: Sleep problem is common among children with autism spectrum disorder (ASD). However, few of intervention studies tested the efficacy of sleep behavior intervention that carried by parents. We aim to test the efficacy on the sleep quality of ASD children by a Parent-Based Sleep Education (PSE) program.

Methods: ASD children were recruited in a child development clinical center. Sleep problems were addressed using *Children's Sleep Habits Questionnaire* (CSHQ, full scale score >41). Forty two ASD children (mean age: 7.36 ± 1.65) with sleep problems were randomly divided into two groups (receiving PSE or non-sleep related Psychological Education, PE). Both of the education programs consisted of two 2-hr sessions (at the weekend). The main behavior strategies in the PSE were Bedtime Routine, Extinction, Sleep Restriction, and Positive Reinforcement, with PE only containing general knowledge about ASD. A 14-day Sleep diary and the CSHQ were used to assess sleep problems of children with ASD before and after intervention. Two follow-up phone calls were also performed to ensure sleep diary record. All these sessions and phone calls were at a one-week interval.

Results: All 42 participants had completed the CSHQ,but sleep diary data were available for 36 of them (PSE:19, PE:17). Compared with PE, PSE had a positive effect to improve ASD children`s sleep quality by increasing sleep efficiency (PSE: before 0.93 ± 0.004, after 0.95 ± 0.001, PE: before 0.93 ± 0.004, after 0.94 ± 0.002, Mean ± SE, $F = 12.709$, $p < 0.001$) and reducing sleep latency (PSE: before 37.55 ± 2.098, after 25.13 ± 0.613, PE: before 33.62 ± 1.579, after 29.14 ± 0.916, min, Mean ± SE, $F = 30.583$, $p < 0.001$) and night waking times (PSE: before 0.29 ± 0.032, after 0.21 ± 0.016, PE: before 0.28 ± 0.039, after 0.34 ± 0.020, Mean ± SE, $F = 5.856$, $p = 0.016$). As for the CSHQ, improvements after PSE treatment

were seen in the scores of the total scale and subscales, including Bedtime Resistance, Sleep Onset Delay and Sleep Anxiety.

Conclusions: Parent-based sleep education with only two sessions could be a potential effective treatment to improve sleep latency, night waking and sleep efficiency in school aged children with ASD.

Disclosure: Nothing to disclose.

P260 | The impact of rotating work schedules on sleep quality among hospital female nurses and midwives

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Objectives/Instruction: In Japan, shift work systems in nursing jobs are undergoing a transition from a conventional three-shift to a two-shift working system. The current cross-sectional study was designed to investigate the subjective sleep quality among nurses and midwives working under these rotating work schedules.

Methods: In total, 2,154 female nurses and midwives working in five hospitals were asked to participate in this study and subjective sleep quality was assessed using the Japanese version of the Pittsburgh Sleep Quality Index (PSQI). Of the 1,580 effective responses, we analyzed the data of 1,057 subjects engaged in four working schedules as follows: day shift, rotating with a 12.5-hr night shift, rotating with a 16-hr night shift, and a three-shift work system.

Results: The percentage of poor sleepers with a total PSQI score of 6 or more among day shift, 12.5-hr night shift, 16-hr night shift, and three-shift workers were 41.6%, 51.8%, 44.5%, and 59.8%, respectively. The median (interquartile range) of the total PSQI score in the three-shift worker group was significantly higher than those in the three other groups (6.0 [4.0–8.0], $p < 0.001$). In addition, 38.7% of the three-shift worker group had difficulty initiating sleep. The influence of the shift work system on poor sleepers was further assessed by logistic regression analysis adjusted by age, body mass index, smoking, drinking, and presence of spouse and child. Using the day shift as the reference group, the odds ratio (OR) for poor sleep was 1.51 (95% CI; 0.98–2.33) in the 12.5-hr night shift, 1.17 (95% CI; 0.79–1.71) in the 16-hr night shift, and 2.01 (95% CI; 1.36–2.96) in the three-shift work system.

Conclusions: Regardless of the working schedules in our study, poor sleep rates were high among hospital nurses and midwives. Remarkably, subjective sleep quality of three-shift workers was significantly affected and resulted in insomnia, which was mainly due to difficulties initiating sleep.

Disclosure: Nothing to disclose.

P261 | Primary care treatment of pain-related insomnia: a feasibility study of a hybrid cognitive behavioural therapy approach

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Objectives/Instruction: Hybrid cognitive-behavioural therapy (Hybrid CBT) is a new approach to tackling pain-related insomnia. The study tested the feasibility of adapting and implementing the Hybrid CBT in primary care using a mixed-method approach.

Methods: Twenty-five patients with chronic pain and comorbid insomnia were recruited from three local general practices and randomly allocated to receive either the Hybrid CBT or a self-help control treatment, in addition to treatment as usual. The Hybrid CBT involved four weekly one-to-one sessions of 2 hr delivered by a trained Health Psychologist in the community. Participants in the self-help control group were sent four information booklets in the post, one weekly, to mirror the dose and frequency of the Hybrid CBT. All participants were assessed using questionnaires at baseline, 12 and 24-week post-randomisation. Candidate primary outcome measures for the definitive RCT were the Insomnia Severity Index and Brief Pain Inventory. Secondary outcomes measures were the Multidimensional Fatigue Inventory, Hospital Anxiety and Depression Scale and EQ5D-5L. Five patients (20%) were interviewed by an independent researcher pre- and post-treatment.

Results: Six health psychologists were offered intensive training to deliver the Hybrid CBT; four were able to travel and provide their service across sites. Fourteen participants were randomised to receive Hybrid CBT, 11 to receive the self-help control treatment. Of the 14 in the Hybrid CBT group, 9 (64%) completed all treatment sessions (4 discontinued due to poor health, 1 time constraints). The total number of participants completing the 12- and 24-week follow-up were 12 (6 per group; Hybrid CBT:43%; Self-Help:55%) and 10 (5 per group; Hybrid CBT:36%; Self-Help:45%). Candidate outcome measures appeared to be sensitive to treatment effects. Thematic analysis of pre-post interview data revealed satisfaction with treatment content among those who completed the Hybrid CBT, whereas those in the self help group wanted therapist guidance on sleep management.

Conclusions: The experience of delivering a complex psychological intervention for the self-management of both chronic pain and insomnia in primary care has been challenging but informative. Important lessons were learnt with regards to the infrastructure required to achieve more efficient therapist recruitment/training and better patient adherence and retention.

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P262 | Influence of regular physical exercise on sleep quality and presence of sleep disorders in patients assisted at the Basic Health Units of Divinópolis, Brazil

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Objectives/Introduction: In recent years the interest and studies by the sleep disorders have increased. Research indicates a high prevalence of these in adults, being considered a public health problem. Physical exercise, besides being considered a non-pharmacological intervention to improve sleep quality.

The objective of this study was to compare the quality of sleep and the presence of sleep disorders in patients who practice regular physical exercise (PRPE) and non-regular exercise (NPRPE) patients, assisted in Basic Health Units (BHUs) of Divinópolis, Brazil.

Methods: The cross-sectional observational study was carried with patients recruited from the BHUs. Sleep quality, presence of sleep disturbances, excessive daytime sleepiness (EDS), risk for obstructive sleep apnea and quality of life were assessed.

Results: The sample consisted of 64 patients, 32 patients in each group. The mean age of the PRPE and NPRPE groups was 63.3 ± 8.6 years and 57.7 ± 13.2 years, respectively; 84.4% vs. 81.2% of the patients were female and the mean body mass index was 26.6 ± 5.2 kg/m^2 and 26.7 ± 5.3 kg/m^2.

When comparing the groups, the PRPE group had a lower mean on the ESS, but with no statistical significance. Regarding PSQI, there was a statistically significant difference in the domains sleep disorders (1.00 ± 0.76 vs. 0.69 ± 0.82 p = 0.025) and dysfunction during the day (0.43 ± 0.53 vs. 1.00 ± 0.92 p = 0.033).

Regarding the domains of quality of life, there was a statistically significant difference in the general state of health (63.54 ± 19.39 vs. 51.54 ± 20.01 p = 0.025), emotional aspects (76.17 ± 27.42 vs. 54.13 ± 26.33 p = 0.005) and mental health (67.50 ± 23.47 vs. 54.63 ± 24.23 p = 0.017).

The PRPE group did not present a history of work-related accidents while in the NPRPE group, 4 patients already presented.

Conclusions: PRPE patients assisted in BHUs presented lower prevalence of poor sleep quality and EDS, although they were not statistically significant, a greater presence of sleep disorders according to PSQI, in addition to a better quality of life and a lower work accident.

Disclosure: Nothing to disclose.

P264 | Sleep quality and risk for obstructive sleep apnea in a sample of the Portuguese population

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Objectives/Introduction: Sleep-related disorders, particularly Obstructive Sleep Apnea Syndrome (OSAS), influence the quality of sleep and have increased in prevalence over the last years.

The aim of this study was to characterize the risk of OSAS and sleep quality of a sample of the Portuguese population, as well as to verify the existence of a correlation between the two variables.

Methods: Sleep quality and risk of OSAS were assessed using the Pittsburgh Sleep Quality Index (PSQI) and the STOP BANG questionnaire respectively in 133 subjects.

Results: The median age was 56 ± 31 years, of which 63.2% were female and the median body mass index was 25.28 ± 5.08.

Of the sample, 43.6% of the individuals presented a low risk for OSAS and only 14.3% presented a high risk. In 67.7% the quality of sleep was classified as poor.

The mean scores for STOP BANG and PSQI were 2.81 ± 1.64 and 8.63 ± 4.86, respectively.

The mean score for STOP BANG was significantly higher in subjects with poor sleep quality (3.20 ± 1.47 vs. 2.35 ± 1.86, p = 0.025).

A positive correlation was found between STOP BANG and PSQI (r = 0.20, $p < 0.022$).

Conclusions: This sample of the Portuguese population demonstrates poor quality of sleep and a low-moderate OSAS risk. It was also found that the higher the STOP BANG score, the lower the quality of sleep, confirming the negative influence of OSAS on sleep quality.

Disclosure: Nothing to disclose.

P265 | Sleep study for suspected sleep apnea - are we overtesting?

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Objectives/Introduction: Sleep apnea (SA) prevalence is increasing and it is thought to remain underdiagnosed. Due to limited capacity of sleep laboratories and the crescent testing demand, we aimed to assess the prevalence of SA among sleep studies requested to our sleep laboratory and which clinical features were more consistent/predictive with SA diagnosis.

Methods: Retrospective analysis of all polysomnographies (PSG) performed between March 2017 and February 2018 and type III

home sleep apnea testing (HSAT) performed between September 2017 and February 2018. Patients' clinical characteristics were collected by chart review.

Results: A total of 316 exams were performed, 214 (67.7%) HSAT and 102 (32.3%) PSG. Referral to outpatient consultation was mostly made by Primary Care physicians (59.2%); 70.3% of sleep tests were requested by Pulmonologists, followed by Otorhinolaryngologists (21.2%). Patients were predominantly male (65.8%), median age of 55 ± 19 years and mean body mass index (BMI) of 29.9 ± 5.2 Kg/m^2. Arterial hypertension, dyslipidemia and diabetes were the most frequent comorbidities with 48.5%, 38.1% and 17.2% respectivelly, and snoring (89.2%), witnessed apneas (55.3%) and excessive daytime sleepiness (EDS) (53.9%) the most common symptoms found. Median Epworth Sleepiness Score was 9 ± 7 points.

Obstructive sleep apnea was the most prevalent disorder- 26.3% mild, 21.8% moderate and 16.5% severe, followed by positional sleep apnea (18%) and central apnea (2.9%). Autopositive airway pressure (APAP) was the most frequent treatment option, 43.1%; there was no indication for therapy in 25.1% (no symptoms or cardiovascular disease) and 2.8% refused treatment.

Sleep apnea was excluded in 46 patients (14.6%) - when compared with the group with SA, patients with no SA were younger (48 ± 14 vs. 56 ± 12 years; p = 0.001), had superior female prevalence (45.5% vs. 32.3%; p = NS), lower BMI (28 ± 5 vs. 30 ± 5Kg/m^2; p = 0.007); also more frequently gasping (25% vs. 18%; p = NS), EDS (50% vs. 45%; p =NS) and headache (22.7% vs. 13.9%; p = 0.012).

Conclusions: Our study revealed a low number of exams excluding SA, meaning that there is a good efficacy between pre-test patient evaluation and the diagnosis of SA.

Disclosure: Nothing to disclose.

P266 | A curriculum for a two day PAP, oral appliance and hypoglossal stimulator handling expertise course for nursing staff in geriatric medicine

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Objectives/Introduction: The vaste majority of nursing staff in nursing homes and geriatric acute and rehabilitation clinics worldwide has no knowledge how to handle PAP, oral appliance, hypoglossal stimulator devices and PAP masks of their elderly patients with diagnosed and PAP or otherwise treated sleep disordered breathing. We aimed to develop a two day expertise seminar with course end exam for nursing staff to learn how to handle PAP and other devices and masks of stationary and ambulant elderly patients.

Methods: In order to develop a stringent feasible weekend course we formed a consensus group of sleep physicians, geriatricians, sleep psychologists and sleep technicians, all engaged in the specific work groups of the German Sleep Society. The consensus group met for a full weekend in Berlin to find consensus by voting on a practical curriculum for nursing staff, which can be adopted by other sleep societies and health care providers.

Results: The curriculum spans over 14 full hours plus 1 hr coffee brakes and 1 hr lunch break each day. The contents are as follows: Part 1: Basic knowledge about all forms of sleep disordered breathing; basic sleep physiology and sleep disordered breathing in the elderly; the different forms of PAP treatment, hypoglossus stimulation and oral appliance treatment. Part 2: Hands on training in small groups in a rotation system: the different types of CPAP machines how to be handled; the different types of ASV devices how to be handled, the different types of PAP masks including chin strapes how to be handled, put on and how to be cleaned; the different oral appliances how to be handled and cleaned; how to control the hypoglossal stimulator. Part 3:Theoretical presentations with practica training: Control of breathing parameters via pulseoximetry; the difficult elderly patient -finding solutions; emergencies-when to call the physician. Part 4: Mediated role playing games: Training patient relatives in handling PAP and other treatments; calming down the anxious patient. Part 5: Written end course exam.

Conclusions: We conclude that we developed a feasible and practical weekend course for geriatric nursing staff in handling all forms of treatment for sleep disordered breathing.

Disclosure: Nothing to disclose.

P267 | What makes doctors ask patients about their sleep even if they do not consult for a sleep complaint? A cross sectional study

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Objectives/Introduction: According to the French National Authority for Health, because of the impact of insomnia and the frequent absence of complaint from the patients, General Practitioners (GPs) should have an "active" approach of the question of sleep during the assessment of the global health of a patient.

The objective of our study was to identify the factors which allow GPs to have such an active approach through asking their patients about their sleep even if the latter do not consult for a sleep complaint.

Methods: We carried out a cross-sectional survey in May 2016 in Sfax governorate, Tunisia. A representative sample of 193 GPs was randomly selected. Among them, 127 accepted to participate in the study.

Results: The response rate to our survey was 65.8%. The sex ratio (Men/Women) was 1.4. Twenty eight GPs (22%) declared they took into account specific recommendations for the treatment of insomnia in their daily practice. Fifty nine GPs (46.5%) reported they often asked their patients about their sleep when the latter did not consult for a sleep complaint. Physical examination for insomniac patients was systematically performed by 89.7% (N = 113) of the participants. Forty nine GPs (40.8%) esteemed they mastered hypnotic drugs' prescription. Seventy two participants (56.7%) thought that sleep hygiene measures are efficient in insomniac patients. The stimulus control technique was known and used by 9.2% (N = 11) and 5% (N = 6) of GPs respectively.

Often asking about the sleep of patients was correlated to making a systematic physical examination for patients who consult for insomnia (p = 0.003), to mastering hypnotic drugs' prescription (p = 0.019), to believing in the efficacy of sleep hygiene measures (p = 0.016) and to the knowledge and use of stimulus control technique (p = 0.018 and p = 0.010 respectively).

Conclusions: Targeted continuous medical education on sleep hygiene and the active approach doctors should have of the question of sleep could help tunisian GPs promote good health as it is defined by the World Health Organisation: a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

Disclosure: Nothing to disclose.

SLEEP & AGING 2

P268 | Morning physiological changes after a dawn simulation light

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Objectives/Instruction: When getting up in the morning, many older people experience orthostatic hypotension, as the cardiovascular system is not able to compensate for the postural shift and maintain blood flow to the brain. In young individuals exposed to a dawn simulation light, we found an increase in heart rate and sympathovagal tone prior to awakening and a decrease in sleepiness upon awakening. In this study, we will determine whether a dawn simulation light is able to decrease sleepiness in older adults and increase their cardiovascular tone and blood pressure such that they would have reduced postural hypotension when they get out of bed in the morning.

Methods: 15 older participants (66.8 ± 9.36 years) had two overnight stays in the laboratory, on one of which a dawn simulation light was used for 30 min prior to scheduled wake time. Subjective sleepiness (Stanford Sleepiness Scale), objective alertness (Psychomotor Vigilance Test, PVT) and balance were tested before and after the night of sleep; heart rate, EEG and blood pressure were continuously recorded.

Results: Associated with the light exposure, we observed a smaller increase in heart rate at wake time (5 ± 4%), and a greater increase in pre-wake blood pressure (59 ± 19 mmHg, $p < 0.02$, T-test). We found no significant effects of light exposure during sleep on subjective sleepiness upon awakening, in measures of standing or ambulatory balance, or in the median reaction time on the PVT and number of PVT lapses.

Conclusions: Unlike healthy younger adults, we found no significant effect on sleepiness after a dawn simulation light exposure in older adults. We also did not observe an impact on measures of balance and objective alertness. However, as shown in younger adults, the heart rate transition appears less abrupt at wake time following the dawn simulation and blood pressure starts to increase before wake time under the light exposure. Dawn simulation light appears to prepare the body in anticipation of a postural change before the awakening.

Disclosure: Nothing to disclose.

P269 | Sleep in Alzheimer's disease spectrum disorders measured by WatchPAT, a home-based polysomnography

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Objectives/Introduction: There have been several human studies regarding sleep parameters and their potential relationship with Alzheimer's disease (AD) pathogenesis. Previous studies were limited by lack of in vivo pathology assessment or lack of intermediate groups of subjects such as mild cognitive impairment (MCI). Furthermore, AD patients potentially have more chances of poor sleep in unfamiliar environment like a polysomnography room in hospital.

In this pilot study we investigated sleep architecture in subjective memory impairment (SMI), MCI, and AD patients who completed amyloid PET scans prior to assessment of their sleep architecture using WatchPAT® which enables measurements of sleep parameters at home.

We hypothesized that patients with AD spectrum disorders or subjects with amyloid pathology in the brain may have more sleep problems.

Methods: A total of 60 subjects (AD, 27; MCI 18; normal cognition or SMI, 7; and other dementia, 8) were enrolled and completed detailed neuropsychological tests, MRI, 18F-Florbetaben PET, and blood tests.

Unexpectedly, around 30% of AD subjects failed to complete the WatchPAT monitoring and finally a total of 49 subjects (AD 19; MCI 18; normal cognition or SMI, 7; other dementia, 5) completed the study. Quality and quantity of sleep and other sleep architectures

were measured overnight by monitoring peripheral arterial tone signal reflecting the sympathetic nervous system activation.

All procedures were approved by the institutional review board at Asan Medical center, Seoul, Korea.

Results: MCI patients showed significantly increase in light sleep time and AD patients slept less on supine position compared to normal control/SMI subjects.

(Table 1, 2) When analyzed per amyloid imaging, subjects with amyloid positivity had a tendency to have delayed sleep latency compared to the amyloid negative group. (Table 3, 4)

Conclusions: This pilot study results suggest poor sleep quality in AD spectrum disorders or subjects with amyloid in the brain. Further studies with increased number of subjects and longitudinal follow-up will provide more information of the causal relationship between the sleep and AD pathogenesis.

Disclosure: Nothing to disclose.

P270 | Sleep disorders, age-related estrogen deficiency and melatonin in therapy

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Objectives/Introduction: As is well-known from SWAN study (H.Kravitz et al., 2003), menopausal status was significantly associated with difficulty sleeping. It is also known that there is a relationship between sleep disorders and decrease melatonin level.

To assess quantitative characteristics of sleep in perimenopausal women treated with melatonin in a dose of 3 mg during 3 month.

Methods: A study included 21 perimenopausal women (51.2 ± 4.7 year) with sleep disorders. IBM −27.09 ± 1.56. Seventeen women completed the study. Insomnia Severity Index (ISI) 21.3 ± 0.54. Anamnestic and gynecological examinations, polysomnographic monitoring (PSM) were used. Polysomnography (PSG) was performed applying system GRASS-TELEFACTOR Twin PSG (USA). All patients received melatonin 30 min before going to sleep in a dose of 3 mg daily during 3 month.

Results: Insomnia was confirmed by PSM. The dynamics of PSM demonstrated the improvement of the latency to sleep onset (39.45 ± 6.71 vs. 23.25 ± 3.71), after 3 months melatonin therapy ($p < 0.05$), total sleep efficiency (70.74 ± 9.43 vs. 95.7 ± 5.09) and increase of REM-sleep (94.72 ± 21.77 vs. 135.63 ± 22.76), ($p < 0.05$). A significant number of EEG activation responses showed a decrease in sleep fragmentation and improvement of the structure of sleep segments.

Conclusions: The use of melatonin in a dose of 3 mg during 3 month, is one of the main methods of treatment of sleep disorders in age-related estrogen deficiency. The main clinical effect was due to the elimination of pre- and intrasomnic disorders.

Disclosure: Nothing to disclose.

P271 | Sleep quality of older adults living in different housing arrangements

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Objectives/Introduction: Our previous study showed that sleep quality (SQ) of 167 retirement home residents was impaired in 77.8% participants. Sleep efficiency, sleep latency, and use of sleep medications were impaired the most, while subjective SQ and daytime functioning were high. The aim of the present study was to examine SQ of community-dwelling (CD) older adults in Zagreb, and to compare it with SQ of those residing in institutions. Life satisfaction was the strongest predictor of SQ in our nursing home (NH) study so we wanted to explore whether it would be significantly related to SQ of CD older adults.

Methods: The results of 55 CD participants (80% females, 63–86 years) were compared with the results of 60 NH participants (85.5% females, 69–87 years). All were ambulatory, without diagnosis of dementia, and the data was collected individually by trained interviewers in a local gerontology centre or in nursing homes. SQ was assessed by the Pittsburgh Sleep Quality Index (PSQI). Two questions were used to measure subjective health, and a standardized scale to measure life satisfaction.

Results: The results showed that SQ of CD participants was significantly better than SQ of NH residents when total PSQI scores were compared (M_{CD} = 5.6 vs. M_{NH} = 8.2, p = 0.000). The differences in the same direction were observed for sleep duration (p = 0.000), sleep efficiency (p = 0.000) and use of sleep medication (p = 0.011). The overall life satisfaction was of similar value in both groups (p = 0.065) and it was relatively high, but the self-rated health was somewhat better in CD participants (p = 0.044). In CD participants life satisfaction was associated only with shorter sleep latency ($p < 0.05$). When housing arrangement was controlled for, life satisfaction was significantly correlated to total PSQI score, subjective sleep quality, sleep latency and sleep disturbances (r = −0.28 to −0.53, $p < 0.01$) and to self-rated health (r = 0.36, $p < 0.01$).

Conclusions: Our results show that the SQ of CD older adults is expectedly better than SQ of NH residents, but the factors contributing to SQ seem to differ depending on housing arrangement.

Disclosure: Nothing to disclose.

P272 | From RBD to AD or mixed neurodegeneration? A case report

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Objectives/Introduction: Rapid Eye Movement (REM) sleep Behavior Disorder (RBD) is a REM sleep parasomnia that can be a prodromal sign of neurodegenerative diseases, in particular alpha-synucleinopathies such as Parkinson's Disease and Lewy-Body Dementia (LBD). Only in a minority of cases a conversion of RBD in Alzheimer's Disease (AD) has been reported.

Methods: We report the case of a 71-year-old patient who referred in 2010 to our Sleep-Clinic for a history of sleep-related behaviors characterized by motor agitation and aggressiveness, screaming, crying and falling out of the bed with a daily frequency from the age of 57.

Results: Habitual snoring, excessive daytime sleepiness and a symptomatology of Restless Legs Syndrome were also reported. Polysomnography (PSG) confirmed the suspect of RBD, furthermore mild Obstructive Sleep Apnea (OSA) and Restless Legs Syndrome with a Periodic Limb Movement Index (PLMI) of 57.1/hr were also diagnosed. Neuropsychological evaluation showed a normal cognitive functioning. The patient was treated with clonazepam and pramipexole. A second PSG performed in 2013 showed no RBD episodes, PLMI = 0 and Apnea-Hypopnea Index (AHI) = 2.7. As in the first assessment the patient exhibited a normal cognitive profile. In 2016, PSG showed electromyographic phasic activities on submental muscle during REM sleep and AHI = 13.4. Strikingly, the neuropsychological evaluation demonstrated the presence of multi-domain cognitive impairments affecting visuo-spatial short-term memory, verbal long-term memory, attention and visuo-spatial abilities along with complaint in episodic memory reported by the patient since one year. Notably, Fluorodeoxyglucose Positron Emission Tomography (FDG-PET) image showed a widespread hypometabolism involving medium and inferior temporal gyrus, temporo-parietal junction, superior and inferior parietal lobule, posterior cingulum and precuneus. Further hypometabolism involved also medial frontal bilateral and dorsolateral prefrontal cortex. This pattern was compatible with AD.

Conclusions: The clinical course and the instrumental evaluations confirm the development of a neurodegenerative disease from RBD. Remarkably, neuropsychological impairments and FDG-PET imaging suggest a possible AD pathology that has to be confirmed with further investigation. This finding should be cautiously interpreted, especially from the neuropathological perspective, that will be examined in depth by means of an Amyloid PET.

Disclosure: Nothing to disclose.

P273 | Links between circadian rhythm fragmentation, regular physical activity and amyloid burden in healthy older adults

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Objectives/Introduction: Sleep-wake disturbances are increasingly considered as risk factors for Alzheimer's disease (AD) because of their links with cognitive decline, brain atrophy and amyloid burden. Conversely, studies have shown that lifestyle could have protective effects against AD, notably physical activity (PA) which has been related to amyloid. The purpose of this study is to explore the links between circadian rhythm quality, PA and amyloid burden in ageing.

Methods: 85 healthy subjects (51 women, 34 men, mean age ± SD: 69.5 ± 4.1 years), presenting risk factors for AD (memory complaint, cardiovascular risk factors, apoE4), were included in this work. Circadian rhythm was assessed using actigraphy to estimate sleep-wake cycle interdaily stability (IS, i.e., the stability of the rhythm over days) and intradaily variability (IV, i.e., the fragmentation of the rhythm relative to its 24-hr amplitude) over a one-week period. Amyloid burden was measured with PET-AV45, and PA was evaluated with two questionnaires: the Physical Activity Scale for the Elderly (PASE) and the Modifiable Activities Questionnaires (MAQ), which respectively measure physical activity over a period of 7 days and 12 months. To explore the links between circadian rhythm, PA and amyloid burden in the whole brain or in regions of interest early affected in AD (namely frontal regions and the precuneus), correlation analysis were computed, with age, gender and Charlson's Comorbidity Index as covariates.

Results: Circadian rhythm IV is negatively correlated with the level of PA (r = –0.30; p = 0.007 for the PASE, r = –0.21; p = 0.061 for the MAQ), and positively correlated with amyloid burden in the precuneus. Moreover, a lower level of PA (measured with the MAQ) was associated with higher amyloid burden in the precuneus (r = –0.26; p = 0.020).

Conclusions: Our results suggest an association between sleep-wake cycle quality, PA and amyloid burden in the precuneus, a region known to be early affected in AD. This work supports the idea that sleep-wake disturbances may contribute to cognitive decline and dementia. Although processes underlying these associations remain unclear, healthy sleep appears to play a role in maintaining brain healthy, and our results highlight the potential effect of physical exercise as a non-pharmacological intervention for improving sleep and preventing AD.

Disclosure: Nothing to disclose.

P274 | Sleep quality, excessive daytime somnolence and quality of life of elderlies.

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Objectives/Introduction: To characterize the profile of older people with poor sleep quality and analyze possible associations with excessive daytime somnolence, quality of life and functional mobility.

Methods: This is a cross-sectional study, involving elderlies. Were used Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS), WHOQOL-OLD and Timed Up and Go test - TUG. The design and conduct of this study followed the guidelines of the Reporting of Observational Studies in Epidemiology (STROBE). The inclusion criteria were 60 years older and score ≥5 in the PSQI. Participants with a cognitive decline according to the Mental State Mini-Exam and those who were performing some treatment for sleep disorder were excluded. The data were tested for normality (*Kolmogorov-Smirnov test*) were subjected to a descriptive analysis by the absolute frequencies and percentages for categorical variables and measures of central tendency and dispersion for numerical variables. Descriptive statistics, Student's *t* test for paired samples and Pearson's correlation coefficient were used. It was adopted the significance level of 5% ($p \leq 0.05$) and statistical procedures were processed and analyzed in *Statistical Package of the Social Sciences* (SPSS).

Results: Were involved 131 elderly people, predominantly female (87%); mean age 68 ± 7 years, low per capita income (84.8% ≤2 minimum wage), low education (86.3% ≤3 years of study), and mostly staying with relatives (67.9%), married (39.7%) or amassed (35.9%). Seventy one percent of the sample is above normal weight, 90.1% of women have an abdominal circumference ≥80 cm and a high prevalence of chronic and psychosocial diseases was identified in the self-report, and the risk of obstructive apnea sleep in 38.2%. The mean PSQI, ESS, WHOQOL-OLD and TUG were equal to, respectively, 11.2 ± 3.2; 8.32 ± 2.2; 84.8 ± 10.2 and 8.97 ± 2. It was observed association of sleep quality with excessive daytime somnolence and quality of life, however it was not observed with functional mobility.

Conclusion: The results of the present study allowed to identify a sleep quality associated with excessive daytime somnolence and quality of life and also to characterize the profile of elders with poor sleep quality.

Disclosure: Nothing to disclose.

P275 | Sleep-wake patterns in older adults with mild cognitive impairment

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Objectives/Introduction: To establish the association between Sleep/wake patterns (SWP) and mild cognitive impairment (MCI) in Chilean elderly dwelling in the community.

Methods: Participants (n = 1,598) were part of the elderly cohorts of the ALEXANDROS follow-up study, and the data correspond to their baseline assessment. A questionnaire was applied including self-report of chronic diseases, medication consumption, functional limitations and, SWP, and an anthropometric evaluation was performed. The nutritional status was categorized according to body-mass index (BMI) criteria established by the World Health Organization. Cognitive status was assessed with the Mini Mental State Examination (MMSE) and MCI was defined as having a score <22. Logistic regression analyzes were performed to identify the association between cognitive status and SWP.

Results: MCI showed a positive association with long sleep (≥9 hr; OR 4.02; 95% CI 1.49–10.80) and a suggestive trend with short sleep (OR 2.05; 95% CI 0.87–4.85) and daytime sleepiness. By including nutritional status, the positive association with long sleep remained apparent, the tendency with short sleep increased their strength (OR 2.39; 95% CI 0.94–6.09) and with daytime sleepiness reached significance (OR 2.55; 95% CI 1.04–6.22).

Conclusions: The results show altered SWP in older adults with MCI. They also suggest that the early assessment of SWP in older people may help identify those at-risk for cognitive decline.

Support: FONDECYT (1130947; CONICYT, Chile) grant.

Disclosure: Nothing to disclose.

P276 | Subjective sleepiness and executive functions over a 14-hour wake period in elderly subjects

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Objectives/Introduction: Although many clinical studies point to excessive daytime sleepiness as a common complaint in aging (e.g., Ohayon and Vecchierini, 2002), systematic data on the time-course of elderlies' vigilance levels over daytime wake period are surprisingly sparse. A few data have been produced on elderly individuals' subjective sleepiness and on its associations with objective behavioural signals, such as yawning and blink rate (Zilli et al., 2008; De

Padova et al., 2009) as well with simple reaction times (Hoch et al., 1992), whereas the relationships between subjective sleepiness and more complex performance measures have still to be clarified.

Therefore, the aim of this study is to trace the time-course of subjective sleepiness and of executive functioning (namely, the inhibition capacity) over a 14-hr wake period in an aged population.

Methods: Fortysix elderly subjects (M = 18, *F* = 28, age 78.0 ± 7.6 years.) were monitored over a 14-hr period for: (a) subjective daytime sleepiness, through a 5-point Likert sleepiness scale administered every hour from 8:30 to 22:30; (b) executive inhibition function, by means of a Go-noGo task that the subjects were instructed to perform at four times (8:00, 11:30, 16:00 and 21:00), with omissions (lapses at the Go stimuli) and false alarms (responses to the noGo stimuli) as dependent variables.

Results: A significant effect of "time of day" was found for subjective sleepiness ($F = 22.6$, $p < 0.0001$), accounted for, as shown by post-hoc contrasts, by the higher values at the post-prandial dip (14:30 and 15:30 measurements) and in the evening hours (21:30 and 22:30 measurements) relative to all other times. The absolute values of subjective sleepiness never exceeded the moderate score of 3.1 on the Likert scale.Instead, no significant effect of "time of the day" was found for objective measures, both for omission ($F = 1,18$, ns) and inhibition capacity ($F = 1,74$, ns).

Conclusions: Repeatedly and systematically measured across the whole wake period, our aged population's vigilance seems strikingly preserved, showing an overall level and a diurnal time course comparable to those described at previous ages. Interestingly, there is no significant variation across daytime of complex performance, suggesting that this variable is partly irrespective of vigilance levels' fluctuations.

Disclosure: Nothing to disclose.

P277 | Home exercise improves the quality of sleep and daytime sleepiness of elderlies

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Objectives/Introduction: Aging causes physiological changes which affect the quality of sleep. Supervised physical exercise is an important therapeutic resource to improve the sleep of the elderlies, however there is a low adherence to those type of programs, which it is necessary to implement an exercise program which is feasible and effective. The study aimed to test the hypothesis that a semi-supervised home exercise program, improves sleep quality and daytime sleepiness of elderlies of the community who present poor sleep quality.

Methods: This was a randomized controlled trial study, conducted according to the CONSORT stands for Consolidated Standards of Reporting Trials from May to September 2017, in Brazil, with elderlies of the community aging 60 years old or older, sedentary, with lower scores or equal to 5 at the Pittsburgh Sleep Quality Index (PSQI) and without cognitive decline. From one hundred ninety-one potential participants twenty-eight refused to participate, therefore, one hundred thirty-one (mean age 68 ± 7 years), and 88% female, were randomly assigned to an intervention group - IG (home exercise and sleep hygiene, $n = 65$) and a control group - CG (sleep hygiene only, $n = 66$). Sleep assessment tools were used: PSQI, Epworth sleepiness scale (ESS) and clinical questionnaire of Berlin. The level of physical activity has been assessed by means of International Physical Activity Questionnaire adapted for the elderly (IPAQ) and Mini-Mental State Examination for cognitive decline. All participants were assessed before and after the 12-week intervention period and, also, the assessors were blind.

Results: The IG showed significant improvement in quality of sleep with a mean reduction of 4.9 ± 2.7 points in the overall PSQI ($p < 0.01$) and in all its 7 components of evaluation ($p < 0.05$), and improvement of secondary endpoint, daytime sleepiness, a decline of 2.8 ± 2.2 points in the ESS ($p < 0.01$).

Conclusion: Our results suggest that semi-supervised home exercise is effective in improving the quality of sleep and self-referred daytime sleepiness of sedentary elderlies of the community who presented sleep disorders.

Disclosure: Nothing to disclose.

P278 | Age related sleep stage trends as measured using remote sleep sensing hardware

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Objectives/Introduction: With increasing age, an increase in wake after sleep onset (WASO) and a decrease in deep and REM sleep is generally observed and has been confirmed in a meta-analysis published by Oyahon et al in 2004. The Ohayon study provides normative data for sleep in the sleeping environments included in the meta-analysis but is likely not representative of sleeping habits in the home. The rise of consumer sleep trackers enables measurement of sleep as experienced by people in daily life. Using an unique set of sleep recordings collected with the S+ by ResMed (a non-contact bio-motion sensor that enables home sleep staging estimation (Schade et al, 2017)), we improved our sleep estimation model and showed that the S+ technology is capable of capturing the age-related trends in sleep-staging using data collected in real life.

Methods: We analyzed the relationship between age and Time in Bed from a subset of 27,098 recordings from the S+ dataset, with the goal of creating a new model that takes into account both sleep stage distribution as reported by Ohayon and Time in Bed in the home environment as measured using S+. This updated set of normative data was then employed to train the S+ algorithm to more accurately capture the age-related trends.

Results: Between the ages of 15 and 75 the Ohayon normative data shows a decrease in Deep (47.9 min) and REM (26.4 min), accompanied with an increase in Light (13.7 min) and WASO (63.3 min). The updated S+ algorithm, run on 27,098 nights of data showed strong agreement with a decrease in Deep (48.3 min) and REM (26.1 min), accompanied with an increase in Light (11.7 min) and WASO (50.4 min) over the same age range.

Conclusions: Here we show for the first time that non-contact bio-motion sleep sensing technology is capable of capturing the well known age-related sleep stage trends. As such, its validation goes beyond the traditional sleep stage agreement statistics, commonly used to show validation. This work lays the foundations for further improvement in the performance of sleep monitoring technologies and shows their validity for use beyond consumer sleep tracking.

Disclosure: Brendan Quinlivan and Alberto Zaffaroni are employed by ResMed. ResMed launched S+ by ResMed in 2014. Ansel Raj, Kenny Santo-Domingo and Roy J.E.M. Raymann are employed by SleepScoreLab.

P279 | Sleep disorders and cognitive impairement: a longitudinal study

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Objectives/Introduction:

1. About 50% of the elderly suffer from sleep disorders; in this context it's important to study the correlation between sleep and cognitive impairement.
2. to evaluate cognitive function assessed by the MMSE and GDS in a homogenous population of elderly suffering from sleep disorders but never been treated before.
3. to analyze the correlation between sleep disturbances (OSAS and insomnia), sleep duration, snore, symptoms such as difficulty to staying awake during the day and, both, cognitive impairement and depression.

Methods: We selected 451 patients (247 Male, 204 Female), mean age 71.50 ± 6.78. All patients were submitted to the anamnestic evaluation of sleep quality and sleep duration keeping a daily sleep diary and underwent to polygraphy; daytime sleepiness was assessed through the Epworth Sleepiness Scale (ESS); the geriatric assessment of mood and depression was performed using the GDS, the cognitive performance status was assessed using the MMSE.

Inclusion criteria: Patient enrolled were >60 years old and received first diagnosis of sleep disorders at observation.

Exclusion criteria: Inability to obtain Formal Informed Consent; MMSE < 10; history of depression or sleep disorders.

Results: There is a statistically significant correlation between: OSAS, rhoncopathy, daytime sleepiness, symptoms related to sleep disturbances and mild cognitive impairement.Short sleep duration (<6 hr) is not related to cognitive deterioration (IC 95%, p = 0.0532). We didn't find any correlation between patients affected by primary insomnia and cognitive impairement; it is possible that this result has been influenced by the difficulty to detect a subject-related symptom without a standardized instrument in clinical practice to detect insomnia except medical history.

As far as the evaluation of mood is concerned, we found statistically significant correlation between: OSAS, short sleep duration (<6 hr), daytime sleepiness and the possibility to develop depression. While we didn't find a statistically significant results between insomnia, symptoms related to sleep disturbances and depression.

Conclusions: Our findings confirm that there is a strong relationship between sleep disorders, cognitive decline and depression. For this reason, sleep disorders should be systematically evaluated and searched in all elderly people to recognize and treat disease at an early stage.

Disclosure: Nothing to disclose.

P280 | Nightly Hypoxemia in the elderly inpatient population and its link to dementia

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Objectives/Introduction: There is evidence from several studies that hypoxemia can lead to cognitive impairment. A Norwegian study showed that roughly 26% of the average elderly population has nightly hypoxemia (Hjalmarsen and Hykkerud, 2008). There is still a lack of epidemiological data referring to hypoxemia in the elderly. The aim of our still ongoing study is to examine subjects concerning nightly hypoxemia and its effect on cognitive impairment and dementia. Furthermore this study investigates, if additional supplied O_2 for hypoxemic patients results in cognitive improvement.

Methods: n = 164 consecutive subjects (113 f, 51 m) of the inpatient population of the geriatric rehabilitation clinic in Bad Aibling, Germany, independent of referral reasons and diagnoses with a mean age of 83.9 years were included. Cognitive functioning was assessed first and after a period of ten days with the number connection test (NCT), a concentration test (AKT) and the MMSE (degree of dementia). The SaO_2 during sleep was measured for at least 4 hr. T90 > 30% was used as a cutoff to distinguish between hypoxic and non-hypoxic patients. Data is expressed descriptively and with Pearson correlation coefficient for correlations between

cognitive function test and t90 results. Patients who fulfilled the t90 criteria were given a nightly 2 l/O_2 supply over a period of 10 days.

Results: 33 of n = 164 patients (20.1%) had a t90 for more than 30% of the time. There were no significant correlations between the t90 and the cognitive functional testing except the MMSE which correlated with the t90 scores with r = −0.224. Sex correlates significantly with t90 (p = 0.000), AKT (p = 0.033) and meanO_2 (p = 0.000). 21 out of 33 Patients agreed to an additional O_2 supply. We didn't see significant improvement of cognitive functioning due to oxygen supply.

Conclusions: We found similar epidemiologic data as the Norwegian group. In this preliminary sample of our study we could see a correlation between the MMSE and the t90 scores, but not for the cognitive functioning tests. Additional oxygen provided for the hypoxemic subgroup did not lead to an improvement in cognitive functioning assessed by the mentioned tests. This might change with a larger sample siz.

Disclosure: Nothing to disclose.

POSTER SESSION 2

BIOCHEMISTRY & NEUROBIOLOGY 1

P281 | Dynamic metabolic changes in the waking and sleeping brain - insights from MR spectroscopy

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Objectives/Introduction: Sleep is important for health and cognitive functioning, and dysregulated sleep-wake processes are at the core of sleep-wake disorders. In humans, blood flow during sleep is decreased compared to wakefulness in the thalamus and anterior cingulate cortex (ACC). Studies in animals suggest that gamma-aminobutyric acid-ergic (GABA) and glutamatergic (GLU) cells in thalamo-cortical projections play an important role in the wake-to-sleep changes in blood flow. Approaches examining the action of neurotransmitter systems in humans from the wake-to-sleep transition are largely absent. Recent methodological advances allow for the non-invasive detection of naturally occurring metabolite concentrations with high data quality in circumscribed areas of the human brain.

Methods: Here we aimed at unraveling the dynamic metabolite changes in the thalamus from wakefulness to sleep onset, and investigating their possible association with increasing depth of sleep at a high temporal resolution. We combined proton magnetic resonance spectroscopy (^{1}H-MRS; metabolite cycling) for GABA and GLU quantification with simultaneously recorded polysomnography (PSG) in 15 healthy, sleep-restricted participants (8 females; 21–26 years) who spent 2 hr during early night-time (10–12 p.m.) in the MR scanner. The measurement contained wake and sleep episodes and metabolic changes in the thalamus were analyzed during wakefulness and sleep according to a within-subject design. An additional condition in which participants stayed awake at the same time of the day was used as a control for circadian changes in metabolites.

Results: In all participants, a decrease in thalamic GLU concentration from wakefulness to sleep was observed (p = 0.006). The decrease correlated negatively with sleep duration in the 2-hr recording period (r = −0.84; p = 0.005). During the control wake episode, no changes in glutamate concentration were observed.

Conclusions: Our results suggest that combined MRS-PSG allows for the reliable detection of small metabolic changes between wakefulness and sleep. Future studies will evaluate whether the decrease in thalamic GLU reflects a global reduction in neuronal activity, or whether it is restricted to central hubs subserving sleep-wake regulation.

Disclosure: Nothing to disclose.

P282 | Randomized, single dose, double-blind, 4-way crossover study determining the abuse potential of pitolisant compared to phentermine and placebo, in healthy, non-dependent recreational stimulant users

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Objectives/Instruction: A clinical Human Abuse Liability (HAL) study was conducted to assess the abuse potential of pitolisant, the first Histamine H3 receptor inverse agonist, a new treatment of narcolepsy with or without cataplexy.

Methods: The study was designed to determine the abuse potential of single doses of pitolisant (optimal therapeutic dose 40 mg (P40) and supratherapeutic dose 240 mg (P240)) compared to phentermine 60 mg and to placebo, in 38 healthy, non-dependent, recreational stimulant users. The primary endpoint was the peak maximum effect for Drug Liking (E_{max}DL), and many secondary endpoints such Overall Drug Liking (ODL), Take Drug Again (TDA), positive and negative drug effects, ARCI stimulant scales, safety and PK parameters were assessed.

Results: E_{max}DL was significantly increased by phentermine compared to placebo ($p < 0.0001$), confirming study validity, while both doses of pitolisant demonstrated a statistically significant and clinically relevant decrease compared to phentermine with overall profile similar to placebo. Similarly for ODL and TDA, the difference between phentermine and pitolisant was always significant

($p < 0.0001$) showing that subjects liked pitolisant less, and had lower preference to take it again, even a trend toward not taking drug again for P240, while comparisons between pitolisant and placebo indicated similar profiles. Moreover bad drug effects were significantly higher with P240. Neither dose of pitolisant altered the ARCI stimulants scales, indicating a dissimilarity to amphetamine and morphine, inferentially producing no signal for euphoria. By contrast, phentermine produced significant changes in all ARCI scales.

Pitolisant PK parameters and safety profile were consistent with previous known data. No serious adverse event and the most common TEAE experienced was euphoric mood with phentermine, and headache with P240.

Conclusions: Overall, this study indicates no evidence for abuse or misuse of pitolisant either in patients or recreational abusers.

Disclosure: B Setnik is a consultant of Bioprojet, C Scart-Grès is an employee of Bioprojet and JM Lecomte and JC Schwartz are founders of bioprojet company which sponsored this study.

P283 | Olanzapine influence on brain activity shown in standardized low resolution brain electromagnetic tomography and heart rate variability during sleep in healthy subjects

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Objectives/Instruction: Several studies have shown in the past a direct influence of olanzapine to prolong slow wave sleep (SWS) duration as well as causing cardiac and metabolic side effects, which has been detected in reduced heart rate variabilities (HRV), weight gain and increased appetite. The subgenual anterior cingulate cortex (sgACC) has been linked functionally and anatomically to the autonomic nervous system (ANS). It has been described to relate more to the parasympathetic system of the ANS. We hypothesized, olanzapine's effect in the region of our interest (ROI) Brodmann area 25 (BA25) would be detectable in the standardized low resolution brain electromagnetic tomography (sLORETA) neuroimaging method, HRV and in increased appetite by using a self- rating questionnaire.

Methods: 10 healthy, young, male subjects underwent two 118 channel Sleep- EEG recordings

- **i)** at baseline and
- **ii)** after treatment with increasing olanzapine usage starting with 2.5 mg up to 10 mg for 7 days.

Artifact-free 5 min EEG clips from the first N3-sleep cycle were used for the following frequency bands: δ, θ, α, β1 and β2. ROI BA25 was analyzed with sLORETA neuroimaging. HRV was analyzed based on: absolute very low frequency (0.003–0.04 Hz), low frequency (LF), (0.04–0.15 Hz), high frequency (HF; 0.15–0.4 Hz), and similar relative power HRV values as well as heart rate (HR).

Results: We observed an increase in the current source density in α- frequency band (baseline 5.42 [SEM = 0.128] in contrast to olanzapine intake 5.76 [SEM = 0.184]; $p \leq 0.01$). In HRV, HR and relative LF-power increased ($p \leq 0.02$). Positive correlation of HRV parameters to sgACC alpha-activity (HF relative) were weakened after olanzapine intake. The self- rated questionnaire increased after olanzapine intake significantly ($p \leq 0.016$), from mean baseline appetite 59.33% (SD ±18.46%) to 70% (SD ±17%).

Conclusions: Reported data suggests that changed activity in sgACC BA25 participates in increased appetite. Olanzapine may have a direct parasympathetic brain effect with increases in SWS duration and α- frequency power of sgACC, but also to disturb the brain-heart axis due to its anticholinergic effect. Additionally, we've shown, the possibility of sLORETA to detect pharmacological modulation during sleep.

Disclosure: Nothing to disclose.

P284 | Relationship between early and late components of the evoked response to two different auditory stimuli applied during slow wave sleep by means of closed-loop technique

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Objectives/Introduction: Closed-loop auditory stimulation is a promising, non-invasive approach to boost slow waves during sleep. The contribution of different features of the auditory evoked response (event-related potentials, ERPs) in the enhancement of slow waves are unknown. The present study sought to compare the ERPs to two auditory stimuli with different frequency composition.

Methods: We collected high-density sleep EEG ($N = 6$, 23.7 ± 1.3 years old) in two conditions carried out in different nights: closed-loop auditory stimulation in the up-phase of slow waves (STIM night) and non-stimulation (BS night). Two types of stimuli were used: 1/*f* pink noise (PN, ~50 dB, 100 ms) and a complex tone (Chord, ~60 dB, 100 ms), composed of four sinusoidal tones (352, 440, 528 and 704 Hz). We assessed the differences between two stimuli types by comparing ERPs in 2.5 s epochs.

Results: There was no group-level difference in the amplitude of ERPs between PN and Chord. We assessed two features of the ERPs: the P200 component of the ERP (at ~250 ms), reflecting initial sound processing, and the amplitude of the evoked K-complex (from 0.3 to 2 s), used as an individual marker of the efficacy of auditory stimulation. To probe if processing of PN and Chord differs among participants, we correlated the ratio of P200 (PN/Chord) and the ratio of the evoked K-complex (STIM/BS). We observed a significant positive correlation ($r_s(6) = 0.943$, $p = 0.017$), indicating that a large difference in P200 between two stimuli types was associated with bigger amplitude of the evoked K-complex.

Conclusions: The positive correlation of the ratio (PN/Chord) in P200 and the amplitude of the evoked K-complex (STIM/BS) indicates that higher efficacy of auditory stimulation was associated with more fine-grained sensory processing. Source localization may help us to understand where this effect originates from.

Disclosure: Nothing to disclose.

P285 | Differential regulation of theta and fast-gamma oscillations in the waking state of mice disrupted in Hypocretin/Orexin Receptor-1, or 2 selectively in noradrenergic, or dopaminergic neurons

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Objectives/Introduction: Neuromodulation of cortical and subcortical circuits by the Hypocretin/Orexin (HCRT) neuropeptides is a fundamental determinant in stability and EEG spectral quality of behavioral states.

Methods: To investigate the specific roles of the Hypocretin-to-Noradrenergic (HCRT-to-NA), and HCRT-to Dopaminergic (HCRT-to-DA) circuits in regulating brain's oscillatory rhythms, we created conditional *HcrtR1* and *2* KO (cKO) genetic alleles and selectively disrupted the *Hcrtr1* gene in NA neurons, and one or both genes in DA neurons. Resulting mice were exposed to various behavioral paradigms, as their EEG/EMG activity was recorded, and their behavior was video-taped.

Results: Disrupting the HCRT-to-NA connectivity (n = 9 mutant; 7 control mice) confirmed its importance in mounting a robust theta/fast-gamma oscillatory response in stressful conditions, but also revealed conditions where it may, in contrast, curb hyperarousal.
Mice with DA-selective *HcrtR2* disruption (n = 9 mutant; 9 control), but not inactivation in *HcrtR1*, or both receptors, were found to exhibit a constitutive upregulation in theta frequencies while awake, with a constitutive active-waking state, which was uncoupled to locomotor activity. Such EEG oscillatory profile of mice lacking HCRTR2 in DA cells resembles, paradoxically, the one of mice in which ventral tegmental area dopaminergic (VTA-DA) neurons were optogenetically stimulated. We aim to investigate at an electrophysiological level how HCRTR2 signaling affects theta network activity.
We also found that alterations in the mice' waking spectral profiles were associated with specific alterations in the spectral quality of their subsequent Slow-Wave Sleep (SWS). In particular theta/fast-gamma-enriched wakefulness was found to have a specific homeostatic impact on a slow component of the delta oscillatory rebound in SWS.

Conclusions: HCRT signaling astutely regulates brain oscillatory network activity, in manners that appear to widely diverge in different behavioral contexts. Moreover, the HCRT circuit appears to use distinct wake-promoting monoaminergic cell groups to differentially adapt and configure wake and sleep states to environmental contingencies, using an array of codes we are just starting to uncover.
Supported by the Swiss National Science Foundation.

Disclosure: Nothing to disclose.

P286 | Homer1a upregulation in the claustrum, a neuronal super-hub, may influence sleep/wake behavior

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Objectives/Instruction: Homer1a, an immediate early gene and dominant negative member of the Homer family of synaptic signaling proteins, is rapidly increased by neuronal activity and sleep loss. Homer1a knockout mice have reduced ability to sustain wakefulness and Homer1a is required for downscaling excitatory synapses during sleep. The cellular basis of these effects are unknown. Using *in situ* hybridization (ISH), we examined Homer1a expression in the mouse brain following acute sleep deprivation (SD) to determine the spatial localization of expression changes. Quantitative PCR (qPCR) was used to confirm ISH results.

Methods: Brains were harvested for ISH from male C57BL/6 mice (young, 2-month; aged, 18-month; n = 8/age) sleep deprived for 1 or 3 hr, undisturbed control mice (n = 8/age) sacrificed at the same diurnal time-point, and mice (n = 3/age) allowed recovery sleep for 3 hr. Brain regions identified by ISH were micro-punched out from 3-hr SD mice for qPCR. Relative gene expression was calculated using the deltaCt method. Comparisons were performed using non-parametric Wilcoxon tests (2 groups) or Kruskal-Wallis tests (multiple groups) followed by pairwise Wilcoxon tests.

Results: Homer1a was upregulated in the claustrum, cingulate and piriform cortices, but not in the classically studied sleep/wake regions following acute SD. Claustrum localization was confirmed by immunostaining with Gng2, a protein enriched in this region, and by double RNAscope to Homer1a and Gng2. Homer1a levels were reduced in all brain regions following recovery sleep. Homer1a is also upregulated in the claustrum of aged mice following SD, but not reduced after recovery. Using q-PCR in the regions identified by ISH, we confirmed that Homer1a was increased in the claustrum (p = 0.0081) and piriform cortex (p = 0.0051), but not the locus coeruleus (p = 0.69) or tuberomammillary nucleus (p = 0.066).

Conclusions: Homer1a shows early upregulation in response to SD primarily in the claustrum and piriform cortex. The claustrum, the most connected structure in the human brain per unit volume with reciprocal connections to all regions of the cortex is a neuronal super-hub. Upregulation of Homer1a in the claustrum suggests a role for this region in sleep/wake behavior. Current studies are focused on investigating the role of the claustrum in sleep/wake behavior using chemogenetics.

Disclosure: Nothing to disclose.

P287 | Gray matter volume correlates of sleepiness: a voxel-based morphometry study in younger and older adults

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Objectives/Instruction: Sleepiness is prevalent in society, often linked to disturbed sleep, shift work, stress, or diseases. It is also associated with an increased risk of accidents. Sleepiness may be related to brain metabolism and, we hypothesize that it is associated with brain gray matter (GM) volume. The present study investigated the association between sleepiness and GM volume in thalamus and insula, with a special focus on age, since both sleepiness and GM volume change with age.

Methods: In all, 84 healthy individuals participated in the experiment, of which 46 were in the age range 20–30 years and 38 ranging between 65–75 years. Data was collected in a 3 T scanner during a 5 min anatomical scan (first in a several sessions in the scanner) in the evening after a full night of sleep. Momentary sleepiness (Karolinska Sleepiness Scale) was rated 7 times during the time in the scanner.

Results: iIn older, relative to younger adults, areas within bilateral insular cortex and thalamus GM regions of interest were negatively associated (FWE-corrected) with sleepiness ($Z = 4.02$, $p = 0.015$ left insula and $Z = 4.42$, $p = 0.009$ for right insula; $Z = 3.75$, $p = 0.020$ for left thalamus and $Z = 4.60$, $p < 0.001$ for right thalamus). Larger volume was associated with low sleepiness in the older group, but not in the older group. The effect in the insula was mainly present in the mid-anterior parts of the structure. In addition, after applying a conservative small volume correction including all ROIs simultaneously, age-interaction effects remained significant. TST the preceding day eliminated effects.

Conclusions: eSlf-rated momentary sleepiness in a monotonous situation is negatively associated with GM volume in areas within both thalamus and insula in older individuals. The results are in line with notions of thalamus as a driver of arousal and of anterior insula as a structure evaluating the state of the organism. Possibly, a larger GM volume in these structures may be protective against sleepiness in older individuals, a hypothesis that needs confirmation in further studies. Possibly, TST plays a role in the observed associations.

Disclosure: Nothing to disclose.

P289 | Scale invariance attenuation and altered sleep parameters following increasing dim-light-at-night duration periods

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Objectives/Introduction: Artificial light has a widespread use nowadays. However, light exposure at night has been associated with various health disruptions including metabolic and immunological disturbances, altered circadian timing and sleep disorders. In our study, we investigated the effect of exposure to different dim-light-at-night [DLAN, 12:12 hr Light:DLAN (50–100:5 lux)] durations on rest-activity behavior, sleep architecture and sleep electroencephalographic (EEG) parameters in C57BL/6J mice. DLAN can be regarded as a condition mimicking artificial light exposure at night.

Methods: EEG and the electromyogram was recorded in mice during a control light-dark baseline day ($n = 5$), following acute 12-hr DLAN exposure ($n = 5$) as well as after one week ($n = 5$), one month ($n = 5$) and three months ($n = 9$) DLAN. For all the different DLAN durations, a second day was recorded at the start of which 6 hr of sleep-deprivation (SD) were conducted by gentle handling. Additionally, locomotor activity for the control light-dark (LD), the one-month and three-month DLAN conditions was monitored by passive infrared detectors.

Results: Prolonged DLAN exposure led to circadian rhythm disruption and sleep quality degradation. We applied detrended fluctuation analysis (DFA) on the behavioral data and found a significantly lower scaling component α in animals exposed to the 3-month DLAN condition compared to control conditions ($p < 0.01$), while following 1-month of DLAN exposure showed intermediate α values between control LD and 3 months DLAN. Additionally vigilance state distribution was altered, showing a gradual delay in the waking peak in the dim light (active) period as a function of DLAN exposure duration (1 day–1 month) compared to control LD. Following 3 months DLAN exposure, mice showed less non-rapid-eye-movement (NREM) sleep during the light period ($p < 0.05$), while waking and NREM sleep levels did not differ from control dark period, particularly in the first half of the dim-light period. Interestingly, a diminished response to sleep deprivation as well as a general attenuation of EEG power density across vigilance states was noted in the 3-month DLAN condition ($p < 0.05$).

Conclusions: Our data show that prolonged exposure to DLAN induces a diminished integrity of the neurophysiological system, impacting sleep, and sleep regulation as well as the underlying brain network.

Disclosure: Nothing to disclose.

P290 | Individual waking alpha EEG power correlates negatively with adenosine receptor density measured with PET

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Objectives/Introduction: The spectral components of quantitative human wake EEG are highly genetically determined which has been demonstrated in twin and test-retest studies. The alpha range (8–12 Hz) dominates the wake EEG. Its occurrence was found to be related to cerebral energy metabolism by an inverse relation in e.g. cortical fMRI BOLD and thalamic FDG PET studies. Adenosine is a neuromodulator directly linked to the energy metabolism by ATP breakdown and a potential mediator of sleep homeostasis. Individual differences in alpha rhythm occurrence might be based on adenosine receptors availability.

The objective of the current study was to investigate whether A_1 adenosine receptor density is related to the alpha component of the wake EEG.

Methods: 14 healthy male volunteers (mean age ± SD 27.7 ± 5.4 years) participated in a dynamic 18F CPFPX bolus/infusions-PET study with blood sampling and metabolite analyses. Regional distribution volumes (V_T) were determined by calculating the tissue-to-plasma ratio during the steady state phase. Wake EEG was acquired repeatedly over two days of sustained wakefulness and after recovery sleep and the alpha power determined by fast Fourier transformation (μV^2) averaged over the sessions and in the respective range. Adenosine receptor availability in atlas based brain regions in proximity to the EEG derivations and known to be relevant in sleep wake regulation were correlated with the alpha power (Pearson's product moment correlational analyses).

Results: Significant negative correlations were found between the alpha power in the occipital recording (O2 electrode) and striatal ($r = -0.59$; $p = 0.025$) as well as thalamic ($r = -0.60$; $p = 0.02$) adenosine receptor availability. Comparable associations were found for the central recordings (C4) and the anterior cingulate cortex ($r = -0.64$; $p = 0.013$), occipital cortex ($r = -0.59$; $p = 0.03$), and the thalamus ($r = -0.6$; $p = 0.038$).

Conclusions: Our findings suggest an individual functional relationship between A1 adenosine receptor availability and EEG alpha power density.

Disclosure: Nothing to disclose.

P291 | Ambient temperature warming and the role of the lateral hypothalamus in REM sleep expression

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Objectives/Introduction: Ambient temperature (T_a) warming toward the high end of the thermoneutral zone (TNZ) preferentially increases REM sleep over NREM sleep across species. Although the role of the anterior hypothalamus in thermoregulation and NREM sleep expression are well documented, the hypothalamic control of REM sleep during ambient temperature manipulation remains to be determined. We examined the potential role of the posterior lateral hypothalamus (LH) melanin concentrating hormone (MCH) system in the modulation of REM sleep during T_a manipulation.

Methods: Genetically engineered MCH-R1-knockout (KO) mice or MCH::cre mice implanted with chronic cortical EEG and neck EMG electrodes were used for experimentation. Mice were housed at 23.0 ± 1.0°C in their home cages in a temperature-controlled cabinet. During the light period at 2 hr intervals, four bouts of rapid T_a warming to a maximum of 31.7°C were achieved for 30 min with a thermostatically controlled combination of convection heater and indirect infrared lamp. To optogenetically manipulate MCH neuronal activity, we stereotactically injected AAV2-EF1a-DIO-ChR2-eYFP, AAV2-EF1a-DIO-ArchT3.0-eYFP, or AAV2-EF1a-DIO-eYFP (controls) in the LH of MCH::Cre mice.

Results: In wild type controls ($n = 4$), REM sleep durations were significantly increased in the warm TNZ high (27.5–31°C) compared to the cool TNZ low (24.0–27.5°C) condition ($p < 0.05$). However, MCH-R1-KO mice ($n = 7$) showed no significant changes in REM sleep as a function of T_a. We found that random semi-chronic optical activation (ChR2, $n = 7$, 473 nm) of LH MCH neurons at 20 Hz significantly increased REM sleep durations compared to YFP controls ($n = 5$, $p < 0.05$) and compared to the baseline condition, but did not affect NREM sleep. Optical activation in combination with the T_a manipulation protocol had an additive effect on increasing REM sleep (gain of function), beyond what optical stimulation or T_a warming alone was able to achieve. Finally, optical MCH inhibition (ArchT, $n = 5$, 532 nm) appeared to block the expected increase in REM sleep during T_a warming.

Conclusions: Taken together, these data support a key role for the MCH system in the output expression of REM sleep during T_a manipulation, and that concomitant MCH activation with T_a warming can over-express this effect.

Disclosure: Nothing to disclose.

P292 | Caring for those with brain injury: investigating sleep disturbances and fatigue

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Objectives/Introduction: Family members such as spouses or partners often provide long-term continuous support and care for individuals with brain injury (BI). Despite this, limited research has investigated how caregiving impacts carer sleep quality, wellbeing and fatigue symptomology. This study aimed to investigate the possible mediating factors that contribute to poor sleep quality in carers for those with brain injury. More specifically, whether fatigue, anxiety, depression and perceived burden were associated with and/or predicted poor sleep in carers of those with brain injury.

Methods: A cross-sectional correlational design was utilised with 237 carers of people with BI completing a battery of measurement including the Pittsburgh Sleep Quality Index (PSQI; Buyssee et al, 1989), Hospital Anxiety Depression Scale (Zigmond and Snaith 1983), Fatigue Severity Scale (Krupp et al, 1989) and Zarit Caregiver Burden Interview Short Form (Zarit et al, 1985). Measurements assessed sleep quality, psychological wellbeing and fatigue.

Results: Study participants (n = 237, 226 female) with mean age of 47.08 (±10.72). Poor subjective sleep (PSQI > 5) was a common complaint with 94.09% of carers being classified as poor sleepers (mean score 10.70 ± 3.336). Self-reported characteristics demonstrated high instances of fatigue (4.94 ± 1.33), burden (ZBI-12; 26.27 ± 9.16), anxiety (12.42 ± 4.39) and depression (9.30 ± 3.75) in carers. Analysis show a significant relationship between anxiety (r = 0.403, $p < 0.001$), depression (r = 0.484, $p < 0.001$) perceived burden (r = 0.335, $p < 0.001$) fatigue severity (r = 0.468, $p < 0.001$) and sleep quality. Multiple regression analysis revealed a significant model F (4,237) = 11.67, $p < 0.001$, R^2 = 31.8, with the model explaining 31.8% of variances in sleep quality. Depression and fatigue were significant predictors of sleep quality with fatigue symptomology being the strongest predictor of poor sleep amongst carers ($\beta 2$ = 0.760).

Conclusions: Carers demonstrated elevated levels of poor sleep quality, fatigue and poor psychological wellbeing. Anxiety, depression, perceived burden and fatigue were associated with sleep disturbances in carers with fatigue and depression predicting poor sleep. These results provide further emphasis on the necessity for support provisions which aim to improve sleep hygiene practices, improve psychological wellbeing and address fatigue symptomology for carers.

Disclosure: Nothing to disclose.

P293 | Habitual daily caffeine consumption and its cessation changes human grey matter density independent from the effect of cerebral blood flow: a multimodal study

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Objectives/Introduction: Grey matter density (GMD), a structural brain measure associated with sleep slow wave activity (SWA), is acutely decreased after caffeine consumption in low consumers. This effect can be explained by decreases in cerebral blood flow (CBF). Here, we investigate the effect of long-term high caffeine consumption and its withdrawal on GMD and its association with CBF.

Methods: Twenty male habitual caffeine consumers (26.4 ± 4.1 y/o, daily caffeine consumption 472.5 ± 106.6 mg) were recruited in a double-blind, crossover design. Each volunteer underwent caffeine (10 days, 3 × 150 mg), withdrawal (placebo after 9-day caffeine), and placebo (10 days) conditions. Sleep electroencephalography was assessed on day 9 and 10. T1-weighted MPRAGE (1 × 1 × 1 mm^3, TR = 2,000 ms, TE = 3.37 ms) and 2D-EPI arterial spin labeling sequence (4 × 4 × 4 mm^3, TR = 3,000 ms, TE = 12 ms) were acquired in a 3T scanner after 12.5 hr of controlled wakefulness on day 10. Voxel-wise multimodal linear mixed-effect model was performed through VoxelStats toolbox. CBF and condition effects as two hypothetical factors of the GMD variable were included into the model step-wisely. Cluster threshold was set at $p < 0.001$. All reported regions were $p_{FWE} < 0.05$.

Results: Compared to placebo, decreases in GMD were evident in both caffeine and the withdrawal conditions in mainly frontal, parietal, superior temporal, and subcortical regions. GMD increase was observed in withdrawal only in inferior frontal gyrus, insula, middle temporal, superior occipital, and caudates. Independent of conditions, CBF was positively correlated with GMD. The interaction analysis (CBF × condition) indicated that the correlation in GMD-decreased regions in caffeine and withdrawal conditions was particularly evident but diminished in the GMD-increased regions (observed only in withdrawal).

Conclusions: Our study corroborates the association between CBF reduction and an apparent decrease in GMD in both cortical and subcortical regions after long-term daily caffeine consumption, this effect lasts at least 36 hr after withdrawal. The data thus strongly suggest to carefully control for caffeine-intake in GMD analyses. Our data further indicate that the withdrawal-induced short-term changes in the adenosinergic system can affect GMD independent of CBF. It

remains to be investigated whether this effect can be linked to other markers of neuronal changes such as sleep slow wave activity.

Disclosure: Nothing to disclose.

SLEEP PHYSIOLOGY 2

P294 | Measures of interoception during changes in conscious state from wakefulness to sleep and their potential significance for altered awareness in psychiatric conditions

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Objectives/Introduction: In order to create a holistic conscious percept, the perceiver's brain needs to form a subject as reference for this percept. During altered states of awareness such as sleep, measures of interoception should therefore change. Interestingly, also psychiatric conditions with altered subjective awareness such as psychotic or dissociative symptoms exist. Our aim is to detect measures of interoceptive awareness in healthy and to later on test these measures in psychiatric conditions with altered awareness.

Methods: So far, we've studied 24 healthy sleepers (mean age = 24.42 years, SD = 2.59, 12 females). 8 hr PSG was recorded using a 32-channel Synamps amplifier (NeuroScan Inc., Texas). Preprocessing and R-peak detection was done in Brain Vision Analyzer 2 (BrainProducts, Germany). Spindle/slow oscillation detection was done using Matlab routines. Heartbeat evoked potentials (HEP) were calculating by averaging 1,000 random segments per subject per sleep stage. HEP amplitudes were detected around 250–400 ms post R-peak according to prior literature. ANOVAs and bootstrapping statistics were calculated. To determine the spectral peak frequency per sleep stage at Oz, the signal was segmented into 6 s epochs, Fast Fourier transformed, and averaged over segments.

Results: Frontocentral HEP amplitude decreased from wake to deep sleep, with a renewed increase during REM (ANOVA sleep stage × laterality, sleep stage: F (5,110) = 3.74, $p < 0.01$, $\varepsilon = 0.76$). Interestingly, heartrate and spectral peak frequency significantly correlated during wakefulness ($r = 0.48$, $p < 0.05$). With increasing sleep depth this correlation faded (S2: $r = 0.40$, $p = 0.056$; S3: $r = 0.34$, p = n.s.; S4: $r = 0.26$, p = n.s.). Heartbeats appearing during a sleep spindle did not produce a detectable response. Furthermore, during SWS we found a temporal coupling of heartbeats and slow oscillations with a significant R-peak grouping during the up-state ($Z = 23.19$, $p < 0.001$).

Conclusions: Our results strongly indicate a coupling between cardiac and central nervous activity which changed with conscious state from wakefulness through sleep. Our aim is to now investigate whether these potential measures of interoception vary with pathological alterations of conscious perception in patients with schizophrenia and dissociative symptoms.

Disclosure: Nothing to disclose.

P295 | Genetic contribution to slow wave energy in adolescents

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Objectives/Introduction: The sleep homeostatic process in adults has been shown to be moderately stable over time and unique to an individual. Work in transgenic mice has suggested a role of genes in sleep homeostasis. The aim of the current study was to quantify the genetic contribution to sleep homeostasis in adolescence. We use slow wave energy (SWE) as a metric for the amount of dissipated sleep pressure. This measure reflects both the magnitude of slow wave activity and sleep duration.

Methods: High-density (58 derivations) sleep EEG was recorded in 14 monozygotic (MZ) and 12 dizygotic (DZ) adolescent twin pairs (mean age = 13.2; SD = 1.1; 20 females). Slow wave energy (SWE) was quantified as the cumulative sum of slow wave activity (1–4.6 Hz) over the night. Structural equation modelling was used to quantify the amount of variance in SWE due to genes.

Results: On average we found that 74% of the variance in SWE across scalp derivations was due to genes. The genetic contribution to SWE was consistently high across all derivations.

Conclusions: Our results show that the amount of sleep pressure dissipated is largely under genetic control. Given the importance of adequate sleep for optimal functioning our findings have broad implications.

Disclosure: Nothing to disclose.

P296 | Slow-wave enhancement reduces trauma-induced APP overexpression in novel mouse model of traumatic brain injury compatible with EEG/EMG headset

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Objectives/Introduction: Traumatic brain injury (TBI) is one of the leading causes of death and disability worldwide, with cognitive impairment being the most prevalent symptom. We recently showed that slow-wave modulation could be used as a potential therapeutic option for protein overexpression/accumulation in TBI. Here, we

present further evidence supporting the role of slow-wave oscillations in the delta frequency band in decreasing protein burden following TBI in mice.

Methods: We adapted a classical weight-drop diffuse mouse TBI model for use in animals preinstrumented with EEG/EMG headset by applying a 70° angle for a 115 g impactor falling from 1 m distance. We then characterized posttraumatic cognition and assessed overexpression of amyloid precursor protein (APP) as a histological trauma indicator. We tested the effect of 3 doses of sodium oxybate (*per os*; 100, 200, and 400 mg/kg) on NREM duration and EEG spectral power during NREM sleep. Finally, we tested the effect of 3 day, 2× day 400 mg/kg sodium oxybate treatment regime on trauma-induced APP overexpression.

Results: Our results show that our mild TBI model results in APP overexpression in perikarya, dendrites and axons (two-way ANOVA, $p < 0.01$, $n = 4$/group). The TBI animals showed impaired object recognition 5 days after trauma (*t*-test, compared to chance level (0.5), SHAM: $p < 0.05$, TBI: ns, $n = 8$/group). Sodium oxybate had dose-dependent effect on the NREM duration (dark phase: repeated measures ANOVA, $p < 0.01$, light phase: repeated measures ANOVA, $p < 0.05$, $n = 5$/group) and increased EEG power in the delta band (Dunett's multiple comparisons (compared to vehicle): 100 mg/kg: 1.5 Hz $p < 0.05$, 2–2.5 Hz $p < 0.001$; 200 mg/kg: 0.5–3 Hz $p < 0.001$; 400 mg/kg: 0.5–2.5 Hz $p < 0.001$, 3.5 Hz $p < 0.05$, 4 Hz: $p < 0.01$; $n = 4$) in the first 2 hr post-injection. Twice daily administration of sodium oxybate during 3 days after trauma significantly reduced trauma-induced APP overexpression in the cortex (two-way ANOVA, $p < 0.01$, $n = 4$/group).

Conclusions: In summary, our murine model shows high degree of construct, face and predictive validity, reflected by replicability of histological trauma marker and cognitive impairment, compared to other rodent models. Further experiments aimed at decreasing delta power following TBI are needed to fully establish the role of slow-wave oscillatory activity in posttraumatic recovery.

Disclosure: Nothing to disclose.

P297 | The 0.02 Hz-oscillation in sigma power times spontaneous transitions from non-REM sleep

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Objectives/Introduction: The mechanisms regulating the microarchitecture of non-REM sleep (NREMS), in particular fluctuations in arousability levels, are critical for sleep pathophysiology. Optogenetic manipulations of specific neuronal populations trigger shifts in arousal probability, yet correlates in undisturbed NREMS are unclear. We investigated spontaneous exits from NREMS with respect to the infra-slow 0.02 Hz-oscillation in sigma power (10–15 Hz), which correlates with permissive windows for auditory stimulus-induced NREMS-wake transitions (Lecci et al., Science Adv., 2017). An additional ongoing experiment using optogenetic technique is aimed at understanding the behavior of the infra-slow 0.02 Hz-oscillation in bouts of NREMS uninterrupted by microarousals.

Methods: We performed 48 hr of polysomnographic recording (EEG/EMG) in freely-moving mice sleeping in undisturbed conditions. The behavioral state was scored with a 4-s resolution and the temporal dynamics of specific frequency bands were analyzed with respect to beginnings or ends of NREMS bouts.

Results: Spontaneous exits from NREMS to both wake and REMS occurred during the fragility period defined by the descending phase of the 0.02 Hz-oscillation in sigma power. Moreover, the sigma power surge preceding NREM-REM transitions arose from the 0.02 Hz-oscillation. Microarousals occurred in 25% of fragility periods, after which the 0.02 Hz-oscillation continued undisturbed. Before a transition to REMS, the 0.02 Hz-oscillation seemed strengthened, whereas after prolonged wakefulness or REMS, the oscillation is weakened.

Conclusions: We propose a biological correlate for the microarchitecture of sleep, the 0.02 Hz-oscillation in sigma power. Spontaneous exits from NREMS occur preferentially during permissive windows defined by the phase of the 0.02 Hz oscillation. To better discriminate the role of microarousals in the course of the 0.02 Hz-oscillation, we planned a new experiment using optogenetic to suppress microarousals and characterize the behavior of the uninterrupted 0.02-Hz oscillation.

Disclosure: Nothing to disclose.

P298 | Sleep under cold pressure: rats vs. hamsters

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Objectives/Introduction: It is believed that to cope with cold environment the hibernators and non-hibernators use the same adaptive adjustments but in a different extent. To what degree they involve sleep in the adaptation to cold have been still poorly understood. The research aim was to compare the effect of rhythmic cold exposures (RCE) with different intensity of the cold stimulus, increasing cold tolerance, on sleep-wakefulness pattern in rats and hamsters.

Methods: Both males of white breedless rats (*Rattus norvegicus*) (250–300 g) and golden hamsters (*Mesocricetus auratus*) (85–95 g) were cold exposed over two days to −12°C or 10°C in the light period for 15 min hourly, for a total of nine exposures per day. Continuous EEG, EMG registration and animals' locomotor activity video recording were performed.

Results: Rhythmic cold exposures (−12°C) nearly inverted the daily rhythms of vigilance states distribution both in rats and hamsters.

The significant decrease in REMS (7.9 ± 1.03 vs. 4.55 ± 1.41, n = 5, p = 0.02, rats, control vs. RCE, respectively, 12.46 ± 1.03 vs. 8.32 ± 1.82, n = 6, p = 0.014, hamsters, control vs. RCE respectively) and SWS (62.51 ± 2.65 vs. 43.97 ± 1.84, n = 5, p = 0.01, rats, control vs. RCE, respectively, 51.94 ± 6.94 vs. 40.31 ± 7.4, n = 6, p = 0.01, hamsters, control vs. RCE respectively) amount in the light phase of the day with subsequent their rebound at night were found during the first day of the exposure. Hamsters were less susceptible to RCE (10°C). The only decrease in REMS (12.46 ± 1.07 vs. 10.15 ± 0.06, n = 6, p = 0.01, control vs. RCE respectively) in light phase during the first day of exposures was found. On the contrary in rats there was an increase in SWS amount during the light phase of the day in both days of cold applications (62.51 ± 7.16 vs. 81.11 ± 5.02, n = 5, p = 0.03, 62.51 ± 7.16 vs. 84.55 ± 5.18, n = 5, p = 0.04, control vs. RCE, the first and the second day respectively).

Conclusions: Despite the ability to hibernate hamsters responded to the studied cold exposures nearly in the same manner as the rats were. The only differences were found under the milder temperature load (10°C). Whether no differences found are accounted to the lost of hibernation phenotype due to the long selection of laboratory Syrian hamsters is to be the topic of future research.

Disclosure: Travel grant received from ESRS.

P299 | Sigma power topography maturation across the first two decades of life

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Objectives/Introduction: Sigma power has been associated with cognitive skills and memory function. However, a data basis is lacking for defining sigma sub-frequency cut-offs and differences in regional occurrence of sigma power. This is particularly important considering the developmental and age-related changes in this frequency.

Methods: 83 high-density sleep EEG (128 channels) recordings from healthy subjects age 2.4–25.9 years were analyzed (12 subjects twice, at 2.4–7.9 and 6.6–12.2 years). Standard EEG preprocessing was applied (artifact rejection, average reference). Topographical distribution of EEG power was investigated in the slow (10–12 Hz) and fast (12.25–16 Hz) sigma frequency range (N2, N3). Normalized data (within-subject, across topography) were used for linear correlation with age and nonparametric statistical mapping with supra-threshold cluster analysis ($p < 0.05$). Clusters of electrodes exceeding the 95th percentile were considered significant.

Results: Age-related changes became apparent in the topographical distribution of sigma power: slow sigma revealed a nearly global decrease with age (104 electrodes, r = −0.59 to −0.28). In the fast sigma frequency an age-related decrease was observed in 38 electrodes arranged in a circular manner over centro-temporal regions (r = −0.38 to −0.22).

Conclusions: Subdivision into prefrontal-central and centro-temporal sigma power maxima was also visually verified (with 7 age groups) and became most apparent approaching the end of the second decade. Topographical distribution of sigma power thus emerges into two different primary locations across maturation. Findings suggest that in later adolescence two regionally differing network refinements occur in the thalamocortical system. This marker may facilitate the localization of maturational processes in neuronal networks underlying thalamocortical connectivity and associated cognitive abilities.

Disclosure: Nothing to disclose.

P300 | Cortical perturbations reveal local sleep-like down states in cortical perilesional area

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Objectives/Introduction: The electrical properties of the portions close to cortical lesions are still poorly defined and we are left to the notion that slow waves can be detected in the wake EEG of those areas. In this work we investigated the occurrence of a general sleep related neurophysiological mechanism over the perilesional areas of unilateral cortical ischemic stroke patients.

Methods: Here we assessed local cortical excitability in unilateral stroke patients using a combination of navigated transcranial magnetic stimulation and high-density electroencephalography (TMS-EEG).

We performed TMS-EEG measurements in a group of ten chronic stroke patients, with unilateral, focal cortical lesions (4 F; age [y ± SEM]: 68 ± 4). Each patient underwent at least to 2 TMS-EEG measurements (one over the perilesional area of the affected hemisphere and one over the homologue contralateral cortical site over the healthy hemisphere, allowing a direct intra-subject comparison). For each cortical site we collected about 200 single-trials for subsequent analysis and averaging.

Results: In unilateral cortical lesions, TMS-evoked EEG potentials (TEPs) recorded over perilesional areas were characterized by the occurrence of a pronounced slow wave (<4 Hz) associated with a suppression in the high-frequencies range (>20 Hz). Statistical analysis between the two conditions were performed across subjects, resulting as follows: amplitude of slow waves comparison, t = 3.3 and p = 0.0076; high frequencies suppression comparison, t = 4.2 and p = 0.0017.

Conclusions: In all patients, the stimulation of the healthy hemisphere was characterized by a complex, long-lasting EEG response similar to those obtained in healthy control subjects. On the other

hand, when applied over the affected hemisphere within the same patient, TMS invariably evoked a high-amplitude, positive-negative EEG response closely resembling those obtained during NREM sleep and general anaesthesia in healthy subjects.

The comparisons were significant for all the subjects, suggesting the occurrence of local cortical down state confined to intact portions of the cortical mantle surrounding the ischemic damage.

These results show the occurrence of a general sleep related neurophysiological mechanism over the perilesional cortical areas. This is relevant since while anatomical lesions and disconnections cannot be reversed, it may still be possible to modulate intrinsic neuronal/network properties thus promoting functional recovery.

Disclosure: Nothing to disclose.

P301 | Peripheral sympathetic activations underlying PWA drops induce significant changes in EEG activity in a sleep-stage-specific manner

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Objectives/Introduction: EEG-microarousals during sleep are associated with surges in sympathetic activity and represent the hallmark of pathological sleep fragmentation common to many sleep-related disorders. However, little is known about their time-frequency composition and its modulation by the magnitude of concomitant sympathetic activity. Here we used drops in pulse wave amplitude (PWA) measured by photoplethysmography (PPG) as a marker of peripheral sympathetic activation [1]–[4] to investigate associated EEG changes.

Methods: PWA-drop detection [5] was performed on the overnight PPG of 16 subjects of the HypnoLaus Cohort [6]. EEG-activity was analyzed in six channels: F3/4-C3/4-O1/2. For each sleep stage, a regression analysis was performed on the time-varying root-mean-square of band-pass-filtered EEG-signals (delta: 0.5–4 Hz, theta: 4–8 Hz, alpha: 8–12 Hz, sigma: 12–16 Hz, beta: 16–25 Hz, gamma: 25–45 Hz), using as regressor the PWA-drop timing (40% amplitude-threshold). A permutation test was performed by randomly shuffling events within the regressor. Then, we explored drop-induced EEG changes and their correlation with the PWA area under the curve (AUC). For each PWA-drop (10% amplitude-threshold), a time-frequency representation of EEG changes (1s time-windows; 75% overlap; 1 Hz frequency-bin; 0–35 Hz) was computed in a 14s-window centered on the PWA-drop beginning. Power values were *z*-scored using EEG-activity 'background' values estimated from a 60 s time-window centered on each drop (drop-associated periods were discarded).

Results: EEG-activity was significantly modulated by PWA-drops in all sleep stages, with the most consistent effect within delta and beta/gamma bands ($p < 0.05$ in >80% of subjects). In all sleep stages, PWA-drops were preceded by sharp significant increases in delta power and followed by significant high-frequency increases (alpha/beta/gamma). In light NREM sleep, relative high-frequency increases were evident even for small PWA-drops, while this was not the case for slow-wave sleep.

Conclusions: Our results demonstrate that sympathetic activations are associated with quantitative and qualitative EEG changes that depend both on the magnitude of the autonomic activation and the sleep stage. This time-frequency characterization of EEG changes may be employed to define new automatic algorithms to detect sleep-stage-specific micro-arousals. This will be helpful in order to understand arousal-related pathological mechanisms involved in many sleep disorders.

Disclosure: Nothing to disclose.

P302 | Sleep orchestrates input-specific plasticity and global stability of neural assemblies in the human cortex

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Objectives/Introduction: Distinct lines of research propose that sleep promotes input-specific plasticity after learning (active consolidation hypothesis) and homeostatic scaling to ensure global stability in neural networks (synaptic homeostasis hypothesis) - a basic challenge for adaptive functioning in a changing environment (plasticity-stability dilemma). However, integrative evidence, particularly in humans, is absent.

Methods: We tested a total of 30 healthy university students (14 females, 16 males, age 24.0 ± 2.1 years, age range 19–28 years) to investigate the effect of a short period of NREM daytime sleep (45 min) on non-invasive indices of input-specific specific long-term potentiation (LTP)-like plasticity (paired associative stimulation, PAS) induced change in motor-evoked potential) and global stability (wake EEG theta activity) of human cortex functioning.

Results: We demonstrate a significant increase in MEP amplitudes ($p = 0.022$) and stabilization of EEG theta activity ($p = 0.049$) in the human cortex after sleep compared with an equal period of wakefulness (repeated-measures design; PAS experimental group: $n = 14$). LTP-like plasticity correlated with local sleep slow wave and spindle activity. The observed increase in MEPs after sleep in the PAS

experimental group, was not caused by sleep itself, but required prior induction of input-specific plasticity, as demonstrated by comparison with a sham stimulation control condition (Sham control group; n = 16; p = 0.003).

Conclusions: We provide first evidence for concurrent promotion of prior induced input-specific LTP-like plasticity and homeostatic global stabilization of neural assemblies in the human cortex after short periods of NREM sleep compared to wakefulness. Our findings indicate that sleep reduces the plasticity-stability dilemma by orchestrating local plasticity and global stability of neural assemblies in the human cortex.

Disclosure: Nothing to disclose.

P303 | Bidirectional and context-dependent changes in theta and gamma oscillatory brain activity in noradrenergic cell-specific Hcrtr1 KO mice

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Objectives/Introduction: Noradrenaline (NA) and hypocretins/orexins (HCRT), and their receptors, dynamically modulate the circuits that configure behavioral states, and their associated oscillatory activities. Salient stimuli activate spiking of locus coeruleus noradrenergic (NA^{LC}) cells, inducing NA release and brain-wide noradrenergic signaling, thus resetting network activity, and mediating an orienting response. Hypothalamic HCRT neurons provide one of the densest input to NA^{LC} cells.

Methods: To functionally address the HCRT-to-NA connection, we selectively inactivated the *Hcrtr1* gene in NA neurons ($Hcrtr1^{Dbh\text{-}CKO}$) mice, and their control littermates (CTR), electrocortical response (ECoG) in several contexts of enhanced arousal.

Results: Under enforced wakefulness (EW: CKO n = 9; CTR n = 7), or after cage change (CC: CKO n = 8; CTR n = 6), Hcrtr1Dbh-CKO mice exhibited a weakened ability to lower infra-theta frequencies (1–7 Hz), and mount a robust, narrow-bandwidth, high-frequency theta rhythm (~8.5 Hz). A fast-gamma (55–80 Hz) response, whose dynamics closely paralleled gamma, also diminished, while beta/slow-gamma activity (15–45 Hz) increased. EW-associated locomotion was lower. Surprisingly, nocturnal nestbuilding-associated wakefulness (CKO n = 5; CTR n = 5), inversely, featured enhanced theta and fast-gamma activity. Lastly, slow-wave-sleep following EW and CC featured a profound deficit in slow-delta waves (0.75–2.25 Hz).

Conclusions: HCRT-to-NA signaling may fine-tune arousal, up in alarming conditions, and down during self-motivated, goal-driven behaviors and is critical to induce the homeostatic slow-delta rebound characteristic of post-stress sleep.

Disclosure: Nothing to disclose.

P304 | Is the sleep structure vulnerable to microbiological indoor air contaminants?

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Objectives/Introduction: The present study aims to assess the indoor air microbiological concentrations and evaluate the existence of associations with sleep parameters.

Methods: A total of nine men following specific inclusion criteria: age between 25 and 40 years old, healthy individuals, non-smoking, without children below five years and without sleeping problems and whose households are within Grande Lisbon area, were recruited. An unattended polysomnography (PSG) was performed during 2 weeknights in a row. The second night PSG's results were used in order to minimize the first night effect. IAQ monitoring was based on a comprehensive multi-pollutant assessment where microbiological (fungi and bacteria) parameters were quantified.

Results: The mean age was 31.9 ± 5.80 years. The increase of fungi concentration was associated to lower percentages of stage 2 of NREM (N2) sleep; this correlation was observed in the fungal concentration at the beginning of the night (r_s = –0.650; p = 0.058) and in the morning (r_s = –0.763; p = 0.017). Both bacteria (r_s = 0.732; $p < 0.050$) and fungi (r_s = 0.733; $p < 0.05$) were related to higher rates of K-complex during the NREM sleep.

Conclusions: The exposure to microorganisms has been demonstrated to have an adverse effect in health with documented allergy reactions, infections, toxic and inflammatory reactions. The results of the present study also indicate a potencial possible existence of a pathway that interfere also with the sleep structure. During the continuous sleep cycles throughout the night, people should spend about half of their sleep time in stage N2 and a decrease in this stage may interfere on the body repair and restauration. The functional role of K-complex is still a matter of debate, although many authors consider it to be an arousal reaction because it can be triggered by external and possibly internal stimuli. In any case, it is well documented that K-complexes are associated with autonomous activation. The environmental characterization enables to understand the factors that may contribute to the degradation of sleep's quality. Deeper studies in a large sample will allow to better understanding the occupants' exposure during this representative period.

Disclosure: Nothing to disclose.

P305 | Sleep quality and daytime sleepiness among primary care physicians

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Objectives/Introduction: Irregular sleep pattern and inadequate sleep duration affect emotions regulation, judgment and increase the risk of accidents. It is also a threat to people whose safety depends on the cognitive functioning of a poorly sleeping person. The aim of the study was to assess the sleep quality of Primary Care Physicians in Poland.

Methods: This questionnaire-based research and was divided into three phases. Here we focus on first two phases in which 3,362 (63% response rate) and 2,564 (43% response rate) physicians participated, out of which 64.5–65.5% were females, mean age was 51.7–51.9 years.

Results: 7.1% of physicians reported totally or clearly unsatisfactory sleep quality. The total number of physician dissatisfied with various aspects of their sleep was 42.5%. In the case of poor sleep quality 47% of physicians did not take any action. 23% of them used hypnotics or sleep-promoting drugs. Only 20% of poorly-sleeping physicians used the sleep hygiene, and 11% regularly exercised physically to improve their sleep. Only 0.6% of the physicians with poor sleep quality have used a specialist's consultation. The average sleep time on working days was 6:45 hr. One third of physicians regularly slept below 7 hr, and as many as 60% of them considered their length of sleep to be adequate. 78.4% physicians answered never or rarely when asked about experiencing daytime sleepiness, which interferes with work and other daily activities. At the same time within this group 41.5% reported they needed 5 min of less to fall asleep and 42.6% reported having fallen asleep during monotonous activities.

Conclusions: The quality of sleep of primary care physicians is similar to that found in epidemiological studies for the general population. An obvious problem is the frequent sleep deprivation. Significant proportion of physicians does not pay enough attention to the quality of their sleep and is not aware about increased sleepiness.

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P306 | Night-shift work and work hours among primary care physicians - consequences for sleep quality, body weight and risk of primary sleep disorders

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Objectives/Introduction: Adequate sleep is important in jobs in which proper performance of duties influences the safety of other people. Night work and long work hours are common among medical professionals and influence occurrence of sleep disorders. The aim of the study was to assess sleep quality, daytime sleepiness and risk of primary sleep disorders among primary care physicians in Poland - including restless leg syndrome (RLS), sleep-disordered breathing based on NoSAS rating and shift work sleep disorder (SWSD).

Methods: This questionnaire-based research was divided into three phases. We focused on third phase of the study in which 2,384 physicians participated, out of which 1,555 (65.2%) participated in all three study phases.

Results: Physicians working different numbers of hours varied on subjective sleep quality ($p = 0.02$), average sleep length ($p = 0.041$), daytime sleepiness ($p = 0.003$), frequency of overweight ($p = 0.001$) and RLS ($p = 0.001$). Number of work hours explained 12.6% of variance in NoSAS ($p < 0.001$). There were significant differences between physicians working shifts and those who do not work nights in subjective sleep quality ($p = 0.042$), average sleep length ($p = 0.028$), frequency of overweight ($p = 0.023$), RLS ($p = 0.003$) and NoSAS ($p = 0.008$). We did not find significant differences in daytime sleepiness ($p = 0.522$), however, there were significant differences in frequency of physicians falling asleep during monotonous activities ($p = 0.011$) and in sleep latency ($p = 0.012$) - physicians who work at night more frequently reported falling asleep during monotonous activities, but also had longer sleep latency. We further verified frequency of risk factors for SWSD and found 14% of our sample of night working physicians ($N = 496$) meeting two or more criteria for SWSD.

Conclusions: Physicians often work extended work hours and night shifts, which disrupt sleep and are linked to heightened risk of sleep disorders. Risk of sleep-disordered breathing is more closely linked to average work hours than night work itself. Risk of RLS is more frequent among night working physicians. Prevalence of SWSD in our sample showed to be higher than previously reported in other studies.

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P307 | A case study: increased spectral power and correlations of multimodal neuroimaging data during N1 sleep as a link to glymphatic mechanism

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Objectives/Introduction: Recently found glymphatic system works as clearing system of the brain, and it doubles the removal of waste metabolites during sleep. Multimodal neuroimaging research shows that cardio- respiratory and low frequency pulsations drive the glymphatic clearance. The role of these physiological glymphatic pulsations is still unknown during sleep.

Methods: Healthy control was scanned after normal night (9 hr sleep) awake and after 21 hr sleep deprivation with 10 Hz whole brain magnetic-resonance-encephalography (MREG, fast fMRI) sequence with Siemens 3T Skyra in combination with 256-channel direct current electroencephalography (DC-EEG), near-infrared spectroscopy (NIRS), and cardiorespiratory signals. Standard sleep staging was performed for EEG, observing non-REM stage1 (N1) through all 8 min signal. After standard preprocessing, MREG average signal of gray matter was calculated, and EEG and water NIRS ($NIRS_{FH,}$ forehead and $NIRS_{OP}$, occipital) were downsampled to 10 Hz. Power spectrum was calculated for MREG, EEG (Fp1 and Pz) and NIRS. EEG channels were correlated with MREG and NIRS in all chosen frequency bands (fullband, FB (0–5) Hz; very-low frequency, VLF (0.01–0.1) Hz; respiration, resp (0.2–0.35)Hz, cardiac, card (0.85–1.05) Hz. EEG channels were separated into frontal, temporal, parietal and occipital lobe, and average negative and positive correlations to MREG and NIRS were calculated.

Results: EEG (Fp1 and Pz), MREG and NIRS showed higher spectral power in VLF and resp in N1. Especially in MREG, power increased 3× higher in N1. Cardiac power was higher in $NIRS_{OP}$ and MREG awake compared to N1. EEG-$NIRS_{FH}$ in FB, VLF (parietal and occipital) and resp (frontal, parietal and occipital) and EEG-$NIRS_{OP}$ in VLF and resp (frontal, parietal and occipital) had higher correlations in N1 compared awake. EEG-MREG and EEG-$NIRS_{OP}$ correlated better awake in cardiac frequency (temporal).

Conclusions: We found increased spectral power in all modalities and higher correlation between EEG and NIRS in VLF and resp in N1. Despite respiratory motion, physiological difference in respiration between sleep and awake is known, and this needs to be discovered in terms of brain pulsations. Findings in VLF support recent literature that global fMRI (MREG) reflects vigilance level. Together our results may be a link to glymphatic pulsation mechanisms by showing the difference of signals between awake and N1.

Disclosure: Nothing to disclose.

P308 | Nonparametric approach for sleep stage classification using cardiorespiratory and movement features

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Objectives/Introduction: Sleep is a naturally recurring process which virtually all higher animals experience and its function is not clearly known. The accepted way to analyze sleep is through its segmentation in four different stages; wake (W), light (N1, N2), deep (N3) and rapid eye-movement (R); as defined by the American Academy of Sleep Medicine by the appearance of brain activity patterns and other physiological signs. The most accurate way to measure the sleep stages is polysomnography (PSG) which is expensive and uncomfortable for a test subject. On the other side of the spectrum lies actigraphy that is used to monitor body movement, but it is not enough to assess sleep stages with high accuracy. In this study, we evaluated the importance of cardiorespiratory features such as heart rate and breathing rate to assess the models for sleep stage classification.

Methods: We have explored cardiorespiratory and movement features from 13 nights' healthy adults' data from CAP and ISRUC database and analyzed their sleep stages with a suite of classification algorithms, such as linear discriminant analysis (LDA), support vector classification (SVM) and random forest.

Results: The non-linear variant of random forests was the algorithm with the best performance, obtaining 85.79 ± 1.6% accuracy for sleep-wake classification using the cardiorespiratory and movement features compared to 67.29 ± 1.29% accuracy using only features derived from body movement. We improved the accuracy to 87.08 ± 1.38% for sleep-wake classification by considering additional features from previous and next two epochs. We have also applied the classification algorithm to classify different sleep stages (W, light, deep, R). We obtained the accuracy 74.97 ± 0.78% using the vital signs compared to 50.16 ± 1.01% accuracy using only features derived from body movement.

Conclusions: The features from respiration and heart rate help in further increasing the accuracy for sleep stage classification compared to movement features only.

Disclosure: The authors Sunil Kumar and Soumya Dash are co-founders by Sleepiz AG, Zürich.

CHRONOBIOLOGY 2

P310 | Does Light with variation in spectrum and intensity during night shift prevent delay of circadian rhythm and sleepiness?

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Objectives/Instruction: Delay of circadian rhythm induced by light exposure at night is one of the causes of circadian misalignment in shift workers. According to the phase response curve, it is expected that combination of low melanopic illuminance light in the early night and high melanopic illuminance light in the late night can prevent the delay of circadian rhythm.

Methods: Eleven young male adults participated in this study. On the second night, the subjects engaged in simulated night work for 12 hr from 21:00 to 09:00. The variable light condition consisted of three types of light. A low melanopic illuminance light (430 lx–3,000 K) was used from 21:00 to 03:00, a middle one (540 lx–4,500 K) was used from 03:00 to 06:00, and then finally a high melanopic one (720 lx–5,900 K) was used from 06:00 to 9:00. A constant light condition as a control was middle melanopic illuminance. Dim light melatonin onset (DLMO) of the first night and third night was measured as an index of the circadian phase. The Karolinska sleepiness scale (KSS) and performance of a psychomotor vigilance task (PVT) were also assessed every hour during the simulated night work. This study was approved by the Ethical Committee of Kyushu University.

Results: DLMO by night shift was significantly delayed in both the constant light and variable light conditions. However, the delay of DLMO in the variable light condition (0.9 hr) was significantly smaller than that in the constant light condition (1.7 hr). Although there were significant increases in subjective sleepiness scale and number of laps of PVT during night work, the differences between the two lighting conditions were not significant.

Conclusions: Variable light during night shift is effective for preventing delay of circadian rhythm but is not effective for preventing sleepiness.

Disclosure: Nothing to disclose.

P311 | Larks, owls, swifts and woodcocks among fruit flies: maladaptive responses of the sleep-wake cycle to hot and/or long summer days are modified by heritable chronotype

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Objectives/Introduction: *Drosophila melanogaster* and our own species have many things in common including history of relatively rapid out-of-Africa dispersal. In Eurasia, we are facing the problem of adjustment of the circadian rhythms and night sleep episode to seasonal variation in day length and air temperature, and we are usually responding to reduction of night sleep by prolongation of siesta. To further explore similarity between two species, we examined possibility to distinguish 4 extreme chronotypes among fruit flies.

Methods: Circadian rhythms of locomotor activity and sleep-wake pattern were tested in constant darkness and 4 strains originating from three wild populations of Africa, Europe and the USA were selected to represent 4 distinct chronotypes: "larks" (early morning and evening activity peaks), "owls" (late morning and evening peaks), "swifts" (early morning and late evening peaks) and "woodcocks" (late morning and early evening peaks). The circadian rhythms and sleep efficiency of the selected chronotypes were further tested under either long day condition (LD20:4 at 20°C) or combination of LD20:4 with hot temperature (29°C). In total, the rhythms of 176 flies were recorded.

Results: Despite identity of such experimental conditions for 4 chronotypes, their circadian rhythms and sleep timing showed significantly distinct patterns of maladaptive response to exposure to heat and/or short days. All two-way rANOVAs yielded significant interaction between chronotype and clock time ($p < 0.001$).

Conclusions: An experimental study of heritable chronotypes in the fruit fly can facilitate a search for genetic underpinnings of individual variation in vulnerability to circadian misalignment, maladaptive sleep-wake behavior, and sleep disorders.

Disclosure: Nothing to disclose.

P312 | Sleep homeostasis during daytime food entrainment in mice

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Objectives/Introduction: 24 hr rhythms of physiology and behaviour are driven by both the environment and the internal endogenous clock. Daily restricted feeding (RF) in nocturnal rodents during their inactive phase initiates food entrainment as activity in anticipation of food (FAA), resulting in reorganisation of the typical 24 hr sleep-wake structure. Here, we investigate the effects of RF on sleep-wake architecture and sleep homeostasis in mice.

Methods: Adult male C57Bl/6J mice (n = 7) were implanted with frontal and occipital EEG and EMG electrodes for chronic recording during a standard RF paradigm, where food access was restricted for 4 hr during the light period (Zeitgeber time; ZT4-8) for 12 days. After the animals were returned to an *ad libitum* food schedule, 3-hr sleep deprivation (SD) was performed between ZT3-6 by providing novel objects to mimic the episode of spontaneous wakefulness associated with FAA and eating. Results were statistically assessed as baseline vs. RF (Wilcoxon signed-rank test).

Results: We compared sleep characteristics between baseline and one representative day of RF once stable entrainment to feeding time was achieved. Although the amount of wake was increased during FAA and subsequent feeding, the total 24 hr amount of wake remained stable (661.4 ± 7.1 vs. 685.7 ± 36.1 mins; n.s.), and the loss of sleep during the light period was compensated by its increase during the dark phase. This was achieved by a lower number of consolidated spontaneous wake episodes (>10 min) during the dark period under RF (9.8 ± 0.5 vs. 6.7 ± 0.6; p = 0.016). Interestingly, while the mean duration of wake episodes during the dark period remained unchanged (45.8 ± 3.1 vs. 50.6 ± 8.5 min; n.s), the initial levels of non-REM EEG slow-wave activity (SWA) during subsequent sleep were significantly lower during RF compared to baseline (frontal: 108.6 ± 1.1 vs. 98.6 ± 1.4; p = 0.016). Consistently, a higher rebound of SWA was also observed during sleep following enforced SD as compared to spontaneous sleep after a similar duration of waking associated with FAA. However, the total amount of SWA accumulated during the 24 hr (slow-wave energy) was similar between baseline and RF.

Conclusions: In conclusion, our study suggests that despite the substantial changes in wake and sleep distribution induced by RF, sleep homeostasis is generally maintained.

Disclosure: Nothing to disclose.

P313 | Melatonin circadian rhythms in menopausal women with insomnia: ethnic aspect

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Objectives/Introduction: The hormone melatonin is one of the elements of the circadian mechanism. The studies carried out so far have shown that people with sleep disorders have a lower melatonin level. The aim of study is an assessment of the melatonin circadian rhythms in menopausal women of different ethnic groups with insomnia.

Methods: 250 menopausal women divided into Caucasian (n = 160) and Asian (n = 90) groups were examined. All women underwent clinico-anamnestic examination. Each ethnic group was divided into perimenopause and postmenopause. After polysomnography and specialized questionnaires for the assessment of sleep disorders groups were divided into control (without insomnia) and main group (with insomnia). Mixed non-stimulated saliva was used as a material to determine the melatonin level; it was sampled at strictly fixed hours four times a day (6:00–7:00, 12:00–13:00, 18:00–19:00, 23:00–00:00 hr). The melatonin content by an immunoenzymometric assay was determined. Statistical analysis was performed by non-parametric tests.

Results: In Caucasian postmenopausal women without insomnia melatonin levels in 12:00–13:00 hr, 18:00–19:00 hr and 23:00–00:00 hr are lower by 1.94 times, 3.22 times and 1.54 times respectively ($p < 0.05$), and in 6:00–7:00 hr are higher by 1.43 times ($p < 0.05$) compared to perimenopausal ones. Statistically significant differences in the melatonin levels between perimenopausal and postmenopausal Asian women without insomnia were not found. There were not ethnic differences between control groups. Insomnia in Caucasian women in perimenopause is associated with a decreasing of melatonin levels in 12:00–13:00 hr, 18:00–19:00 hr and 23:00–00:00 hr by 1.58 times, 1.96 times and 1.54 times respectively ($p < 0.05$), and an increasing in 6:00–7:00 hr by 2.09 times ($p < 0.05$). In Asian perimenopausal women with insomnia compared to control the melatonin level is lower in 18:00–19:00 hr and 23:00–00:00 hr by 1.97 times and 1.71 times respectively ($p < 0.05$); in postmenopausal ones - is lower in 12:00–13:00 hr, 18:00–19:00 hr and 23:00–00:00 hr by 2.41 times, 1.48 times and 1.87 times respectively ($p < 0.05$).

Conclusions: Insomnia in Caucasian perimenopausal women is associated with a shift in the peak of melatonin secretion in the early morning hours while in Asian women both in perimenopause and postmenopause insomnia is associated with a decrease in melatonin level in the evening and night hours.

Disclosure: Nothing to disclose.

P314 | Evening and bedtime use of electronical devices and its effects on subjective sleep characteristics. Are blue light filters effective?

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Objectives/Introduction: Light is considered one of the most important factors influencing circadian system in humans. Inadequate light signal can cause desynchronization of circadian rhythms and serious health problems, disrupted sleep or impaired cognitive functioning. Particularly blue end of light spectrum with wavelengths between 460 and 480 nm, also emitted from all kinds of electronical devices, has an important role in influencing our circadian system. Its use in the evening and night hours can significantly suppress melatonin levels and lead to the disruption of sleep and circadian functioning. The objectives of the study are to map "light hygiene" in the population of healthy volunteers and to compare reports of subjective sleep quality in groups divided by the length of evening and night exposure and by the use of filters blocking blue light spectrum.

Methods: 866 participants in total completed a questionnaire battery consisting of Pittsburgh Sleep Quality Index (PSQI), Fatigue Severity Scale (FSS), Epworth Sleepiness Scale (ESS), The Munich Chronotype Questionnaire (MCTQ), Morningness-Eveningness Questionnaire (MEQ) and added questions mapping the length of the evening exposure to electronical devices (TV, PC, tablets and phones), the timing of this exposition, the length of exposition during night awakenings and the use of various filters blocking short-wavelength light.

Results: Statistical analyses (Independent-samples t -tests and Kruskal-Wallis tests) show that people using blue-light filters have less sleep disturbances ($p = 0.047$), people that are exposed to light 1.5 hr before sleep and those that who tend to expose themselves to screens during night have more daytime dysfunction ($p = 0.011$ and $p = 0.003$ resp.) the following day. Also those who are exposed to light 1.5 hr before sleep feel less alert ($p = 0.008$) and less refreshed ($p = 0.007$) the next morning.

Conclusions: Our results are in line with other studies that converge to show the negative impact of evening and night light exposure to short-wavelength spectrum on subjective and objective sleep parameters.

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Disclosure: Nothing to disclose.

P315 | Effects of lighting with continuously changing color temperature and illuminance on subjective sleepiness and melatonin profiles

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Objectives/Introduction: Current understanding of the term "Human Centric Lighting (HCL)" is the change of correlated color temperature and illuminance across the day. Here we tested the repercussions of a HCL solution on subjective sleepiness and melatonin secretion during two 16:8 hr light:dark cycles in healthy men.

Methods: Fourteen male healthy sleepers spent twice 48 hr in the laboratory once under a fixed light condition (fixedLED) and once under dynamically changing light (dynLED) in a balanced crossover design. After a 13-hr baseline phase (5 hr preparation under 2,800K/100lux followed by 8 hr sleep), a 35-hr phase followed (16 hr of scheduled wakefulness - 8 hr of scheduled sleep - 11 hr scheduled wakefulness). During wakefulness light exposure in the fixed condition was set to 4,000K and 95lux (at the eye level). The dynamic condition was defined as a light change starting in the morning with 3,500K/<1lux incrementally increasing until reaching a 5,000K/100lux during the day until 5 p.m. Correlated color temperature and illuminance continuously decreased afterwards finally reaching 2,700K/<1lux at bedtime.

Results: The diurnal profile of subjective sleepiness did not significantly change between fixedLED and dynLED (factor "light condition": $p = 0.43$, "time of day": $p < 0.001$, interaction "light condition" × "time of day": $p = 0.37$), while the diurnal melatonin profile yielded an almost significant ($p = 0.056$) interaction between "light condition" and "time of day". Post-hoc comparisons revealed significantly higher melatonin values under dynLED compared to fixLED 1 hr prior bedtime (p at least <0.004).

Conclusions: Melatonin being important for many physiological processes in the human body should not be suppressed in the evening and night by light. Our results foster the common recommendation of using warmer color temperature light in the evening. Since subjective sleepiness did not change under the HCL condition compared to the standard lighting condition, we can now extend this recommendation for night shift workers.

Disclosure: Nothing to disclose.

P316 | The impact of shift-work on human energy intake: a systematic review

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Objectives/Introduction: Epidemiological studies show that shift-work impacts negatively on cardiovascular and metabolic health. Shift-workers are particularly susceptible to obesity and associated co-morbidities such as diabetes, which may potentiate adverse health consequences.

This systematic review investigated whether the energy intake of night shift-workers differed from that of other shift schedules as determined by food diary or food recall over a 24-hr period.

Methods: A systematic review was conducted. CINAHL, MEDLINE, Web of Science, Embase and PsycINFO databases were searched for observational and interventional studies measuring energy intake in real or simulated shift-work amongst healthy shift-workers. Search terms related to shift-work, food and energy intake. Energy intake in kilojoules was extracted for each work schedule to compare between and within night, day, afternoon and rotating shift work cases.

Results: The primary search identified 1,366 records. There were 1,056 abstracts after duplicate removal, 67 full-text articles were assessed for eligibility and 16 studies met the criteria for inclusion in the qualitative analysis. These studies were mostly case control studies in healthy middle-aged shift-workers. There was no definitive indication that night shift-work impacted upon energy intake compared to a regular shift pattern. There appeared to be a lack of congruency in the macronutrient distribution consumed by each shift schedule category. Risk of bias assessment showed a low to moderate risk of bias in the majority of studies with the major issues arising from variable shift classification. There is an inherent challenge in the assessment of shift-work due to heterogeneity in the patterns of shifts and timing of dietary assessment that precluded formal meta-analysis.

Conclusions: There was no clear impact of night shift on energy intake and nor did any particular macronutrient seem to be favoured amongst shift-workers. The broad variability in shift-work schedules and lack of clarity around the timing of dietary assessment resulted in misclassification bias that potentially favoured a null hypothesis. Future studies should clearly describe shift schedules and consider the timing of dietary assessment to capture a more reliable and realistic summary of dietary choices to allow fair comparison.

Disclosure: Nothing to disclose.

P317 | The effects of a split-sleep schedule on vigilance and sleep in nurses working night shifts

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Objectives/Introduction: Shift workers need to be alert during the night and sleep during the day. Due to this circadian misalignment, shift workers often report shorter and disturbed sleep. As a consequence, cognitive performance is affected resulting in an increased chance of errors and accidents during work at night. A possible solution to counteract sleep deprivation and its associated impaired performance in shift workers is to adhere to a split-sleep schedule, i.e. having two or more sleep bouts in a period of 24 hr. In this current real-life study, the effects of a split-sleep schedule were investigated in a group of nurses.

Methods: Over a period of a month, 50 nurses working in night shifts were randomly assigned to either a control group or an intervention group. In the latter group, participants were instructed to sleep in two bouts over a period of 24 hr: 5–6 hr after their night shift and 2–3 hr right before the next night shift. A 10-min psychomotor vigilance test (PVT) was completed at the beginning, in the middle and towards the end of each night shift. Subsequently, the Karolinska Sleepiness Scale (KSS) was completed to assess subjective sleepiness. During the whole month, sleep was assessed via a sleep wake diary and an Actiwatch.

Results: During the nightshifts and especially towards the end of the night, participants in the intervention group showed less decline in PVT reaction time and number of lapses (both $p < 0.05$) as compared to the control group. Furthermore, participants in the intervention group reported that they slept significantly more in a period of 24 hr ($p < 0.05$). Sleeping in two bouts did not influence subjective sleepiness as measured with the KSS.

Conclusions: Sleeping according to a split-sleep schedule improved nocturnal performance and increases self-reported total sleep time in nurses that worked in nightshifts. To our knowledge, this was the first study in a real-life setting showing the effects and practicability of a split sleep schedule. More research is needed to investigate whether sleeping in a split-sleep schedule is capable of preventing the longer-term risks that are associated to working in night shifts.

Disclosure: Nothing to disclose.

P318 | Interaction of chronotype subscales and their association with single nucleotide polymorphisms in shift-working drivers

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Objectives/Introduction: Chronotype is a complex of traits and preferences in sleep and activity timing. People demonstrate a wide range of characteristics that cannot be described by a simple "early-late type" scale. The interaction of chronotype components may be the most prominent when the organism has to adapt such conditions as shift work. Genetic factors also play an important role in chronotype formation. The aim of this study was to examine the interaction of various chronotype parameters and associations with single nucleotide polymorphisms (SNPs) in drivers working on rolling shifts.

Methods: 303 professional bus drivers (all male, age 21 to 68 years, average 45.7) took part in the study. All of them worked on rolling 8–10 hr shifts starting at 3:30–17:30. To assess chronotype we have used a Russian version of Munich Chronotype Questionnaire (MCTQ) and a part of a Sleep-Wake Pattern Assessment Questionnaire (SWPAQ) for morning and evening activation assessment. Candidate SNPs were: *RORA* (rs1159814), *CLOCK* (rs12649507), *PER3* (rs2640909), *NPSR1* (rs324981), *NPAS2* (rs4851377), *DRD3* (rs6280), *SLC6A3* (rs6347), *DBH* (rs1611125).

Results: Chronotype parameters in our sample were correlated: people with later midsleep time suffered from stronger social jetlag; both of these parameters were also associated with lower morning activation (correlation analysis, $p < 0.01$). Overall drivers had a prominent social jetlag (1.6 ± 1.6 hr). Subscales of morning and evening activation were highly correlated ($p < 0.001$). The drivers mostly demonstrated a mixed "owlark" type, likely due to professional selection. Minor allele frequencies of SLC6A3 and NPSR1 SNPs were correlated with midsleep time ($r = 0.36$; $p < 0.001$ and $r = 0.21$; $p < 0.01$). Major allele homozygotes in CLOCK SNP had higher social jetlag (one-way ANOVA, $F(2;173)=3.9489$; $p < 0.05$). PER3 and RORA polymorphisms were associated only with morning activation subscale. Minor allele homozygotes in PER3 had later morning activation, in case of RORA they had an earlier type (ANOVA and pairwise comparison with other genotypes, $p < 0.05$ and $p < 0.001$ respectively).

Conclusions: In the studied sample morning activation plays a significant role in chronotype formation, and PER3 and RORA SNPs influence it. SNPs in CLOCK, NPSR1 and SLC6A3 genes are also associated with chronotype parameters.

Disclosure: Nothing to disclose.

P319 | No circadian activity rhythm in single-handed racing sailors

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Objectives/Introduction: The report aims to know whether the high stress suffered by single handed sailors during a transatlantic race could distort their circadian activity rest-cycles.

Methods: From the official page of the "Mini Transat Illes de Guadeloupe, 2015" race, we downloaded, every 6 hr, the successive geographic coordinates of a sample of single-handed sailors participating in the race. Although a total of 81 sailors participated, we only studied a sample of 15 sailors, comprising the first 5 ones arriving to destiny, the 5 last ones, and a third group of 5 sailors arriving in intermediate places. The ships′ coordinates were used to calculate the distance run every 6 hr, from the departure (Lanzarote, Canary Islands) to the arrival to Guadeloupe 14–20 days later.

We assumed that the oscillations in the displacements of ships every 6 hr would be a proxy of the general activity of the sailors governing the helm and the sails. To validate this assumption, we provided three sailors with wrist activity meters. However, only one of the meters provided data on the real activity rhythms of the wearer.

The distances run every 6 hr by the sailors and the activity data recorded with the wrist activity meter were submitted to cosinor analysis.

Results: The Cosinor analysis revealed that, by far, no sailor showed significant circadian activity at all, despite of being exposed to one of the strongest Zeitgebers known for humans, the L/D cycles of tropical seas. Further, the data recovered from the single activity meter also showed total absence of significant circadian activity rhythm.

To our knowledge, this is the first report of total absence of overt circadian activity rhythm in humans, with absolute independence of being exposed to a powerful Zeitgeber. These results extend to previously unsuspected limits the flexibility of the human circadian system responsible of regulating the activity-rest and wake-sleep cycles.

Conclusions: The human circadian rhythms of rest-activity disappear under highly stressful situations.

Disclosure: Nothing to disclose.

P320 | Effects of short exposure to different light illuminance in regular rest breaks on melatonin suppression and sleepiness during simulated night work

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Objectives/Introduction: Exposure to bright light during night work can suppress melatonin and disrupt circadian clock but it could be effective in maintaining wakefulness and/or visibility. Towards reaching a compromise between the opposite effects of lights, in the present study, we investigated the effects of regular short exposure to different illuminance of lights on melatonin and sleepiness during simulated night work under constant light exposure.

Methods: In the first experiment, the effects of brighter light exposure in regular short breaks during night work on melatonin and sleepiness were investigated. Twelve healthy male subjects (21.3 ± 2.5 years old) participated in two break conditions, including constant lights (same illuminance with that in the night work: 550 lx) and brighter lights (4,700 lx) during break period (10 min). Each condition conducted at random with an interval of two weeks. From a week before the experiment, subjects were scheduled to sleep between 24:00 and 01:00 and wake between 07:00 and 08:00. Subjects spent time under dim lights (<30 lx) between 21:00 and 1:00 and then executed simulated night work under constant lights (550 lx) between 1:00 and 6:00. Subjects took breaks every hour from 02:00 to 06:00. Salivary melatonin and subjective sleepiness (Karolinska sleepiness scale: KSS) were measured every hour. In the second experiment consisted of twelve healthy male subjects (20.0 ± 0.9 years old), the effects of taking a short break under dim lights (<1 lx) were examined using the identical protocol in the first experiment.

Results: Melatonin suppressions at 04:00, 05:00, and 06:00 were significantly lower when subjects took breaks under brighter lights than when they did under constant lights ($p < 0.05$, respectively). Conversely, melatonin suppressions at 04:00, 05:00, and 06:00 were significantly greater when subjects took breaks under dim lights than when they did under constant light condition ($p < 0.05$, respectively). However, there were no such significant difference in subjective sleepiness in both experiments.

Conclusions: Our findings suggest that regular short exposure to brighter lights can diminish melatonin suppression by constant lights during night work whereas regular short exposure to dim lights can promote melatonin suppression. Unexpectedly, however, subjective sleepiness was barely affected.

Disclosure: Nothing to disclose.

P321 | Social jetlag in Chinese assessed with wearable devices

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Objectives/Introduction: Social jetlag (SJ) is highly prevalent in modern societies and associated with many health problems. SJ has never been assessed in China, a rapidly developing country. Thus, we recorded sleep-wake behavior in a large cohort of the Chinese population and objectively derived SJ for each volunteer.

Methods: 71,176 anonymous Chinese volunteers wore HUAWEI wearable devices continuously for at least 7 days and their sleep data were recorded in 2017. Changes of the adjusted midpoint of sleep on free-days (MSFsc) and SJ (the difference between midpoints of sleep on free-days and weekdays) with age, the gender differences of MSFsc and SJ, the relationship between SJ and daytime-nap (DN)/nocturnal sleep duration (NSD) and BMI, were analyzed. Subgroup comparisons between people with DN (average DN >30 min, $n = 29{,}917$) and without DN (average DN = 0, $n = 4{,}223$) were done to test whether DN influenced SJ.

Results: The peak of MSFsc in our Chinese cohort was at 4-am at an age of 22-years. No statistical differences were found between 22-years and the age range 16–26 years ($p > 0.001$), and between males and females. The mean SJ was 0.3(1.23)-hr [mean(std)] and only 17.1% Chinese had more than 1-hr SJ. SJ significantly correlated with age ($r = -0.03$, $p < 0.0001$), MSFsc ($r = 0.54$, $p < 0.0001$) and NSD ($r = 0.014$, $p = 0.0002$), but did not correlate with BMI ($p = 0.297$). No gender difference were found in SJ ($p = 0.06$).The comparisons between DN and non-DN groups showed no differences in MSFsc (3.69(1.62) vs. 3.66(1.41), $p = 0.31$) and SJ (0.3(1.41) vs. 0.26(1.16), $p = 0.11$). There was no correlation between SJ and the DN duration ($p = 0.25$). In each group SJ did not correlate with BMI ($p = 0.30$ and 0.34, respectively); SJ yielded no gender difference in the two subgroups ($p = 0.77$ and 0.86, respectively) either. Age correlated to SJ only in the DN group ($r = -0.03$, $p < 0.0001$).

Conclusions: SJ was smaller in China compared to Europe (17.1% vs. 69% population with SJ > 1-hr). It negatively correlated with age, without gender differences and correlation with BMI, which is in conflict with European results. Subgroup comparisons suggest that very common napping was less influential to SJ in Chinese, but whether this is due to a ceiling effect needs further studies.

Disclosure: Nothing to disclose.

P322 | Is sleepiness in shift work different according to work schedule?

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Objectives/Instruction: Excessive sleepiness is a main symptom of shift work disorder (SWD). However, little is known on the sleepiness course on 24-hr that is specific to shift workers with SWD. This study aims at identifying sleepiness under two different shift work schedules for workers with SWD in comparison to good sleepers.

Methods: 80 night shift workers of which 43 met SWD criteria were recruited. They work 6 to 10 nights out of 14. Night shifts are either consecutive (CNS) or fragmented (FNS), for which nights are intervened with free days. Participants without SWD and satisfied with their sleep were good sleepers (GS). Four groups were created: (1) CNS-SWD; (2) CNS-GS; (3) FNS-SWD; and (4) FNS-GS. Sleepiness was assessed in three ways: (1) participants were asked if they experience excessive sleepiness (yes/no); (2) based on the Stanford sleepiness scale (SSS) they rated their sleepiness level before day sleep, after day sleep, before night work, during night work, after night work, before night sleep and after night sleep; (3) they completed the Epworth sleepiness scale.

Results: There is no significant difference between shift workers with SWD and GS on the Epworth and the proportion of "yes". CNS-SWD present a significant higher total score on the SSS (p = 0.046) and a significant higher sleepiness level when they wake up after day sleep (p = 0.033) than CNS-GS. FNS-SWD present significant higher sleepiness level during night work than FNS-GS (p = 0.026). CNS-GS present significant higher sleepiness level than FNS-GS before going to bed in the morning (p = 0.040).

Conclusions: The moment sleepiness is excessive varies according to the work schedule. A high sleepiness after day sleep seems to be specific to CNS with SWD. When the work schedule is fragmented, the sleepiness seems to be more problematic during night work. The study also show that only asking to shift workers if they experience excessive sleepiness do not allow to identify those with this difficulty. Similar findings are obtained with the Epworth sleepiness scale. More thorough evaluation of sleepiness in shift workers is warranted with paying attention to work schedule and the presence or not of SWD.

Disclosure: Acknowledgement: The study was supported by a CIHR funding 191771 awarded to the last author.

P323 | The relationship between vitamin D deficiency and daytime sleepiness in workers of a general hospital

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Objectives/Instruction: Several previous studies have demonstrated that decrease in serum vitamin D level can lead to sleep disturbances, and shift workers might be more vulnerable to vitamin D insufficiency. The present study investigated the relationship between serum vitamin D levels and sleep problems in shift workers and non-shift workers.

Methods: Data were obtained from 134 shift workers with night time hours and 260 non-shift workers at Seoul National University Bundang Hospital in Seongnam, Korea. All the participants underwent blood tests for vitamin D and completed self-reported questionnaires regarding demographic information, sleep quality, daytime sleepiness and fatigue. Vitamin D deficiency was defined as a serum 25-hydroxyvitamin D concentrations <20 ng/mL.

Results: Among the 394 workers, 322 were diagnosed as vitamin D deficiency representing a prevalence of 81.7%.

There was no substantial difference in serum vitamin D levels between shift workers and non-shift workers after controlling for possible confounding factors. However, the prevalence of vitamin D deficiency was higher in shift workers (p = 0.004). In the whole participants, vitamin D-deficient group suffered from more severe daytime sleepiness (p = 0.045). We also found that serum vitamin D levels were negatively correlated with daytime sleepiness (p = 0.018) in shift workers while there was no significant correlation was found in non-shift workers after adjusted analysis.

Conclusions: The prevalence of vitamin D deficiency was high in both shift workers and non-shift workers. In particular, vitamin D deficiency was associated with severe daytime sleepiness in shift workers. Therefore, physicians need to recognize and modify vitamin D deficiency for alleviating shift work-related daytime functioning impairment.

Disclosure: The source of funding: Ministry of Science and Informatiin and Communication Technology

P324 | Pilot study to investigate sleep disorders in blind and severe visual impairment

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Objectives/Introduction: Sleep disorders are associated with serious health problem in blind and visual impaired people. The loss of

light perception may result in a shift of sleep-wake-pattern, which may lead to significant impediments in daily life due to problems falling asleep, maintaining sleep and daytime sleepiness - so called Non-24-sleep-wake-rhythm-disorder. Up to date epidemiological data about Non24 only exist for the USA. This pilotstudy was conducted to provide first epidemiological data for Germany for the prevalence of Non24 and other sleep disorders.

Methods: 111 blind and visual impaired subjects (36 subjects without light perception; m = 56, 27–85 years, Mx = 59.53, SD = 14.69) and 111 sighted controls (m = 41, 27–88 years, Mx = 58.32, SD = 14.21) were recruited to answer a set of validated questionnaires referring to general health status (SF-36), sleep characteristics (PSQI) and daytime sleepiness (ESS). In addition a questionnaire to predict Non24-sleep-wake-disorder, which is not validated in German yet, was provided.

Results: Results show a prevalence of 72.2% for the Non24-sleep-wake-disorder in blind people, which is in accordance to results of the US-study. In contrast, our results indicated Non24 in only 21.3% of the subjects with residual light perception. Furthermore, we found that for both blind and people with visual impairments other sleep disorder like problems falling asleep (100% vs. 79.9%), maintaining sleep (90% vs. 88.1%), breathing disorders (19.4% vs. 32%) or sleep related moving disorders (28.1% vs. 32.9%) were common in our study collective.

Conclusions: The Non24-sleep-wake-disorder is a frequent problem among people with no light perception. The perception of light, functioning as an extern cue for our endogenous circadian sleep-wake-rhythm, plays therefore a key role. But sleep disruption is not fully explained by Non24, making a detailed sleep history essential.

Disclosure: Nothing to disclose.

P325 | Daytime siesta is associated with increased HbA1c community cross-sectional study

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Objectives/Introduction: Sleep timing has different patterns worldwide and it can be influenced by social, cultural and environmental factors. Daytime siesta is commonly practiced in different parts of the world with controversial results of its effect on glucose metabolism. The aim of the study is to examine the association of afternoon siesta and glycated hemoglobin.

Methods: This is a cross sectional study conducted between June 2015 and February 2017. Young adults and middle-aged local subjects were randomly selected and enrolled in the study. Anthropometric measurements were taken for height and weight and hip and waist ratio. Consented subjects were asked to wear actigraphy for one week and run their usual daily activities. They had been asked to come fasting on day seven for blood collection to test for fasting glucose, glycated hemoglobin (HbA1c), lipid profile and insulin.

Results: Four hundred subjects agreed to participate in the study (52% male, 48% female). The mean age of participants was 32.8 ± 11.5 years. The study indicated that duration of afternoon siesta was significantly associated with HbA1c in non-diabetic subjects (HbA1c< 7%) (p = 0.001, B coefficient 0.123) independent of age and gender and nocturnal sleep duration, but it was not associated significantly with fasting glucose and fasting insulin levels. Siesta duration was not associated with traits of obesity (BMI, waist circumference), dyslipidemia (Total cholesterol, triglycerides, LDL) and increase in blood pressure ($p > 0.05$).

Conclusions: Afternoon siesta is associated with increased level of glycated hemoglobin and that may predispose to the development of type 2 diabetes mellitus.

Disclosure: The study is funded by the research council of Oman

P326 | Variability of total sleep time in patients with delayed sleep-wake phase disorder

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Objectives/Introduction: The patients with delayed sleep-wake phase disorder (DSWPD) often exhibit prolonged sleep time. Our goal was to clarify whether the quantity of sleep in patients with DSWPD would substantially vary during the course, and this had association with the clinical status (remission or non-remission).

Methods: Study subjects were the patients diagnosed with DSWPD according to International Classification of Sleep Disorders, third edition (ICSD-3). Data were retrospectively collected from medical records and sleep diaries of the patients. The weekly averages of the total sleep time (TST) and the length of main sleep phase (LMSP) were determined based on the sleep diary. The distributions of TST and LMSP for each patient were examined, and their association with remission/non-remission were statistically tested. Clinical factors such as social adaptation, medication and comorbid psychiatric or sleep disorders were also examined for each patient with regards to the influence on TST or LMSP based on the medical record.

Results: Among 24 patients enrolled, 19 patients [13 males and 6 females; mean age, 24.8 ± 8.9 (SD, 12–42) years] could be analyzed, and the durations of analyzed sleep diary were 6–48 weeks (mean 25.7 ± 11.1 weeks). The width of TST's variation had a range of 1.2–5.9 hr, and that of LMSP had a range of 1.0–6.8. Seven patients (36.8%) exhibited ≥10 hr TST. There was a tendency that both of TST and LMSP were longer when the patients were in non-remission than in remission, although these differences did not reach statistical significance (TST: p = 0.2055, LMSP: p = 0.0699). Direct effects of

above clinical factors on TST or LMSP were identified only in a few patients according to the medical record.

Conclusions: In most of patients with DSWPD, the duration of sleep time changed markedly during the treatment course; however, we could not clarify whether this had association with the clinical status. The possibility that various clinical factors had effects could also be considerable. For further discussion, well-designed prospective studies including control subjects are needed in the future.

Disclosure: This is not an industry-sponsored study. Dr. Arakawa, Dr. Watanabe, Dr. Hirose, Dr. Esaki, Dr. Kawai, Dr. Kumagai, Dr. Yamamoto, Dr. Ono, and Dr. Morishita declares that there is no conflict of interest. Dr. Iwata has received research grants from Otsuka, GSK, Tanabe-Mitsubishi, Dainippon-Sumitomo, Eizai, Daiichisankyo, and has received personal fees from Eli Lilly, Janssen, Otsuka, Shionogi, GSK, Dainippon-Sumitomo, Astellas, Yoshitomi, Meiji, Novartis, and Pfizer. Dr. Kitajima has received research grants from Eizai, Takeda, MSD, and has received personal fees from Eizai, Tanabe-Mitsubishi, Otsuka, Takeda, Eli Lilly, MSD, Meiji, Yoshitomiyakuhin, Dainippon-Suimitomo, Fukuda, Shionogi, and Novo Nordisk.

P327 | Sleep coaching in a population-based RCT improves adolescent sleep

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Objectives/Introduction: Efficient measures to help adolescents in their circadian regulation are scarce. Instead of authoritarian bedtime regulations, more emphasis should be placed on adolescent self-regulation and motivation building. The current study tested the efficiency of a new 4-week sleep coaching protocol, basing on motivational interview, reflective listening, and individualized solutions for better sleep rhythm. The individual meetings were organized through Skype.

Methods: 1,374 adolescents (16–17 years olds) selected from the population register responded to a screening questionnaire. Those with markedly late sleep rhythm were selected to a randomized intervention. 109 completed the intervention. The change in sleep was measured with actigraphy before and after the intervention.

Results: Those in the sleep coaching group increased their sleep time significantly ($p < 0.05$) compared to the control and bright light treatment conditions. However, the timing of the sleep did not change significantly.

Conclusions: This study shows that personalized support and coaching is a feasible method to improve sleep in adolescents. Still the timing of the sleep did not change significantly. This probably reflects the fact that their late sleep rhythm was not truly extreme at the baseline.

Disclosure: Nothing to disclose.

P328 | Tasimelteon for jet lag disorder: results of the JET8 study, a randomized placebo controlled phase 3 trial

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Objectives/Introduction: The JET8 study measured the effects of tasimelteon on objective and subjective sleep parameters during an 8 hr phase advance simulating jet lag disorder. Jet lag disorder is a circadian rhythm disorder that commonly affects millions of travellers per year who cross multiple time zones. Tasimelteon, a MT1 and MT2 melatonin receptor agonist, demonstrated significant and clinically meaningful benefits in nighttime and daytime sleep parameters in the JET8 8 hr phase advance study. The JET8 study design induced the circadian challenge experienced by travellers who cross 8 times zones. The JET8 study was a randomized, double-blind, placebo-controlled, multicentre phase III study.

Methods: Subjects received 20 mg of tasimelteon or placebo orally prior to an 8 hr phase advance and were assessed by PSG for effects on night-time sleep parameters including total sleep time (TST), latency to persistent sleep (LPS), and wake after sleep onset (WASO). Next Day Alertness was determined from the Karolinska Sleepiness Scale (KSS) and the Visual Analog Scale (VAS).

Results: Subjects receiving tasimelteon compared to placebo had a significant improvement in sleep parameters including TST in the first two thirds of the night (tasimelteon = 216.4 min., placebo = 156.1 min., $p < 0.0001$), TST in the full night (tasimelteon = 315.8 min., placebo = 230.3 min., $p < 0.0001$), LPS (tasimelteon = 21.8 min., placebo = 36.8 min., $p < 0.01$), and WASO (tasimelteon = 144.6 min., placebo = 219.1 min., $p < 0.0001$). The study also demonstrated improvement in Next Day Alertness as measured by average KSS (tasimelteon = 4.0, placebo = 4.5, $p < 0.01$) and average VAS (tasimelteon = 60.8, placebo = 54.2, $p < 0.01$). The JET8 study randomized 318 healthy subjects.

Conclusions: The JET8 study demonstrated clinically meaningful and statistically significant improvement in both night-time sleep and next day alertness in patients affected by jet lag disorder. These results suggest that tasimelteon can be an effective therapeutic tool in the treatment of individuals that experience symptoms of jet lag disorder.

Disclosure: Nothing to disclose.

BEHAVIOR 2

P329 | Quantifying the risk of poor sleep outcomes for high and very high adolescent social media users: findings from the nationally representative UK Millennium Cohort Study

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Objectives/Instruction: The impact of adolescents' social media use on sleep has become a topic of concern for parents, teachers and practitioners, with recent evidence indicating that heavier users tend to report poorer sleep. However, there remains a need to establish a baseline of typical daily social media use in today's adolescent population, with prevalence rates for comparatively high and very high users; and to quantify their associated risk of poor sleep outcomes. This study aims to address these gaps in current evidence using data from the nationally representative UK Millennium Cohort Study.

Methods: 11,714 adolescents (aged 13–15) reported their social media and sleep habits in Sweep 5 of the UK Millennium Cohort Study. Odds Ratios from binomial logistic regression models were used to calculate the adjusted Relative Risk of various sleep outcomes for high (3–5 hr; 14% of adolescents) and very high (5+ hr; 21% of adolescents) daily social media users, compared to average users (1–3 hr), controlling for demographics, household characteristics, health, wellbeing and physical activity.

Results: Compared to average users, on school days comparable high and very high social media users were 17% and 67% more likely (respectively) to have later than average sleep onset (after 11 p.m.), and 58% and 83% more likely to have later than average wake times (after 8 a.m.). In basic models, controlling only for age and sex, high and very high users were more likely to have long sleep onset latency (over 30 min) and frequent nighttime awakenings. However, these effects were non-significant or notably reduced in comprehensively controlled models, with only very high users 27% more likely to have frequent nighttime awakenings than comparable average users. Reported effects are significant at $p < 0.05$.

Conclusions: This study establishes typical levels of daily social media use - and prevalence rates of comparatively high and very high use - in the UK adolescent population. It quantifies the associated risk of poor sleep outcomes for each group, controlling for a comprehensive range of demographic and health measures. It highlights a dose-response relationship whereby the heaviest social media users are most likely to have later sleep onset, wake times and nighttime awakenings.

Disclosure: Nothing to disclose.

P330 | Effects of bright light on sleepiness and cognitive performance during simulated night shift work

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Objectives/Introduction: Bright light has been suggested as a countermeasure to sleepiness and cognitive impairment during night shifts. We aimed to investigate how different intensities of full-spectrum white light (4,000K), administered through ceiling mounted Light Emitting Diode (LED) room lighting, affected subjective sleepiness and cognitive performance during simulated night shifts.

Methods: We conducted a randomized controlled study employing a counterbalanced, repeated-measurements design. To simulate night shift work, 25 participants (5 males), aged 19–27 years, performed a battery of cognitive tasks in the laboratory between 11 p.m. and 7 a.m. for three consecutive nights, in two light conditions: bright light (mean illuminance: 890.2 lx, SD = 85.9) and dim light (mean illuminance: 88.5 lx, SD = 8.3). Between the light conditions there was a four week washout period. A 10-min psychomotor vigilance task (PVT) and the Karolinska sleepiness scale (KSS) was completed five times (11:40 p.m., 1:10 a.m., 2:40 a.m., 4:10 a.m. and 5:40 a.m.).

Results: Preliminary analysis indicates that the number of PVT performance lapses and KSS-scores increased during each night shift, in both light conditions. However, in the bright light condition the increase in PVT-lapses and KSS-score was substantially lower than in the dim light condition in the later hours of the night shifts. The mean number of PVT-lapses during the first night shift was significantly lower in bright light compared to dim light condition at 2:40 a.m. (7.7 ± 7.9 vs. 14.6 ± 16.1; $p < 0.05$) and 4:10 a.m. (9.5 ± 7.7 vs. 17.4 ± 14.3; $p < 0.05$). During the third night shift, the mean number of PVT-lapses was lower in bright light compared to dim light condition at 4:10 a.m. (11.0 ± 10.9 vs.19.1 ± 16.9; $p < 0.05$) and 5:40 a.m. (12.6 ± 12.3 vs. 19.6 ± 15.3; $p < 0.05$).

Conclusions: Exposure to full spectrum bright light (890 lx) seems to improve cognitive performance and reduce sleepiness as compared to dim light (89 lx) during simulated night shift work.

Disclosure: The authors disclose no conflict of interest. Authors Mrdalj and Sunde contributed equally to this work.

P331 | Daytime sleep following bright light exposure during simulated night shifts

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Objectives/Introduction: Bright light has been suggested as a countermeasure to sleepiness and cognitive impairment during night shifts, and to lessen negative effects on subsequent sleep. We aimed to investigate the effect of light intensity during simulated night shifts on daytime sleep following the shifts.

Methods: We conducted a study employing a randomized counterbalanced, controlled, repeated-measurements design. To simulate night shift work, participants performed a battery of cognitive tasks in the laboratory from 11 p.m. to 7 a.m. for three consecutive nights in two different light conditions: full spectrum bright light (mean illuminance: 890.2 lx, SD = 85.9) and dim light (mean illuminance: 88.5 lx, SD = 8.3). Daytime sleep following each night shift was monitored at home by the use of polysomnography. Here we report preliminary data on 10 out of 13 participants. Mean ± SEM and Cohen's *d* are used to estimate differences and effects sizes between conditions.

Results: Following the third night shift in bright light, participants exhibited longer total daytime sleep (421.9 ± 30.9 min vs. 324.5 ± 25.2 min, *d* = 1.6), shorter sleep onset latency (5.1 ± 2.0 min vs. 8.9 ± 1.5 min, *d* = −1.0) and higher percentage time spent in stage N2 (44.2 ± 5.7% vs. 32.1 ± 4.3%, *d* = 1.1) compared to the dim light condition. Percentage time spent in stage N3 and REM sleep indicated smaller differences in the bright light condition compared to the dim light condition (21.5 ± 9.1% vs. 32.6 ± 6.8%, *d* = −0.6, and 25.0 ± 3.87% vs. 26.0 ± 3.1%, *d* = −0.1, respectively).

Conclusions: Total daytime sleep was increased after exposure to bright light during simulated night shifts compared to lower intensity light.

Disclosure: The authors disclose no conflict of interest. The authors Jelena Mrdalj and Torhild Pedersen have contributed equally to this work.

P332 | Social media use and sleep in adults: a vulnerability perspective

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Objectives/Introduction: This study expands knowledge on the effects of technology use on sleep by

(1) looking at social media use in an adult sample,

(2) considering the difference between overall and night-time specific social media use, and

(3) exploring a vulnerability perspective.

For the latter, the moderating roles of gender, age, and habitual checking behaviour were examined.

Methods: A representative quota sample of 584 adults (51.2% women, M_{age} = 48.5 years old) participated in an online survey. Participants reported their overall and night-time social media use based on Woods & Scott (2016). Nighttime checking habit was assessed with the Self-Report Habit Index (Verplanken & Orbell, 2006). They co23mpleted the Pittsburgh Sleep Quality Index. Moderation analyses were computed with Hayes' PROCESS macro.

Results: Almost 40% indicated they used social media on a daily basis, and 44.3% used social media multiple times per day. For night-time use, 60% of respondents used social media shortly before bedtime, 28.9% used them in bed, before going to sleep. Only night-time social media use predicted poorer sleep quality (β = 0.206, $p < 0.01$). This association was moderated by age (B = −0.005, 95% CI [−0.009; −0.001]), and was thus stronger among younger participants. Gender was not a significant moderator. Regarding nighttime checking habit, overall social media use predicted better sleep quality only among those with a with a low tendency to check social media at night (B = 0.020, 95% CI [0.004; 0.035]). Contrarily, night time social media use was associated with a better sleep quality only among those with a strong evening checking habit (B = 0.014, 95% CI[0.007; 0.021]).

Conclusions: Nighttime social media use seems detrimental for sleep quality, in particular for younger adults. For the puzzling findings regarding habit strength, we hypothesize that a strong tendency to check social media at night may be indicative of compulsive social media use. Nighttime social media use may gratify the need to check social media accounts, lowering potential mental arousal and benefitting sleep. Prior research already signaled that, compared to children and adolescents, adults may use media as a coping strategy for sleep problems.

Disclosure: Nothing to disclose.

P333 | Bedtime and behavioral problems in Finnish students

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Objectives/Introduction: Adolescent sleep is essential not only for well-being but also for learning. Previous research on Finnish adolescence revealed that those who have later bedtime are at risk for health problems. The present longitudinal study explores if late bedtime at the beginning of the seventh grade (12–13 years)

predicts behavioral problems at the end of the ninth grade and in the second year of upper secondary school.

Methods: The data were collected from the metropolitan area of Helsinki in 2011, 2014 and 2016. Only the data that consisted of the students who provided data in all three collections were included in this study. Hence, the data comprises 3,513 students. Strengths and difficulties questionnaire (SDQ) was used to measure behavioral problems. The SDQ comprises five subscales; emotional symptoms, conduct problems, hyperactivity, peer problems and prosocial behavior. The total difficulties score includes the first four subscales excluding the prosocial subscale. The bedtime was measured with the question "What time do you usually go to bed during school week?"

Results: All of the SDQ subscales (prosocial scale excluded) used to assess behavior problems suggested that bedtimes after 11:00 p.m. at the seventh grade predict the self-reported difficulties. In addition, later bedtimes increased the odds ratio (OR) for behavior problems in adolescents.

Conclusions: Bedtime after 11:00 p.m. at the seventh grade predicted the behavioral problems in each subscale as well as a higher score in total difficulties. This study implies that adolescent sleep should be taken more closely into account in health education and planning of school schedules.

Disclosure: Nothing to disclose.

P334 | The pleasure of sleeping

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Objectives/Introduction: For most people, sleeping is a pleasure. Conversely, sleep deprivation is an excruciating torture. In addition, it is known that dopamine, the neurotransmitter responsible of the wanting for pleasant stimuli, plays a pivotal role in the regulation of wake and sleep, being necessary for maintaining wakefulness, irrespective of the actual sleep propensity. Moreover, the inhibition of ventral tegmental dopaminergic neurons promote, before inducing sleep, sleep-related nesting behaviour, a direct proof of the causal relation between Dopamine levels and sleep propensity. Despite of these evidences, the pleasant properties of sleep remain largely unrecognized. This report aims to fill the gap: sleep, like food, water and sex, is a primary reinforcer.

Methods: We developed a questionnaire searching for factors eventually related to the main question, the degree of agreement with the sentence "For me, sleeping is a pleasure". The subjects, mostly, university students, had to reflect their agreement in a Lickert scale:

1 (never),
2 (rarely),
3 (on occasions),
4 (often) and
5 (always).

Under the hypothetic assumption that evening types would show higher affect to sleep, we also provided the responders with the Horne and Östberg morningness-eveningness questionnaire.

Results: Only two subjects out of 217 respondents (0.9%) marked 1, (never felt pelasure in sleeeping) while 77% marked 4–5 and over 99% recognized having enjoyed sleep always, or, at least, on some occasion.

In addition, 0.46% of the respondents were definitely morning type, 11.52% moderately morning, 66.82% neither type, 19.35% moderately evening and 2.3% definitely evening, i.e. the chronotype of the studied population remained within the known normal limits. The Pearson index for the correlation between love for sleep and chronotype was small ($r = -0.17$, $p < 0.012$) which means that the love for sleep is greater in evening types, but the differences only explains less than a 3% of the variance.

Conclusions:

1 Sleeping is a pleasant state for an ample majority of humans
2 Although evening chronotypes appreciate sleeping more than morning chronotypes, the difference is quite small.

Disclosure: Nothing to disclose.

P335 | No effect by daily coffee consumption on the association between a common gene variant of the melatonin receptor 1B and fasting blood glucose

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Objectives/Introduction: The association between genetic variant in the melatonin receptor 1B(*MTNR1B*) and type 2 diabetes mellitus (T2DM) can be moderated by chronotype (i.e. timing of sleep and wake-up), thus behavioral factors related to circadian rhythm might be involved in this interaction. Caffeine has been shown to delay melatonin-induced circadian rhythm. Since caffeine-enriched coffee is a common diet in Western societies, we sought to investigate whether the association between *MTNR1B*and T2DM (defined by morning fasting glucose level or use of antidiabetics) varies by daily coffee consumption.

Methods: This cross-sectional investigation utilized a subsample of 2,389 individuals from the EpiHealth study. Participants were Swedish adults aged 61.4 ± 8.4 years (50.3% female). T2DM was found in 8.4% of the participants. Genotyping of the*MTNR1B*rs10830963 single-nucleotide polymorphism was done by a custom Illumina iSelect array. Daily coffee consumption, habitual sleep duration, chronotype,

and level of leisure time physical activity were assessed by questionnaire. Logistic regression models were used to calculate odds ratios (ORs) and 95% confidence intervals (CIs).

Results: An association was shown between rs10830963 genotype in the *MTNR1B*and T2DM (OR = 1.60, 95% CI: 1.18–2.17, $p = 0.002$). However, no connection was found between daily coffee consumption and T2DM (OR = 0.96, 95% CI: 0.86–1.07, $p = 0.456$). Finally, no interaction between coffee consumption and rs10830963 genotype in the *MTNR1B*was found (OR = 1.01, 95% CI: 0.82–1.25, $p = 0.932$).

Conclusions: Our study does not indicate a role of daily coffee consumption in the association between the *MTNR1B*rs10830963 polymorphism and T2DM.

Disclosure: Nothing to disclose.

P336 | Which characteristics predict the preference for later school start times in Zurich adolescents?

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Objectives/Introduction: Empirical studies have shown that adolescents suffer from a sleep deficit and significantly sleep longer on weekend than on school days. In fact, associated daytime sleepiness has negative effects on adolescents' health, well-being and school performance. Chronic sleep deficits in adolescents are seen as a public health issue. Thus, later school start times in the morning were recommended for adolescents by the American Academy of Pediatrics in 2014. In Switzerland, however, such advances are not yet established. The aim of the present online survey was to define whether adolescents in the greater Zurich area prefer to go later to school and which socio-demographic, school- and sleep-related variables are associated.

Methods: Cross-sectional study of 5,310 high school students, age 10–22 years (65% females). Preference for later school-start times, school characteristics (time table, public transportation, duration of way to school), sleep-scheduled times (school- and weekend-days), daytime sleepiness, and health-related quality of life were assessed by standardized questionnaires (MCTQ, KIDSCREEN) and integrated in the online survey.

Results: The majority of the adolescents (72%) wish to have later school start times in the morning. They indicated that their preferred average school start time would be at 8:36 a.m. (SD = 0:42). In addition, they indicated that lunch time could be shortened in order not to have to stay longer at school in the afternoon. Multivariate analyses showed that later school start times are preferred by boys more than girls, by students with longer commute to school than with shorter way to school, using public transportation compared to private transportation, with lower school marks compared to students with higher marks, with later chronotypes than with earlier chronotypes, with greater sleep deficit than less sleep deficit, and with greater daytime sleepiness than with lower daytime sleepiness ($p < 0.001$).

Conclusions: Our study shows that Zurich adolescents are ready for later school start times in the morning. Especially boys, those students with longer commute to school, using public transportation, lower school marks, later chronotypes, greater sleep deficit and daytime sleepiness support later school start times in the morning.

Disclosure: Nothing to disclose.

P337 | Young children's sleep and maternal sleep-related cognitions: a comparison between three different Arab societies in Israel

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Objectives/Introduction: Cultural and parental sleep-related behaviors and cognitions have an important role in the development of children's sleep. However, to the best of our knowledge, no study has yet investigated parental factors in relation to children's sleep among Arab families in Israel. There are three Arab ethnocultural groups living in Israel, namely Christian, Muslim and Bedouin. The three groups differ from each other culturally, residentially, and in their social and economic characteristics. Thus, this study examine similarities and differences between Arab families in Israel regarding maternal sleep-related cognitions and children's sleep.

Methods: Mothers of 120 young children from three different Arab Societies in Israel participated in this study. The average age of the children was 18.2 months (range: birth to three years; SD = 10.36). Mothers completed the Brief Infant Sleep Questionnaire (BISQ), and the Infant Sleep Vignettes Interpretation Scale (ISVIS).

Results: Analysis revealed significant group differences on two ISVIS subscales: Distress and Temperament (F (2,117) = 8.82, $p < 0.002$; F (2,117) = 3.72, $p < 0.018$). On the ISVIS Distress subscale, Christian mothers scored significantly higher than did Muslim and Bedouin mothers, indicating that they were more likely to interpret infant night-wakings as a sign of distress and need for help. On the other hand, Christian mothers scored significantly lower on the ISVIS Temperament subscale compared to Muslim and Bedouin mothers, indicating that they were less likely to attribute infant night-wakings to infant nature. Likewise, significant group differences were found with regard to children's sleep (F (2,117) = 3.93, $p < 0.023$). Post-hoc analysis indicated that Christian mothers reported more children's night-wakings than did mothers of Muslim and Bedouin children.

Significant Pearson correlations were found between the Maternal Distress, Limits subscales and child sleep. These findings demonstrated that mothers who were more likely to attribute infant-night-

wakings to infant distress and who were less likely to emphasize the importance of limiting parental nighttime involvement, reported that their children had more fragmented sleep.

Conclusions: The findings of this study support the literature on the importance of cross-cultural factors in the development of sleep in early childhood and demonstrate for the first time cross-cultural differences in young children's sleep and in maternal sleep-related cognitions in Israeli Arabs.

Disclosure: Nothing to disclose.

P338 | Equality of sleep disturbances in parents is associated with reduced stress

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Objectives/Introduction: Mothers generally take a greater responsibility for childcare during the night than fathers, and reports support that mothers get up more times during the night and therefore have more disrupted sleep. We propose that an imbalance in sleep between parents can affects parental stress and relationship satisfaction. The aim of this study was to determine whether there is any objective and/or subjective support for a sleep imbalance between mothers and fathers, unfavorable for women, and whether such an imbalance predicts more parental stress and worse relationship satisfaction.

Methods: Sleep and daytime functioning will be measured with actigraphy and questionnaires for 7 days in 80 parent couples (48 couples have gone through the protocol so far and tentative analyses are presented below). An inclusion criteria was having a child with sleep problems. The parental stress scale consists of items measuring both positive and negative aspects of parenting that are likely to change on a daily basis.

Results: Mothers reported being awake more often during sleep than fathers ($p < 0.01$), something that was also supported by more time awake objectively ($p < 0.05$). There was a trend for a larger sleep imbalance to predict greater parental stress ($p < 0.1$). Parental stress increased for women but decreased for men as a function of minutes awake during the night ($p < 0.001$). We found no association between sleep imbalance and relationship satisfaction ($p > 0.1$).

Conclusions: We suggest that being awake during the night (amount of minutes) cause more stress amongst women the following day, but less stress in men, which in turn suggests that if men take more responsibility of the child during the night, parental stress may be reduced for both women and men. The analyses will be done with the larger population to conclude direction and strengths of possible relationships.

Disclosure: Nothing to disclose.

P339 | Romantic love - another reason to sleep less during adolescence

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Objectives/Introduction: Early-stage romantic involvement may resemble hypomania in its manifestation on behavioural, physiological and psychological levels. Previous research suggests that self-reported sleep may diminish as a result of falling in love during adolescence.

Methods: 1374 adolescents (66% girls; mean age 16.9, SD = 0.6 years) selected from the population register responded to a battery of questionnaires before an invited subsample (resulting $n = 309$) underwent a week-long actigraphy measurement period (GeneActiv Original). The adolescents responded to questions about their sleep behaviour and also a question regarding romantic love. In this study, we compared those who reported being in the early stages of love to those who were not regarding self-reports of sleep duration as well as objectively measured sleep. Girls and boys were analysed separately.

Results: 11% of all participants reported being in the early stages of romantic love. Girls who were in love, had shorter self-reported sleep duration both on weekdays (mean difference 31 min, $p \leq 0.001$) and at weekends (15 min, $p = 0.037$) than those who were not in love. During the actigraphy measurement period the mean difference in sleep duration was 24 min ($p = 0.041$). Boys' sleep did not differ significantly according to self-report about being in love (all p-values >0.42).

Conclusions: During adolescence, romantic love may be one further cause for shorter sleep duration, especially in girls. While the mechanism remains unclear, feelings of romantic love contain important lessons in a developmental context, and may require processing time in the evening. There are several potential confounders which need to be further investigated.

Disclosure: Nothing to disclose.

P340 | To snooze or not to snooze: effects of intermittent morning awakenings 30 minutes before final awakening

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Objectives/Introduction: Hitting snooze on one's alarm repeatedly before getting up ("snoozing") is a common practice. Although

there is much research on sleep restriction, sleep fragmentation, and sleep inertia, little is known about the effects of snoozing per se. Here, we wanted to study whether snoozing has effects similar to those of sleep fragmentation and/or if it may alleviate sleep inertia.

Methods: Following a habituation night, 23 habitual snoozers (mean age 26.3 years) were measured with polysomnography during two nights in the lab: one snooze night and one non-snooze night. In the snooze condition, participants set their alarm 30 min before their preferred wake time and hit the snooze button four times before performing cognitive tests (addition and short-term memory). In the non-snooze condition, participants set their alarm to their preferred wake time and immediately performed the cognitive tests when the alarm went off. The tests were also performed 45 min after waking and twice in the afternoon.

Results: There were no differences in whole night sleep between the two conditions (p's ranging from 0.063 to 0.862 for all polysomnography measures, $N = 23$). During the last 30 min of the night, there was a significant decrease in total sleep time, N3, and REM, and increase in wakefulness, N1, and number of arousals (p's between 0.037 and <0.001) in the snooze condition. In the snooze condition, participants were faster at adding numbers during the first test of the day ($p = 0.013$), but not at later times. Furthermore, there was no difference in percentage of correct additions ($p = 0.779$), nor for short-term memory ability ($p = 0.115$) at any point. There was also no difference in self-reported sleepiness or effort at any test session (p's > 0.572)

Conclusions: Although snoozing the last half hour of the night resulted in 8.5 min less sleep during that time, it did not cause a significant difference in sleep over the full night. There were no differences in the measured cognitive abilities, nor self-rated sleepiness, during the day following snooze or non-snooze, but snoozing made participants faster at an addition task performed right upon waking, suggesting that this waking style may help curtail sleep inertia.

Disclosure: Nothing to disclose.

P341 | Sleep complaints and well-being in shiftworkers of different occupational groups

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Objectives/Introduction: Sleep problems are the most often complaints of night- and shiftworkers. The purpose was to compare sleep related complaints in shiftworkers of different occupational groups.

Methods: Blood pressure (BP), heart rate (HR), calculated hemodynamic parameters, breath holding, balance keeping and responses to the questionnaire to evaluate the biological age by Voitenko (1991) were studied in shiftworkers: 59 telephonists (30–55 years old, women), 62 truck drivers (28–65 years old, men), 67 surgeons (23–74 years old, men) and 31 miners (32–58 years old, men). Surgeons and miners worked regular night hours under harmful environment, truck drivers and surgeons - long work hours. Two sleep related complaints in connection with other studied parameters were investigated:

(1) sensitive sleep and

(2) sleep loss due to excitement.

TTEST at $p < 0.05$ was used to compare shiftworkers of 2 groups within each occupation: those who complained, and those who did not complain.

Results: Sensitive sleep reported 57% of telephonists, 55% of truck drivers, 42% of surgeons and 29% of miners. This complaint was accompanied also by worse ($p < 0.05$) balance keeping and breath holding (in surgeons and miners); lower HR and older biological age (in surgeons); higher pace of aging, high BP (143/92 vs. 133/83 mmHg), HR (83 vs. 79 bit/min) and worse hemodynamic parameters (in miners); worse subjective health evaluation (in the each occupation but in telephonists - at $p < 0.07$). More frequently encountered ($p < 0.05$) concomitant complaints were found by 1 question in truck drivers and surgeons, by 4 questions - in telephonists, by 13 questions - in miners.

Sleep loss due to excitement reported 55% of telephonists, 49% of truck drivers, 58% of surgeons and each miner. This complaint was accompanied by worse subjective health evaluation (in the each occupation), older biological age (in drivers and surgeons), higher pace of aging (in telephonists) and also other complaints due to 3 indices in drivers, by 10 indices - in telephonists and surgeons.

Conclusions: Sensitive sleep is accompanied rather by worsening in objective parameters of body functioning while sleep loss due to excitement - by subjective complaints. Unfavourable work place factors promote sleep complaint concomitant unfavourable changes in workers well-being.

Disclosure: Nothing to disclose.

P342 | Reactivation of hypothalamic inhibitory neurons during REM sleep maintains appetite

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Objectives/Introduction: Sleep has been linked to the consolidation of memories related to spatial encoding, reward and emotion. Reactivation of neural sequences in the hippocampus and neocortex during sleep reflects transfer and storage of information acquired

during awake behavioral conditioning. However, whether sleep reactivation within homeostatic circuits strengthens innate behaviors is unknown.

Methods: We use *in vivo* calcium imaging (GCaMP6s) in freely-moving mice to longitudinally record activity dynamics from single glutamatergic or GABAergic neurons in the lateral hypothalamus (LH^{vglut2} and LH^{vgat}, 153 cells from 4 animals and 151 neurons from 6 animals, respectively) across sleep and feeding behaviors. Furthermore, we applied optogenetic tools to silence LH^{vgat} neurons selectively during REM sleep or wakefulness prior to a goal-oriented task (8 test animals, 8 controls).

Results: We showed that the cellular activity of LH^{vgat} and LH^{vglut2} neurons clusters into 'food-directed' and 'food-avoidance' behaviors, respectively, while both populations show strong cellular activities during REM sleep. Importantly, LH^{vgat} neurons active during food-directed behavior are reactivated during rapid eye movement (REM), but not non-REM, sleep, whereas no sleep-state specific reactivation was observed for LH^{vglut2} neurons. The reactivation of LH^{vgat} neurons across REM sleep episodes occurred in parallel, rather than sequential patterns. Finally, REM sleep-, but not wake-specific optogenetic silencing of LH^{vgat} neurons decreased food intake during subsequent wakefulness.

Conclusions: Collectively, these results demonstrate that reactivation of food-directed neurons during REM sleep is essential to maintain feeding and expand the role of REM sleep to the stability of innate behavior.

Disclosure: Nothing to disclose.

P343 | Benefits of a short afternoon nap: Investigating the parallel effects on physiological arousal and cognitive performance

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Objectives/Introduction: Previous studies have demonstrated that the benefits of short afternoon nap on habitual nappers' task performance would be moderated by the cognitive complexity and task difficulty (Ru, Chen, You & Zhou, 2017, in press).The current study aims to further investigating the effects of afternoon nap on physiological arousal in parallel to its effects on task performance and testing the possibility of physiological arousal as underlying mechanism of napping effects on mental performance.

Methods: A 2 (Nap intervention: nap/no nap) × 2 Task difficulty: easy/difficult) within-subject design was employed in the current study, in which seventeen university students with the long-term habit of an afternoon nap participated in all three conditions (including an adaption condition) on three inconsecutive days. Polysomnography was used to record EEG during nap intervention and task session for measuring physiological arousal. During the task session, participants performed both an easy and a difficult measurement block each including a sustained attention (auditory PVT—easy: 1~5 s ISI; difficult: 1~9 s ISI) and a working memory (N-back task—easy: 2back; difficult: 3back) task. Adaption condition always came first; the order of nap vs. no nap condition and the easy vs. difficult block was randomized across the participants.

Results: Linerar mixed model was employed for data analysis. Results showed that (1) a habitual midday nap improved performance on sustained attention ($p < 0.05$) but not on working memory; (2) for the EEG power ratio, nap condition elicited higher θ than no nap did while this is only the case for δ and reverse for β on difficult PVT trails ($ps < 0.05$); higher δ and lower β than no nap did while higher α was found only on 2-back trials ($ps < 0.05$); (3) the lapse in easy PVT was marginally correlated with δ component ($r^2 = 0.18$, $p = 0.07$), the response speed in 2-back task was marginally related with θ component ($r^2 = -0.18$, $p = 0.08$) and the response speed in 3-back task was significantly related with θ component ($r^2 = -0.21$, $p < 0.05$).

Conclusions: Physiological arousal as mechanism underlying napping effects on task performance was only partially supported.

Disclosure: Nothing to disclose.

P344 | Glucose tolerance following a 6-week sleep extension protocol in overweight short sleepers

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Objectives/Introduction: The evidence suggests that weight gain can, in part, be mediated by impaired glucose tolerance resulting from chronically restricted sleep. Less experimental attention has been paid to the hypothesis that sleep extension, by positively impacting glucose handling, could provide a pathway to improved metabolic health and weight loss. We examined the feasibility of delivering a practical sleep extension protocol which significantly increased sleep duration, and impacted glucose tolerance among overweight 'short sleepers' at increased risk of diabetes. Following screening, 22 men (mean age = 42.2, SD = 8.8; BMI = 29.65, SD = 2.93) were randomised to an intervention sleep extension condition, or the control condition.

Methods: Following baseline assessment, intervention participants were provided with personalised guidance in a 1-to-1 session. Opportunities for extending the sleep period were identified and agreed. Access to online resources (specifically addressing sleep hygiene, relaxation procedures, and cognitive strategies) was provided. The 6-week sleep extension period which followed aimed to increase total sleep time from baseline by 1 hr. A helpline number/email was provided for this period.

For both groups a 3-hr meal tolerance/insulin sensitivity test procedure was employed at baseline and 6 weeks. Total sleep time (TST) was recorded daily on a personal sleep diary. Actigraphic sleep measures continued for both groups throughout the trial.

Results: At baseline, there was no difference in TST between the intervention and control group (Control 5.62 hr; intervention 5.64 hr). After 6 weeks of sleep extension, the intervention group reported a total sleep time of 7.05 hr, compared to the control group who reported total sleep time of 5.83 hr. These differences were corroborated by actigraphy.

There was no difference in insulin response between the two groups at baseline ($t(10) = 0.98$, two-tailed). However, when the test was repeated at 6 weeks, the intervention group showed significantly lower insulin concentrations (mU/L) relative both to the control group ($t(10) = 0.03$, two-tailed), and their own baseline ($t(10) = 0.05$, two-tailed).

Conclusions: These findings are consistent with improved glucose tolerance following the implementation of a successful sleep extension protocol in overweight habitually short sleepers.

Disclosure: Nothing to disclose.

P345 | Is it possible to adjust the driving and resting times when operating highly autonomous trucks?

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Objectives/Introduction: The ADAS&ME project seeks to create driver monitoring systems facilitating safer and more efficient use of highly autonomous vehicle functionality. One application is to adapt the driving and resting times by continually adjusting the tachograph mode from driving to resting during autonomous driving at times when the driver is genuinely resting. The goal of this exploratory pilot study was to investigate the effect of a mid-shift rest period on driver sleepiness.

Methods: Ten professional truck drivers (3 female, age: 45 ± 17 years) participated in this within-subject design study. Two counterbalanced conditions (Drive/Rest) were driven on a motorway during daytime, each lasting about 6 hr including breaks. In Rest, a confederate driver drove the truck for about 2 hr mid-drive while the participants could do as they wished from the passenger seat. Drive was a baseline condition with ordinary driving. Before and after the driving session, the TAP-M, Lane Change Task (LCT) and N-back tests were performed. During driving, ECG, EOG, KSS and stress ratings were acquired every fifth minute.

Results: A 2 (Drive/Rest) by 2 (Before/After) repeated measures ANOVA showed no significant differences for any of the cognitive tests or for the measures acquired while driving. There was a trend towards higher KSS ratings after driving in the Drive condition, $F(1,25) = 3.91$, $p = 0.06$, which stemmed from markedly higher KSS ratings in three individuals (KSS 3–6, 2–5 and 3–7).

Conclusions: The driving and resting times should prevent drivers from becoming too fatigued, something which explains the non-significant results. However, one third of the drivers had markedly higher KSS ratings after the Drive condition, whereas none of them showed any signs of sleepiness after the resting period. The low number of participants makes it difficult to draw any conclusions and further investigations are needed, especially since the rather high KSS values that were reached are known from other studies to be associated with an increased risk for involuntary lane crossings.

Disclosure: Nothing to disclose.

P346 | Excessive daytime sleepiness and traffic accidents among taxi drivers: a cross-sectional survey in Izmit

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Objectives/Introduction: Sleepiness is a condition that has a negative effect on motor and cognitive performance. It is one of the individual risk taking behaviour as excessive speed and alcohol use for traffic accidents. The aim of this study is to investigate that potential relationship between sociodemographic characteristics, personalbehaviours, excessive daytime sleepiness conditions and traffic accidents among taxi drivers.

Methods: The survey was conducted between June and August 2016 using a face-to-face interview technique at the taxi stand. The sample size was calculated as 190 and 160 of them participated in the survey. The questionnaire that used was including the sociodemographic characteristics, working conditions, healthy lifestyle behaviors, body mass index (BMI), previous traffic accidents, perceived health status of the participants, Eppworth Sleepiness Scale (ESS) and General Health Questionnaire (GHQ-12). Descriptive, univariate and Pearson correlation analyzes were performed. Significance level of alpha was accepted 0,05.

Results: The participation rate of taxi drivers was 84%. All drivers are male and average age is 44.9 ± 10.9. 82.5% of the participants were married and 56.3% were high school graduates. 66.9% of participants stated that they use cigarette, 30.9% said they use alcohol. 88% of drivers rated their perceived health as good -very good. The frequency of those who have traffic accidents is 66.2% and the frequency of EDSS was found 2%. The mean of the ESS scores is 2.7 ± 2.4. There was a significant difference between the frequency of accident those whom has higher ESS scores than lower ESS scores (p:0.007). There were statistically significant positive

correlations between ESS scores, alcohol consumption amounts, traffic accidents, number of work accidents, number of night work, BMI and GHQ-12 scores in the correlation ($p < 0.01$).

Conclusions: Even though assessment of sleep disorders is a prerequisity for fitness to work, it might be other reasons as like lack of healthy life behaviours for EDSS among taxi drivers. It need to be considered to promotion of healthy life behaviors and wareness of sleep hygiene to prevent excessive daytime sleepiness while working.

Disclosure: Nothing to disclose.

LEARNING, MEMORY & COGNITION 2

P347 | Neural correlates of autobiographical memory and self in patients of stroke and head injury

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Objectives/Introduction: Autobiographical memories (AMs) are significant in maintaining a sense of self. AM is a multifaceted higher-order cognitive process which involves recollection of specific personal events. It is mainly categorized into Semantic AM and Episodic AM. Studies evaluating AM separately in stroke and head injury patients have shown that AM is affected in them.

Methods: In this study we are comparing the effects of mild stroke in PCA (Posterior Cerebral Artery) and in MCA territory (Middle Cerebral Artery) and in mild head injury on episodic and semantic AM at two different time points that is in the acute phase (approx. 10 days) and at 3 months. 15 patients and 10 healthy subjects were examined on *Autobiographical Incidents Schedule* (AIS), *Personal Semantic Memory Schedule* (PSMS) and Self test.

Results: All patients group were impaired on both tests relative to controls ($p < 0.001$). Episodic memories was most affected in MCA stroke ($p < 0.001$) and personal semantic memories most affected in PCA stroke ($p < 0.005$). We found that when both episodic and semantic AM was considered PCA stroke affected the most. Further, on hemispheric comparison AM was most affected in patients of right MCA stroke than left MCA stroke and contrastingly, left PCA stroke than right PCA stroke. Childhood episodic AM was most affected in MCA stroke whereas early adult and recent event memories was most affected in head injury than in stroke.

Conclusions: Critical areas of the brain are important for AM and self and injury to these specific areas by stroke or head injury dictate the outcome and recovery.

Disclosure: Nothing to disclose.

P348 | Sleeping after an emotional event leads to long-term decreases in visceral and subjective emotional responses associated with memory

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Objectives/Introduction: How does sleep influence the emotional tone associated with memories? Recently, we demonstrated that cognitively influenced aspects of emotional tone, i.e. those which are subject to top-down control mechanisms (measured by subjective valence and arousal ratings), decreased after a 10-hr interval filled with nocturnal sleep compared to a day of wake. In contrast, sleep compared to wake increased more automatic aspects of emotion (heart rate deceleration, HRD) after a short delay. Here, we examined whether these short-term influences (i.e. after 10 hr) persist after an extended delay (i.e. one week).

Methods: During the encoding session, participants viewed negative and neutral pictures either in the morning before a day of wakefulness (Wake group, $n = 16$) or the evening before a night of sleep (Sleep group, $n = 16$). Participants returned one week later for a recognition session. While viewing the images at each session, subjective ratings (i.e. valence and arousal) and HRD responses were measured. Emotional response was calculated as the response to negative images minus the response to neutral images. During the recognition session, the emotional response measure was limited to pictures that were correctly recognized (hits).

Results: After one week, the valence rating emotional response was lower (less negative) in the Sleep than the Wake group ($F(1,26) = 5.24$, $\eta_p^2 = 0.17$, $p = 0.03$) when controlling for encoding emotional response (which was significantly related to the emotional response after one week: $F(1,26) = 36.12$, $\eta_p^2 = 0.58$, $p < 0.001$). The HRD emotional response was also lower in the Sleep group compared to the Wake group ($F(1,26) = 6.97$, $\eta_p^2 = 0.21$, $p = 0.014$). Sleep did not influence arousal ratings.

Conclusions: Our results suggest that sleeping after a negative event might beneficially decrease the emotional response associated with the memory for that event in the long-term. After one week, both automatic (HRD) and cognitively controlled (subjective valence ratings) emotional responses decreased if participants slept directly after encoding. These results build on our previous findings showing that the HRD emotional response is increased in the short-term by sleep, suggesting sleep's influences on the emotional tone of memories may exhibit complex dynamics that evolve over time.

Disclosure: Nothing to disclose.

P349 | A daytime nap facilitates the consolidation of and modulates the autonomic response to emotional memories

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Objectives/Introduction: Notwithstanding compelling evidence supports the role of sleep in consolidating neutral information, how sleep processes emotional memories remains controversial. Here we tested whether and how a daytime nap, containing no REM sleep, modulates emotional memories processing both at the behavioral and at the autonomic level.

Methods: Thirty-nine (19 F) healthy students were exposed to 24 highly-arousal unpleasant and 24 neutral pictures at 1:00PM. After each image, participants rated their subjective valence and arousal. Then participants were split into the Nap group (N = 19), who took a 60-min nap in the lab, and the No-Nap group (N = 20), who continued with their daytime activities. At 5:00PM all participants performed a recognition test during which they saw half of the previous pictures intermixed with 24 novel stimuli. They had to decide whether they had seen the picture before. During both sessions, electrocardiogram and electrodermal activity were recorded to assess autonomic reactivity to the stimuli.

Results: The Nap group showed higher memory discrimination than the No-Nap group for unpleasant pictures (p = 0.034). This effect was mainly driven by the higher false alarm rate observed in the No-Nap group (p = 0.030). Memory discrimination in the Nap group was positively associated with delta and spindle activity during slow wave sleep (SWS; r = 0.60, p = 0.025 and r = 0.49, p = 0.073, respectively). Subjective arousal decreased in both group for both stimuli type. Both groups showed a skin conductance response habituation in the recognition session. However, the Nap group showed a reduction in cardiac deceleration after the nap for both unpleasant and neutral stimuli, whereas the No-Nap increased the deceleration for the unpleasant stimuli (p's < 0.05).

Conclusions: Our results confirmed our previous results that a nap, even without REM sleep, can facilitate the consolidation of emotional memories compared to a similar period of wakefulness. This process seems modulated by SWS activity. Moreover, we observed that after a period of sleep participants reduced their orienting responses to the unpleasant stimuli (i.e., reduced cardiac deceleration), whereas participants who did not sleep increased their orienting responses. We suggest that sleep may help to preserve the adequate autonomic response to emotional events.

Disclosure: Nothing to disclose.

P350 | Assessing the sequential hypothesis for memory consolidation in narcoleptic patients

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Objectives/Introduction: How sleep architecture plays a role in memory consolidation is still debated: does each stage of sleep benefit independently to memory, or is the non-rapid-eye-movement (NREM) - rapid-eye-movement (REM) sleep sequence more efficient for memory consolidation (sequential hypothesis)? We aimed to answer this question in studying a group of narcoleptic patients, who offer the unique opportunity to manipulate the order of sleep stages, as these patients can sometimes fall asleep in REM sleep before entering NREM sleep.

Methods: 54 patients with central hypersomnia, between 18 and 45 years old, were included in the analysis. They were tested for declarative (word pairs) and perceptual (visual texture discrimination task) memory before and after a nap, repeated 3 times during the day. 50 patients were kept for analysis with a total of 149 naps. Naps/patients were assigned to one group or the other depending on the sleep sequence during the nap (NREM-REM or REM-NREM sleep). Naps/patients without a complete sequence were assigned to the No-Sequence group.

Results: In the declarative task, all groups showed equally decreased performances after sleep. The time spent asleep or in a specific sleep stage was not correlated with performances.

In the perceptual task, patients who slept with a complete sequence (NREM-REM or REM-NREM) tended to increase their performances, while patient napping without a complete sequence tended to decrease their performances after sleep. However, there was no significant interaction. Taken all naps together, better performances were correlated with more time spent in NREM sleep (p < 0.05).

Conclusions: No effect of the sleep sequence could be demonstrated in this study. Only a positive effect of the time spent in NREM sleep was shown on performances in the perceptual task. Then, our results do not support the sequential hypothesis, and the NREM-REM sequence may not be necessary for an optimal memory consolidation. Alternatively, the sleep sequence may not be necessary in the specific tasks tested, or we cannot exclude a negative effect specific to the patient population. This study is one of the first to test experimentally the sequential hypothesis in humans.

Disclosure: Nothing to disclose.

P351 | Lack of frequency-tagged magnetic responses suggests statistical regularities remain undetected during NREM sleep

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Objectives/Introduction: Hypnopedia, or the capacity to learn during sleep, is debatable. Although convincing evidence was provided for the creation of elementary conditioning during human sleep, it remains unclear whether more sophisticated learning is possible. We tested using magnetoencephalographic (MEG) frequency-tagged recordings whether high-order associations embedded in statistical regularities can be detected during NREM sleep.

Methods: Young adults (N = 21; 23.7 ± 2.7 years) participated in 2 MEG sessions. In the Sleep (90 min nap) MEG session, they heard habituation auditory streams (HAB; ascending/descending half-tone scales) while falling asleep. While in stable NREM2/NREM3 sleep, stimulation switched to statistical (STAT) and random (RDM) 5-min auditory streams (counterbalanced). Participants not reaching NREM sleep were assigned to the NoNREM_NoExposure group (N = 10); others belonged to the NREM_Exposure group (N = 11). In the subsequent MEG session at Wake, both groups were delivered 5-min STAT and RDM streams 2 times each (counterbalanced). Auditory streams material: STAT streams featured non-melodious successions of 12 pure tones statistically grouped into four randomly alternating tritones (G#CD, AC#G, FA#D# and EF#B in musical notation, A = 440 Hz). Transitional succession probability between two tones within a tritone was 1.0, and between two tritones 0.33, creating statistical grouping regularities. In RDM streams, the 12 tones were randomly presented (transitional probability = 0.09). Tones were delivered at a 5.505 Hz presentation rate, thus tritone presentation rate was 1/3 = 1.835 Hz.

Results: During sleep (NREM_Exposure), strong tone-related (5.505 Hz) signal-to-noise ratio (SNR >10) was present in bilateral temporal sensors, reflecting successful perception of auditory stimulations both in STAT and RDM streams ($p > 0.1$). However, no tritone frequency (1.835 Hz)-tagged response was evidenced in STAT or RDM streams (SNRs = ±1). During subsequent wakefulness, both NREM_Exposure and NoNREM_NoExposure groups exhibited unambiguous tritone-frequency tagged responses during STAT but not RDM streams (cluster-based permutation test $p < 0.05$) in left and right temporal sensor, reflecting successful detection of statistical auditory regularities.

Conclusions: We show using MEG frequency-tagged recordings that associations embedded in statistical regularities remain undetected during NREM sleep whereas learned during subsequent wakefulness. These results suggest that the brain's learning capabilities during NREM sleep restrict to elementary associations.

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P352 | Perinatal memory and the influence of prenatal stimulation on newborns sleep

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Objectives/Introduction: Newborns are reported to recognize their mother's voice after birth, suggesting that a fetus has in principal the ability to learn. The aim of our study was to examine overt signs of recognition in newborns to a more complex stimulus, namely a prenatally repeatedly presented nursery rhyme. Given that sleep is prominent in third term fetuses and newborns, we were additionally interested if and how prenatal stimulation influences the distribution of sleep/wake states in newborns during periods of renewed stimulation and non-stimulation (silence) after birth.

Methods: Pregnant women (n = 30) either replayed a taped nursery rhyme from week 34 of gestation until birth, twice a day, to the unborn (experimental group; EG) or did not (control group; CG). Two and five weeks after birth, infants' electrocardiogram (ECG) was collected while playing the same (familiar) rhyme and a newly presented (unfamiliar) rhyme back over speakers, each with the maternal (familiar) and a strange female (unfamiliar) voice. Randomized stimulation periods were alternating with non-stimulation (silence) periods. Every stimulation and non-stimulation block lasted 180 seconds, resulting in a total recording time of 27 min per recording.

Results: After calculating differences in mean heart rates (HR) between stimulation and preceding non-stimulation blocks, repeated measures ANOVA revealed no significant main effects for rhymes or voices at both recordings. In a next step mean HR and heart rate variability (HRV) for summed up (i) stimulation and (ii) non-stimulation periods was calculated. Independent Samples T-Test has shown, that infants unfamiliar with prenatal stimulation (CG) had higher mean HR (p = 0.004) and lower parasympathetic activity (mean high-frequency power of HRV; p = 0.001) during stimulus presentation times at week 2. Furthermore, despite active ("REM") sleep was prominent at both recordings, infants unfamiliar with prenatal stimulation (CG) have shown higher amount of wake states during stimulation periods (42% vs. 20%) at week 2.

Conclusions: Our findings suggest no signs of perinatal memory for more complex prenatal stimulation material like nursery rhymes. Nevertheless, newborns familiar with prenatal stimulation appear less stressed and less disturbed in their sleep behavior during re-stimulation after birth, indicating prenatal habituation to auditory stimulation.

Disclosure: Nothing to disclose.

P353 | Brain connectivity during the consolidation of procedural learning in quiet rest versus sleep

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Objectives/Introduction: Post-learning sleep and sleep-specific neural oscillations can facilitate off-line memory consolidation. Some of these oscillatory patterns might also be functional during a wakeful quiet rest state, however, the influence of wakeful rest on memory consolidation was only scarcely investigated. Furthermore, the beneficial impact of sleep on non-declarative, procedural skills, especially sequence learning is less conclusive. The aim of our study was to explore the functional connectivity (FC) during memory consolidation of subprocesses of procedural learning in quiet rest vs. sleep.

Methods: Here, we applied a complex perceptual-motor procedural learning task (namely the Alternating Serial Reaction Time Task) in order to investigate the consolidation of two learning processes: (1) implicit statistical learning, a fundamental mechanism of the brain, which extracts and represents regularities, and (2) explicit sequence learning which is a higher-order type of learning with explicit access to the represented regularities. Young adults (N = 72) after performing the task were randomly allocated into one of two different groups to spend a one-hour off-line period in a relaxed resting state (quiet rest, N = 34), or asleep (N = 38). EEG connectivity was analyzed throughout the off-line period.

Results: On a behavioral level, we have found no differences between these groups (F (2,75) = 1.10, p = 0.34): statistical learning and explicit sequence learning was preserved in all groups after the off-line period. However, we investigated the individual differences within the groups, so we calculated correlations between different types of learning indices and brain connectivity of the consolidation both in the sleep group and the quiet rest group. FC was calculated by WPLI (Weighted Phase-Lag Index) after Laplace transformation. To study the relationship between individual FC and overall learning score indices, permutation-based correlation analysis was conducted (all $ps < 0.05$).

Conclusions: Our findings indicate, that the beneficial long-range connections during the consolidation in different states (i.e. sleeping vs. quiet rest) could predict individual differences in different subtypes of procedural learning.

Disclosure: Nothing to disclose.

P354 | Reinstatement of emotional associations during human sleep: an intracranial EEG study

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Objectives/Introduction: Memory replay occurs spontaneously during sleep and promotes consolidation. Such replay can be experimentally triggered by presenting sensory cues that had previously been paired with recently encoded information. Whether this same procedure may allow the reactivation and consolidation of associated emotional states is still unknown.

Methods: Here we recorded intracranial EEG signal in 7 epileptic patients (undergoing presurgical investigation; N = 7). Six patient had an electrode implanted in the amygdala (N = 6), six in the hippocampus (N = 6) and five in the orbitofrontal cortex (N = 5). They heard two different sounds presented together with either funny or neutral pictures. After this conditioning phase, both sounds were played while patients had a nap, and after the nap. We analyzed the EEG response to both sounds of the amygdala, hippocampus and orbitofrontal cortex across different frequency bands. We compared the conditions with two-tailed paired t-test.

Results: We first controlled that participants found the funny pictures more emotional. Patients all rated funny pictures as more emotional on average ($p < 0.001$). We then investigated how the amygdala and the orbitofrontal cortex react to the two types of conditioned sounds. During sleep, the emotionally conditioned sound increased oscillations implicated in memory in the amygdala (theta range; $p < 0.01$) and orbitofrontal cortex (beta range; $p < 0.05$). Together with this effect, a stronger connectivity between the orbitofrontal cortex and the hippocampus was observed in the theta frequency range ($p < 0.01$).

Conclusions: We showed that, during sleep, the emotional components of memories are replayed in limbic circuits when cued. Moreover, we showed that this process implicate an increase in oscillations and connectivity typically involved in memory encoding and retrieval (theta and beta frequency range). The predominance of these oscillations in contrast with more classical sleep oscillations (like spindles or slow-oscillations) suggest a complex interplay across frequencies and regions. We hope these clues will provide new insights into the involvement of the different frequency bands in shaping memories during sleep.

Disclosure: Nothing to disclose.

P355 | Pre-attentive auditory perception during slow-wave sleep: a study of event-related potentials in response to violation of global and local regularity in the sound sequence

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Objectives/Introduction: Data on auditory event-related potentials (ERPs) prove that sound detection is altered but remains during slow-wave sleep (SWS), however novelty detection may be absent. To test this we aimed to compare patterns of mismatch negativity (MMN), index of pre-attentive discrimination evoked on global (GV) and local violations (LV) of auditory sequence regularity during SWS and waking state (WS).

Methods: Auditory ERPs were recorded from 14 healthy volunteers during a daytime nap. Passive odd-ball paradigm with LV and GV was presented during SWS and after sleep during WS. Both irregular sequences consisted of trials where the first four sounds were the same (standards), but the fifth sound differed. In the LV sequence 80% trials ended with the standard sound (composed of 500, 1,000, and 1,500 Hz harmonic sinusoidal waves) and 20% trials ended with the deviant sound (505, 1,010, and 1,515 Hz). In the GV sequence 80% trials ended with the deviant sound and 20% with the standard sound. We detected negative peaks of averaged ERPs difference waveforms (Deviant - Standards) in several time windows: 60–160 ms, MMN 160–260 ms, 280–380 ms, 360–500 ms. Using repeated measures ANOVA we compared the peak latencies and amplitudes at frontal F (Fz, F3, F4) and central C (Cz, C3, C4) electrode clusters in LV and GV sequences during SWS and WS.

Results: The latency of early negative peaks in LV was longer in SWS than WS for (60–160 ms: F electrodes, $p = 0.031$; MMN 160–260 ms: $p = 0.049$). The late negative peak latency was also longer in LV than in GV (360–500 ms: C electrodes, $p = 0.039$) during SWS. The MMN amplitude increased during SWS for MMN 160–260 ms in LV at F electrodes ($p = 0.027$). As we observed an incomplete structure of ERPs in GV we expectedly found no significant differences for global MMN between SWS and WS.

Conclusions: The ERPs results suggest that discrimination of LV in auditory sequences remains even in SWS, but with increased latency and amplitude of MMN. An absence of clear MMN or other components of sound novelty detection in passive GV paradigm in SWS supports previous data on disrupted high-level discrimination in sleep.

Disclosure: Nothing to disclose.

P356 | The impact of sleep on complex gross-motor adaptation in adolescents

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Objectives/Introduction: Sleep has been shown to facilitate the consolidation of newly acquired motor memories in adults. However, the role of sleep in motor memory consolidation is less clear in adolescents, especially concerning real-life gross-motor skills. Therefore, we investigated the effects of sleep and wakefulness on a complex gross-motor adaptation task by using a bicycle with an inverse steering device.

Methods: 29 healthy adolescents aged between 11 and 14 years (5 female) were either trained to ride an inverse steering bicycle with supporting wheels (learning condition) or a stationary bicycle (control condition). Training took place in the morning (WAKE, $n = 14$) or in the evening (SLEEP, $n = 15$) followed by a 9 hr retention interval and a subsequent re-test session. Slalom cycling performance was assessed by speed (riding time) and accuracy (standard deviation of steering angle, SDSA) measures.

Results: Behavioral results indicated that both groups showed similar speed and task accuracy throughout training and retrieval regardless of spending the retention interval asleep or awake ($SDSA_{GROUP}$: F (1,27) = 0.326, $p = 0.573$, $\eta^2 = 0.012$; riding $time_{GROUP}$: F (1,27) = 1.863, $p = 0.184$, $\eta^2 = 0.065$). However, overnight performance gains in accuracy were associated with an increase in left hemispheric N2 slow sleep spindle activity (SpA) from control to learning night ($r_{15} = -0.522$, $p = 0.046$). Furthermore, decreases in REM ($r_{15} = 0.581$, $p = 0.023$) and tonic REM ($r_{15} = 0.550$, $p = 0.034$) duration were related to higher overnight accuracy improvements. Regarding speed, an increase in tonic REM duration was especially favorable for higher overnight performance gains in riding time ($r_{15} = -0.533$, $p = 0.041$).

Conclusions: Thus, although not yet detectable on a behavioral level, sleep seemed to play a role in the acquisition of gross-motor skills. A promising direction for future research is to focus on the possibility of delayed performance gains in adolescent populations.

Disclosure: Nothing to disclose.

P357 | Does sleep benefit prospective intention realization: comparing valence and neutral cues

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Objectives/Introduction: Several studies evidence retrospective memory facilitation following nights of sleep when compared with wakefulness. The same results do not hold for prospective memory as few studies have attempted to investigate the relationship. Within the event cued prospective memory system cue characteristics play a central role in the success of its detection and further retrieval of intention. Emotions salience is an important cue characteristic that facilitates cue detection and intention realization. The present study explores the role of sleep in stabilizing and consolidating valence and neutral cues traces and its effect on prospective memory performance

Methods: A repeated measure design was used on twenty paid volunteers (mean age: 21 ± 1.5) with no prior history of sleep disturbances and psychiatric conditions. Subjects learnt prospective cues on experimental nights prior to sleep/deprivation and performed on prospective intention realization task after one night of recovery sleep

Results: *Behavioral Analysis:* Data for accuracy of intention realization was subjected to 2 retention (sleep, deprivation) × 2 affect (valence, neutral) repeated analysis of variance. The results suggest that sleep following cue learning leads to more successes in prospective intention realization as compared to deprivation (F (1,19) = 8.23, $p < 0.05$). Similarly, valence cue resulted in more number of prospective intention realization at retrieval (F (1,19) = 5.61, $p < 0.05$). Post-hoc analysis on retention x affect interaction suggests sleep benefits valence cue dependent intention realization more than neutral cues.
ERP Analysis: Mean amplitudes between 160–210 ms (prospective monitoring) and 600–900 ms (retrospective remembering) from 9 electrodes (F7, Fz, F8, T7, Cz, T8, P7, Pz, P8) site following cue onset at retrieval were subjected to repeated measure ANOVA [retention (sleep, sleep deprivation), Affect (valence, neutral) & LCR (lateral, central, right)]. None of the main variables reported significant main effects. Only partial interaction effects were reported.

Conclusions: The result suggests that both sleep and cue valence individually facilitates the accuracy of prospective intention realization.

Disclosure: No conflict of interest among authors.

P358 | Well done! Effects of post-learning positive reinforcement on motor memory recall performance 12 hours and 1 month after learning

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Objectives/Introduction: Procedural memory is an implicit type of memory, and includes learning of complex motor skills (e.g. a new dance move). The extent by which newly acquired motor skills are consolidated is driven by various factors, including sleep and whether the memory is expected to be of future relevance. Whether positive reinforcement on learning performance, irrespective of the person's actual performance, improves the ability to recall motor memory both in the short and the long-term has not yet been investigated.

Methods: To test this hypothesis, we compared effects of positive reinforcement vs. no reinforcement on consolidation of procedural (finger sequence tapping) memory in 68 male and female students. In the reinforcement group (N = 34), positive feedback was provided by the computer after cessation of the learning session ("*That was one of the best performances we have had*"). The positive feedback was given irrespective of the participant's actual performance. Learning took place in the evening before in-home sleep (measured by actigraphy). Two recalls were scheduled after learning: 12 hr and about one month later. No additional reinforcement was given at any of the recalls

Results: Positive reinforcement immediately following learning improved consolidation of the newly acquired motor memory ($p < 0.05$), as indicated by the gain in finger tapping performance across the post-learning night. Strikingly, the difference in the gain in procedural memory between the reinforcement and control group was still seen after one month. Sleep parameters collected during and after the post-learning night, such as total sleep time and subjective sleep quality, did not correlate with overnight consolidation of the motor memory.

Conclusions: Our findings suggest that positive reinforcement during learning of a motor task is a simple intervention to boost motor memory recall performance in students, both in the short and in the long term.

Disclosure: Nothing to disclose.

SLEEP DEPRIVATION 1

P359 | The effect of sleep deprivation on recognition of ambiguous emotional facial expressions in individuals with ADHD

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Objectives/Introduction: The present study sought to investigate whether young adults with ADHD have more difficulty recognizing emotional facial expressions compared with young adults without ADHD, and whether such a difference worsens following sleep deprivation.

Methods: Thirty-one young men (M = 25.6) with (*n* = 15) or without (*n* = 16) a diagnosis of ADHD were included in this study. The participants were instructed to sleep 7 hr or more each night for one week, and their sleep quality was monitored via actigraph. Subsequently, the participants were kept awake in a controlled environment for 30 hr. The participants completed a visual emotional morph task twice—at the beginning and at the end of this period. The task included presentation of interpolated face stimuli ranging from neutral facial expressions to fully emotional facial expressions of anger, sadness or happiness, allowing for assessment of the intensity threshold for recognizing these facial emotional expressions.

Results: At the onset of the experiment there were no differences in recognition thresholds between the participants with ADHD and those without ADHD. Following sleep deprivation, however, the ADHD group required clearer facial expressions to recognize the presence of angry, sad, and, to a lesser extent, happy faces.

A significant Time × ADHD interaction was found for angry emotional recognition threshold (ERT) [F (1,27) = 21.55, $p < 0.01$, eta = 0.44]. Similarly, a significant Time × ADHD interaction was found for sad ERT [F (1,27) = 11.75, $p < .01$, eta = 0.30]. Finally, a significant Time × ADHD interaction was found for happy ERT [F (1,27) = 7.49, $p < 0.05$, eta = 0.22].

Conclusions: Among young adults with ADHD, sleep deprivation may hinder the processing of emotional facial stimuli.

Disclosure: Nothing to disclose.

P360 | The sleepiness curve of young men with and without Attention Deficit Hyperactivity Disorder (ADHD)

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Objectives/Instruction: The present study aimed at comparing the sleepiness curve of young men with ADHD to that of young men without ADHD, and to examine whether ADHD is associated with heightened sleepiness in general, and during and after a night of sleep deprivation in particular.

Methods: Thirty young men (M = 25.5) with (*n* = 14) or without (*n* = 16) a diagnosis of ADHD were included in this study. Five days prior to the experimental session, participants were instructed to sleep at least 6 hr each night and their sleep quality was monitored via actigraph. During the experimental session, participants were kept continuously awake in a controlled environment for 25 hr (8 a.m.–9 p.m.). Every hour the level of sleepiness of the participants was assessed by the Karolinska Sleepiness Scale (KSS) in order to obtain the sleepiness curve of both study groups.

Results: Actigraphy data demonstrated that sleep duration of the participants with ADHD was similar to that of participants without ADHD but their sleep efficiency was poorer. Moreover, during the experimental session the ADHD group demonstrated higher levels of sleepiness at all time points, with the difference reaching statistical significance during afternoon (1–5 p.m.) and following 2 p.m. Specifically, both groups demonstrated a steady increase in sleepiness from midnight to 9 a.m. but the increase was significantly greater among the ADHD participants.

Conclusions: Young men with ADHD suffer from sleepiness more than their counterparts from the general population, and the magnitude of this difference depends on the time of day and is severely aggravated by sleep deprivation.

Disclosure: Nothing to disclose.

P361 | The effect of short sleep on lipid metabolism in Japanese university students

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Objectives/Instruction: Sleep deprivation is common among the current society and has several adverse effects, such as changes in metabolism and inflammatory response, dyslipidemia, and cardiovascular disease. The recent development of mass-spectrometry-based methods to resolve complex lipid components is having a profound effect on current approaches to analyzing the pathophysiological role of lipid species. In this study, we investigated the effect of short sleep on lipid metabolism in healthy university students.

Methods: Sixteen healthy university students enrolled in this study. We selected participants who usually sleep between 6 and 8 hr nightly according to sleep logs. We obtained informed consent in writing from each participant after the nature of the procedures had been fully explained. On natural-sleep nights, subjects were in bed for 8 hr (natural sleep), and on controlled-sleep nights, they were allowed to be in bed between only between 3 a.m. and 7 a.m.,

limiting their total sleep time to less than 4 hr (short sleep). Lipid from plasma was evaluated using liquid extraction surface analysis with nanoelectrospray ionization mass spectrometry (LESA-MS). Data were analysed with a chi-square test using statistical software (SPSS ver. 25, IBM). Probability (p) values of <0.05 were considered statistically significant.

Results: LESA-MS detected more than 700 lipid molecule species from seven lipid classes, including phosphatidylcholines (PC), phosphatidylethanolamines (PE), phosphatidylserine (PS), sphingomyelin (SM), triacylglyceride (TAG), phosphatidylinositols (PI), phosphatidylglycerols (PG), and sphingomyelins (SM). We identified 20 significantly different lipid species in five classes including PC, PE, PS, SM and TAG between natural sleep and short sleep.

Conclusions: The association of short sleep duration with molecular lipid species reflects the importance of changes in lipid homeostasis in the pathogenesis of sleep deprivation.

Disclosure: Nothing to disclose.

P362 | Homeostatic response to sleep restriction in adolescents

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Objectives/Introduction: As chronic sleep restriction is highly prevalent in adolescents, it is important to understand how adolescent sleep is regulated under such conditions. In adults, sleep intensity is homeostatically regulated: if sleep is restricted, then sleep intensity increases. Our knowledge of this process is primarily informed by total sleep deprivation studies and has been incorporated in mathematical models of human sleep regulation. Some animal studies, however, suggest that adaptation occurs in chronic sleep restriction conditions. Our goal was to investigate sleep regulation in adolescents undergoing different durations of sleep opportunities.

Methods: 34 subjects were divided into three groups: 5, 7.5 and 10 hr of sleep opportunity. Each group underwent a protocol of 9 nights mimicking a school week between 2 weekends: 2 baseline nights (10 hr sleep opportunity), 5 condition nights (5, 7.5 or 10 hr), followed by two recovery nights (10 hr). Markers of sleep homeostasis, slow-wave activity (SWA; EEG power in 0.75–4.5 Hz range) and slow-wave energy (SWE; cumulative SWA) were calculated for frontal and central EEG derivations and compared to predictions of the two-process model of sleep regulation.

Results: The protocol was effective in restricting sleep, with decreased TST and sleep latency, and increased sleep efficiency in all nights in the 5-hr and 7.5-hr conditions. Time in REM sleep was decreased in all restriction nights in the 5-hr condition and most nights in the 7.5-hr condition. Frontal SWA was increased compared to baseline in the 5-hr condition during the first 3 restriction nights (p = 0.001). In central derivations, SWE was significantly below baseline in restriction nights 1 and 5 in the 5-hr (p = 0.013) and 7.5-hr condition (p = 0.033). Predictions of the two-process model were accurate, with only minor differences (frontal derivations) compared to empirical homeostatic markers.

Conclusions: Sleep homeostasis is preserved under chronic sleep restriction in adolescents. These findings improve our understanding of effects of repetitive short sleep in adolescents.

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Disclosure: Nothing to disclose.

P363 | Intrinsic nonlinearity of psychomotor vigilance test metrics as a function of hours awake during sleep deprivation

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Objectives/Instruction: The Psychomotor Vigilance Test (PVT) measures sustained attention through speeded responses to visual stimuli (rolling millisecond counter), which appear at random 2–10 s intervals across a 10 min test period. Performance impairment on the PVT during sleep loss can be quantified with a variety of outcome metrics, which describe different aspects of the response time (RT) distribution. We investigated the psychometric properties of previously published PVT outcome metrics. Here we focus on the extent to which they show linear change as a function of time awake.

Methods: N = 23 healthy subjects (ages 22–37 years, 12 females) completed one of two in-laboratory studies with a sleep opportunity (10 hr time-in-bed) followed by 62 hr of total sleep deprivation (TSD). The PVT was administered every 2 hr during TSD. Thirty-six outcome metrics were calculated for each PVT bout. Analyses focused on daytime test bouts that occurred at 3 time points during TSD on the same time of day (i.e., at 24 hr intervals, keeping time of day constant). Data were analyzed with nonlinear mixed-effects regression against time awake and time awake squared, controlling for study and time of day, and including a random intercept over subjects. Curvature was calculated as the metric deviation from linearity from time point 2 to time point 3 divided by the linear slope from time point 1 to time point 2, where zero curvature indicates perfect linearity across time awake.

Results: In total, 23 subjects completed 267 test bouts. The smallest curvatures (i.e., greatest linearity across time awake) were found

for a likelihood ratio metric for relative RT frequency in three portions of the RT distribution (curvature ± SE: 0.01 ± 0.22; $t = 0.03$, $p = 0.97$), the log of the SD of RTs (0.01 ± 0.18; $t = 0.05$, $p = 0.96$), and six metrics based on the number of lapses (RTs >500 ms) ($t \leq 0.25$, $p \geq 0.80$).

Conclusions: The degree of linearity across time awake varied greatly among the 36 PVT outcome metrics investigated. Metrics based on the number of lapses were among the most linear, indicating that performance impairment observed on these types of PVT metrics is robustly proportional to the amount of sleep deprivation incurred.

Disclosure: Nothing to disclose.

P365 | Cognitive performance and self-reported sleepiness are modulated by time-of-day during a mountain ultramarathon

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Objectives/Instruction: Studies examining performance during an ultramarathon have primarily used race time or ranking as dependent variables. Few studies have examined cognitive performance or sleepiness during an ultramarathon. Ultramarathon studies with measures of cognitive performance or sleepiness have largely been limited to pre-race and/or post-race assessments. We examined cognitive performance and self-reported sleepiness throughout a mountain ultramarathon (MUM).

Methods: Ninety-two runners completed the study during a 168 km MUM. Sleepiness and cognitive performance were assessed at up to eight checkpoints during the race using the Karolinska Sleepiness Scale (KSS) and correct responses on the Digital Symbol Substitution Task (DSST), respectively. Runners also reported any sleep obtained on the course at the checkpoints. Hours of sleep obtained the night before the race were also reported. KSS and DSST data were analyzed with nonlinear mixed-effect regression models with a sinusoidal function to model the circadian rhythm, time-into-race and cumulative on-course nap duration as main effects, and a random intercept over subjects.

Results: Runners reported 7.24 ± 0.92 hr (mean ± SD) of sleep the night before the race, and 14.40 ± 9.60 min of sleep during the race (77% of runners reported a nap). Average KSS and DSST scores at the start line were 1.89 ± 0.97 and 39.30 ± 7.40, respectively. Average KSS and DSST scores at the finish line were 2.78 ± 2.10 and 34.12 ± 8.69, respectively. KSS ratings peaked at 03:15, and DSST scores peaked at 15:15. KSS scores increased significantly and DSST scores decreased significantly across the course of the race ($t > 2.94$ $p < 0.01$). Amount of sleep obtained on the course was not a significant predictor of KSS scores ($t_{91} = 1.53$, $p = 0.13$), but the amount of sleep obtained on the course was significantly and negatively associated with DSST scores ($t_{87} = -2.32$, $p = 0.02$).

Conclusions: Sleepiness and performance decrements increased across the course of the race and were modulated by time-of-day. Amount of sleep obtained on the course was not related to sleepiness levels. Runners who slept on the course prior to testing, however, had poorer cognitive performance, which may suggest that naps were not a fatigue mitigation strategy but a result of physical exertion.

Disclosure: Nothing to disclose.

P366 | Chronic sleep restriction only reduces performance when it accrues rapidly

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Objectives/Introduction: Laboratory research shows a strong relationship between chronic sleep restriction (CSR, where sleep is curtailed night after night) and reaction time performance. There has, however, been limited research investigating the extent of CSR in occupational settings and the consequences for workers' functioning.

Methods: Air traffic controllers (ATCs) worked a schedule that included two sets of backward rapidly rotating shifts (afternoon, day, morning, night shift beginning the day the morning shift ends, ×2), and a second schedule that included a longer forward rotating work pattern (2 morning, 2 afternoon, 2 night shifts). Sleep was measured via actigraphy and reaction time performance at the end of each night shift with a 10-min Psychomotor Vigilance Task test (PVT). CSR was determined by comparing sleep per 24-hr on work days to non-work days. Sleep lost or gained each 24-hr was summed to produce a CSR value at the end of the work period, which could not be greater than zero (assuming that sleep cannot be stored). Mixed model ANCOVAs investigated whether the level of CSR, sleep in the last 24-hr, workload, schedule worked, or the interaction of factors affected performance at the end of the night shift.

Results: ATCs ($n = 13$, mean age = 48, 11 males) obtained 7.6 hr sleep on average on non-work days. CSR averaged 4.4 hr (SD 1.5 hr) and 4.5 hr (SD 1.6 hr) across the two backward rotating work periods, and 7.4 hr (SD 3.2 hr) across the forward rotating work period. A significant interaction was found between the schedule worked

and CSR for response speed (p = 0.0021) and fastest 10% of responses (p = 0.0061), with greater CSR associated with slower performance in the backward rotating schedule but not in the forward rotating schedule.

Conclusions: These findings suggest that the way in which sleep loss accumulates may be more important than the actual amount of sleep loss accrued across a work pattern. In the backward rotating schedule CSR builds more rapidly compared to the forward rotating pattern, which may allow some opportunity for partial adaptation to the effects of CSR.

Disclosure: Support: This study was industry funded. T. Leigh Signal declares no conflict of interest. Jennifer Zaslona declares no conflict of interest. Margo van den Berg declares no conflict of interest. Lora Wu declares no conflict of interest.

P367 | The alerting effects during the wake maintenance zone vary with prior duration of wakefulness

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Objectives/Instruction: Sleepiness does not simply increase the longer one stays awake, instead it is regulated by a homeostatic and a circadian process. In the evening, prior to the dim light melatonin onset, there is a strong circadian arousal signal that opposes the homeostatic build-up of sleepiness, called the Wake Maintenance Zone (WMZ). The aim of this study was to investigate how the WMZ affects different cognitive performance tests, as well as subjective and objective sleepiness after different durations of prior wakefulness.

Methods: Twelve young male participants (25.3 ± 2.6 yrs; mean ± SD) completed a constant routine protocol with 40 hr of extended wakefulness in dim light, including two WMZs. A range of cognitive performance tests were assessed, including sustained attention, response inhibition, working memory and executive functioning. The cognitive tests were divided in two parts which alternated every hour so that each cognitive performance tests was carried out every 2 hr. Subjective sleepiness, salivary samples for melatonin concentrations and the Karolinska Drowsiness Test (3 min; open eyes) in the electroencephalogram (EEG) were assessed hourly.

Results: Cognitive response inhibition was improved during WMZ1 (13.5 hr awake) and sustained attention was improved during WMZ2 (37.5 hr awake), while higher executive function tests showed no significant improvements. The EEG power density showed significant reductions in the delta/theta frequency range during WMZ1 and in the delta/theta, alpha, and sigma/beta ranges during WMZ2, with a greater change in the sigma/beta range during WMZ2 compared to WMZ1. During WMZ1 the EEG power reductions coincided with stable subjective sleepiness and sustained attention. During WMZ2, the EEG power reductions were more pronounced and coincided with improved sustained attention.

Conclusions: Our results show that the circadian arousal signal in the evening differently modulates cognitive functions and EEG power, depending on the duration of prior wakefulness.

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P368 | Effect of a single night of total sleep deprivation and a night of recovery sleep on plasma melatonin and cortisol profiles and the metabolome

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Objectives/Introduction: Disruption to sleep and the circadian timing system can impact metabolism. The aim of this study was to investigate the effect of a single night of sleep deprivation and a subsequent recovery night on melatonin, cortisol and the metabolome in young females to increase understanding of metabolic pathways involved in sleep/wake regulation.

Methods: Healthy young female subjects (n = 12, 24.8 ± 1.3 years (mean ± SEM)) maintained a regular sleep/wake schedule for 10 days prior to an in-laboratory session, comprising a 24-hr period (day 1) incorporating a sleep opportunity (23:00–07:00 hr), followed by 24 hr during which subjects remained continually awake (day 2) and another 24-hr period (day 3) which incorporated a recovery sleep opportunity. Blood samples were collected for 72 hr at 1–2 hr intervals for measurement of plasma melatonin, cortisol, and targeted liquid chromatography-mass spectrometry (LC/MS) metabolomics analysis. Night timepoints between 00:00 and 06:00 hr for day 1 (baseline sleep), day 2 (no sleep) and day 3 (recovery sleep) were analysed using repeated one-way ANOVA.

Results: The dim light melatonin onset time on day 1 was 21:56 ± 0:14 hr and this did not significantly change between study days (22:02 ± 0:14 hr; day 2, 21:54 ± 0:11 hr; day 3). Mean nighttime melatonin levels showed a trend to increase during sleep deprivation (19.0 ± 6.9%, p = 0.07) relative to baseline sleep, these levels declining back to baseline during recovery sleep. No significant

differences were observed in cortisol levels. Using targeted LC/MS metabolomics, 130 plasma metabolites were quantified. Of these, 6 (4.6%) metabolites were significantly changed between baseline sleep and sleep deprivation, 5 (histidine, butyrylcarnitine, symmetric dimethylarginine, alpha-aminoadipic acid, lysoPC a C18:0) decreasing and 1 (tetradecenoylcarnitine) increasing. These levels returned to baseline during recovery sleep. Some metabolites were significantly altered during recovery sleep compared to baseline sleep (n = 22, 16.9%).

Conclusions: Melatonin and metabolites that were altered during acute sleep deprivation returned to baseline levels during a subsequent night of recovery sleep.

Disclosure: Nothing to disclose.

P369 | Sleep deprivation alters affective and neural responses to erotic stimuli in heterosexual males

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Objectives/Introduction: Based on recent data evidencing the impact of sleep loss on reward brain functions, here we hypothesized that sleep deprivation may alter behavioral and neural responses to primary rewards, here specifically sexual stimuli.

Methods: Seventeen healthy young heterosexual men underwent functional neuroimaging (fMRI) while they were exposed to five categories of pictures: erotic pictures of only women, only men, heterosexual couples, non-erotic pictures of people, and landscapes. For each picture, participants judged the level of emotional arousal elicited and perceived emotional valence. Each participant was tested after a night of normal sleep (baseline) and following 24 hr of total sleep deprivation.

Results: Arousal judgments were affected by sleep deprivation (main effect of Sleep, F (1,16) = 5.34, $p < 0.05$), and stimulus type (main effect of Stimulus Category, F (4,64) = 86.75, $p < 0.05$), with a tendency for an interaction between both factors (F (4,64) = 1.85, p = 0.13). Post-hoc analyses showed that arousal for pictures of men was significantly reduced after sleep deprivation compared to baseline (p = 0.01), with a tendency for a similar effect for pictures of women (p = 0.09). For valence, there was a tendency for main effect of Sleep (F (1,16) = 3.73, p = 0.07), a significant main effect of Stimulus Category (F (4,64) = 112.34, $p < 0.05$), and no interaction (F (4,64) = 0.77, ns). At the brain level, sleep deprivation reduced brain responses to erotic pictures of women in the ventromedial prefrontal cortex, implicated in computing the hedonic value of rewards. Critically, sleep deprivation increased amygdala activation when individuals rated the erotic pictures as more arousing, and decreased left prefrontal cortex activity for pictures judged as more positive (i.e. erotic pictures of women).

Conclusions: While sleep deprivation did not affect judgments for highly salient stimuli, such as erotic pictures of women, it did affect reward and executive brain functions. Indeed, sleep deprivation increased amygdala reactivity to arousing stimuli and limited the recruitment of prefrontal regions involved in behavioral inhibition when facing erotic pictures of women. Whether this pattern of activation may facilitate the enactment of inappropriate sexual behaviors after sleep deprivation remains speculative.

Disclosure: Nothing to disclose.

P370 | Work organization reduces sleep quality among airline pilots

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Objectives/Instruction: To estimate the prevalence and risk factors of work organization associated with bad sleep quality among pilots.

Methods: 1,234 airline pilots filled in an online questionnaire. Independent variables included demographic data, working organization aspects, health, and sleep information. A question derived from the Karolinska Sleep Questionnaire was used to obtain the subjective quality of sleep. Poisson regression with robust variance was performed, adjusted by gender, age, having children under 12 years of age, education, BMI and marital status.

Results: The prevalence of bad sleep quality was 48.2%. Bad sleep quality was associated with the high frequency of technical delays (PR 1.14, CI 95% 1.01–1.28), five or more consecutively night shifts (PR 1.33, CI 95% 1.09–1.62), moderate and great need for recovery after work (PR 1.96, CI 95% 1.60–2.41, and PR 2.38, CI 95% 1.94–2.91, respectively), difficulty to commute to work (PR 1.19, CI 95% 1.04–1.38), being insufficiently physically active (PR 1.17, CI 95% 1.05–1.32) and sleeping 6–8 hr and less than 6 hr on days off (PR 1.16, CI 95% 1.03–1.13, and PR 1.59, CI 95% 1.31–1.93, respectively) (Area ROC = 0.73).

Conclusions: Pilots′ daily work, consisting of frequent delays, long working hours and the perception of unsuficient work demand recovery has a negative impact on the quality of sleep of these professionals. The high prevalence of bad sleep quality is worrying as it can lead to poor health conditions, as well as decreased performance and compromised flight safety.

Disclosure: Nothing to disclose.

P371 | Decreased inhibitory control after partial sleep deprivation in individuals reporting binge eating

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Objectives/Instruction: Impairments in executive functions (EFs) have been shown to be associated with dysregulated eating, such as binge eating. Poor EFs have been linked to greater caloric intake in both healthy children and adults. In parallel, experimental findings suggested that sleep deprivation markedly impairs EFs. The aim of this study was to evaluate if partial sleep deprivation may impair EFs in a group of individuals reporting binge eating (BE) and in a group of healthy controls (C).

Methods: EFs (switch cost and backward inhibition) were measured in the laboratory using the Task Switching Paradigm after a habitual night of sleep and after a night of partial sleep deprivation. Sleep was ecologically measured trough an electronic portable device and sleep diaries. Depression was measured by a self-report questionnaire.

Results: The total sample consisted of 27 participants divided in two groups (BE, $N = 14$; C, $N = 13$). Results showed a significant interaction Night × Group (F (1,25) = 4.68, $p = 0.04$) even after controlling for depression (F (1,24) = 6.96, $p = 0.014$) on the backward inhibition score. First, LSD post hoc tests showed that the two groups differed in the habitual night (F (1,24) = 6.32, $p = 0.019$), evidencing higher inhibitory control in BE group compared to C group. Second, LSD post hoc tests showed that after partial sleep deprivation, compared to the habitual night, backward inhibition was decreased in BE group (F (1,24) = 4.69, $p = 0.04$), while in the C group it was higher (F (1,24) = 3.60, $p = 0.07$).

Conclusions: This preliminary study was the first to explore the impact of sleep deprivation on executive functions in participants reporting binge eating symptoms and healthy controls. It demonstrated that sleep deprivation may affect inhibitory control in participants reporting binge eating symptoms, thus highlighting their potential mediating role in influencing eating behavior.

Disclosure: Nothing to disclose.

P372 | State anxiety over 62 hours of sleep deprivation and recovery

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Objectives/Instruction: Previous work has indicated increases in self-reported anxiety following one night of total sleep deprivation (TSD). This study extends previous work by assessing the effects of two nights of sleep deprivation on state anxiety as well as the effect of a single night of recovery sleep.

Methods: Seventeen healthy adults (7 females) ranging from 18 to 33 years of age participated. Self-reported state anxiety was assessed using the Spielberger State Trait Anxiety Inventory (STAI-S). The STAI-S was administered at 10 a.m., 1 p.m., and 4 p.m. under four sleep conditions

(1) Baseline: day following one night of 8 hr time-in-bed (TIB),
(2) TSD1: day following one night of TSD,
(3) TSD2: day following two nights of TSD,
(4) Recovery: day following 12 hr TIB after 62 hr of TSD.

The data were analyzed with a 4 (Sleep Condition) × 3 (Time of Day) mixed linear model.

Results: There was a significant main effect of Sleep Condition, F (3,192) = 15.94, $p = 2.70 \times 10^{-9}$. Post-hoc tests revealed that anxiety was significantly increased after one night of TSD compared to baseline ($p = 0.009$). Additionally, anxiety reported following two nights of TSD was further increased compared to one night of TSD ($p = 0.0008$). This increase in self-reported anxiety was reversed after one night of recovery sleep (decreased compared to TSD2, $p = 2.50 \times 10^{-9}$; no difference compared to baseline, $p = 0.37$). There was no main effect of Time of Day nor was there a significant interaction between Sleep Condition × Time of Day.

Conclusions: The present findings suggest that state anxiety levels, as measured by the STAI-S, increase across two nights of TSD and return to baseline following a single night of recovery sleep. These preliminary findings suggest that a single 12-hr period of sleep is sufficient for restoring baseline levels of state anxiety - a finding that has implications for determining appropriate 'recycle rates' (duration between mission) for Soldiers and others involved in continuous operations.

Disclosure: Nothing to disclose.

P373 | Specified brain states determined by dynamic functional connectivity occur with higher frequencies after 52 hours sleep deprivation compared to recovery

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Objectives/Introduction: Resting-state fMRI (rs-fMRI) studies demonstrated sleepiness could induce brain functional dysconnectivity associated with the cognitive abnormalities. Currently, a dynamic

functional connectivity (FC) approach allows us to estimate the covariances across a series of short sliding windows and generate corresponding brain states using *k*-means clustering. In this way, the dynamic FC differences during rs-fMRI scanning can be well characterized. The aim of this study is to investigate how the brain states are dynamically altered by sleep deprivation in comparison to sleep recovery.

Methods: We recruited 14 right-handed males (Age: 28.21 ± 5.21 years) with sleep durations ranging from 7 to 8.5 hr. MRI datasets and sleepiness severity were acquired after 52 hr sleep deprivation and 14 hr of recovery sleep. We preprocessed the rs-fMRI data with first 5 volumes deletion, realignment, slice-timing and motion correction, normalization with DARTEL and spatial smoothing. Using the Group ICA Of fMRI Toolbox (GIFT), 34 components were identified. We then applied a sliding window of 22 images (TRs) with a step of 1 TR to calculate the covariances. Number of clusters was determined using the elbow criteria and brain states were estimated with *k*-means algorithm. Then, we statistically compared the group-differences on the mean dwell time, fraction of states and number of transitions.

Results: We observed four brain states and a significantly higher number of transitions ($p = 0.017$) after sleep deprivation. Interestingly, state 4 was present only after sleep deprivation. However, the mean dwell time and fraction of state 2 were significantly increased after recovery sleep ($p = 0.026$; $p = 0.034$). Correlational analysis further revealed sleepiness was negatively correlated with mean dwell time and fraction of state 1 ($p = 0.003$, $r = -0.727$; $p = 0.002$, $r = -0.744$) but positively associated with fraction of state 4 ($p = 0.038$, $r = 0.558$). At last, we replicated our brain states across different windows size and numbers of clusters.

Conclusions: These results suggest 52 hr sleep deprivation leads to a higher number of transitions of FC brain states compared to rested wakefulness which might be caused by a specific state associated with drowsiness or light sleep.

Disclosure: Nothing to disclose.

METHODOLOGY & COMPUTATION 2

P374 | Comparison between the use of APAP and manual titration during split night polysomnography for diagnosis and treatment of OSA

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Objectives/Instruction: Is to compare between the use of APAP and manual titration to determine the needed CPAP pressure during split night polysomnography for diagnosis and treatment of OSA.

Methods: 100 patients with severe OSA were enrolled after exclusion of patients with heart failure or respiratory failure. After diagnostic polysomnography, patients were divided into 2 groups: group1 offered manual CPAP titration and Group2 offered APAP titration, the time for CPAP titration was at least 4 hr in both groups.

Results: Both groups were matched as regard age, gender, BMI, sleep parameters and AHI (44.52 ± 7.81/hr in group1 and 42.66 ± 9.68/hr in group2 with no statistical significance, after CPAP titration AHI was significantly improved in both groups, the time needed to reach the therapeutic pressure was significantly lower in group2 than in group1, attended technician was needed only in group1.

Conclusions: Use of APAP was equal to manual titration in this group of patients with severe OSA, with decreased cost and lesser time to reach the therapeutic pressure, large multicenter trials are needed to update the guidelines in view of using APAP in split night protocol for diagnosis and treatment of severe uncomplicated cases of OSA.

Disclosure: Nothing to disclose.

P375 | Outcomes of TORS as part of multilevel surgery in select OSA patients

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Objectives/Instruction: TORS has found to be the best sleep surgery procedure so far. It is a novel technique involving surgical resection of base of tongue. TORS for base of tongue resection with or without epiglottoplasty and palatoplasty or septoplasty depending upon the need has changed the overall outlook and outcome of sleep apnea surgeries.

Methods: Surgical outcomes of 50 patients have been studied at our centre post TORS procedure. Inclusion criteria begin all patients aged above 18 years, with mild, moderate or sever OSA but with AHI levels not exceeding 45/hr and BMI less than 35 and with CPAP intolerance or non -acceptance. All underwent PSL and DISE prior to surgery. All were primary cases for TORS. Oher than AHI, Oxygen desaturation index, ESS, pre and post treatment for blood pressure, pre and post treatment sugar control, reduced or absent snoring and overall improvement in Quality of life were analyzed for outcomes.

Results: Almost all patients post surgery had no snoring or diminished snoring. 18 patients were on anti hypertensives prior to surgery out of which 16 patients did not require the drugs post surgery. 15 patients were diabetic and all of them had better sugar control post operatively except one. Quality of life improved significantly in 60% cases. Improvement in AHI were noticed in 50% of patients.

Conclusions: TORS is an effective modality in non CPAP compliant patients with acceptable outcomes and in some significant

improvement in quality of life. However meticulous attention is paid to selection of cases.

Disclosure: Nothing to disclose.

P376 | Agreement of mobile app with SleepSense and polysomnography in patients with sleep-disordered breathing

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Objectives/Introduction: SleepSense is a recently developed non-contact home sleep monitoring device using mobile application. It detects the heartbeat, respiration rate and accelerates motions, then it estimates sleep-wake pattern as well as sleep structure by their algorithm. To validate the reliability of this SleepSense, we conducted the comparison and agreement analyses between SleepSense and PSG for various sleep parameters.

Methods: 36 participants who are complaining of sleep disturbances for more than 3 months underwent one-day full night PSG with mobile app and SleepSense on the mattress. Sleep parameters (time in bed [TIB], total sleep time [TST], sleep onset latency [SOL], sleep efficiency [SE], wakefulness after sleep onset [WASO min] and sleep structure [% NREM, REM sleep]) were compared. Wilcoxon Signed-Rank test was used for the intergroup comparisons of parameters. Agreements among parameters were assessed with intraclass correlation coefficient (ICC) and 95% confidence interval.

Results: Mean age of participants were 46.5 ± 14.8 y. Mean apnea-hypopnea index (AHI) was 22.7 ± 17.8/h. Mean values of TIB, TST, SE and WASO between PSG and SleepSense were not statistically different. Sleepsense overrated SOL (24.8 ± 21.25 min vs.15.5 ± 29.40 min, $p < 0.001$) and N3 sleep (17.9 ± 13.04% vs.5.1 ± 5.52%, $p < 0.001$) while it underestimated REM sleep (12.8 ± 7.58% vs.19.4 ± 6.36%, $p < 0.001$) and light sleep (N1 + N2 sleep) (52.2 ± 15.60% vs.73.6 ± 14.73%, $p < 0.001$) than PSG. In the correlation analyses, TIB showed a good agreement (ICC 0.964) between two devices. However, other parameters did not show good agreement (ICC < 0.700). According to the severity of sleep-disordered breathing (SDB), two groups (AHI ³ 15/h, $n = 22$ & AHI < 15/h, n = 14) were assessed. Both groups showed a satisfactory agreement in the estimation of TIB (ICC > 0.930). In addition, in group of AHI < 15 demonstrated the significant agreement in the TST (ICC 0.925) and WASO (ICC 0.847) between two devices.

Conclusions: Agreement of mobile app with SleepSense is useful to that of PSG for differentiating sleep status from wakefulness. Estimation of sleep stage by SleepSense is limited yet. The presence of SDB may affect the assessment of sleep-wake and sleep structures with this contactless sleep monitoring device.

Disclosure: Nothing to disclose.

P377 | Methods for detecting abnormal ventilation in children with snoring and with different genetic features

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Objectives/Introduction: Detecting respiratory effort and hypoventilation in children is demanding. In polysomnography recordings (PSG) respiratory effort is assessed with esophageal pressure measurement (pESO), but requires use of uncomfortable trans-nasal pressure sensor catheter. Indirect methods such as inductive abdominal/thoracic belt sensors and surface electromyography (EMG) of respiratory muscles can be used, but tend to interfere with subject's sleep and normal activity during the test. Neither the belts nor EMG provides qutitative measure for respiratory effort. In this study we tested noninvasive sensors, which were compared to traditional ones.

Methods: We made PSG for 12 children with snoring, including one with Pitt-Hopkins (PHS), and another with Russel-Silver syndrome (RSS). PHS is known to alter the neural structure of respiratory centers and cause a unique type of hyperventilation. RSS causes growth reduction thus potentially affecting the diameters of respiratory structures. These syndromes challenge the recording systems in very different ways. The acquisitions made include conventional PSG channels with simultaneous etCO2 measurement and video monitoring (Embla, Natus Medical Inc., USA). Some subjects had video recording with depth sensor (Neuro Event Labs, Finland), tracheal microphone (PneaVox, Cidelec, France) for detection of breathing sounds. All recordings include electromechanical film transducer (Emfit, Finland) mattress for movement and sleep-disordered breathing estimation. Mattress signal, which isvalidated against pESO, provides information of increased respiratory effort and prolonged partial obstruction.

Results: The PSG results were analysed and snoring was estimated in relation to tracheal microphone analysis and increased respiratory effort in mattress signal. The depth sensor analysis was done off-line, from intervals of interest to develop analysis methods for online monitoring. The PHS patient had hyperventilation during wake, which was detectable with the standard instrumentation. The analysis showed that our depth sensor instrumentation needs modification. Belts can detect respiratory movements and frequency easily, as in RSS patient, but continuous movement artifacts as in PHS patient represent serious challenge for effective monitoring.

Conclusions: Video recordings with depth sensors can be used for real-time monitoring of breathing parameters like frequency and amplitude. It will however continue to be challenging to develop wearble probes for children in particular, that can measure breathing parameters during wake and sleep.

Disclosure: Nothing to disclose.

P378 | Evaluation of home polysomnography for making a sleep diagnosis

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Objectives/Introduction: Clinical polysomnography (C-PSG, type 1) is the golden standard for investigating sleep disorders. The disadvantages of a C-PSG are a possible first night effect and high costs. An alternative for a C-PSG is the home polysomnography (H-PSG, type 2). By performing two consecutive 24 h H-PSG we investigated if the first night effect occurs and if a second consecutive H-PSG is necessary to come to a correct sleep diagnosis. We also investigated if possible sensor loss influences the diagnostic process using H-PSG.

Methods: A retrospective study was performed on the data of patients visiting our tertiary sleep center. Analysis was performed on the sleep parameters of the first and second night for the total group of patients who underwent this investigation between January and December 2013. Statistical analysis was performed by paired-samples T-Test. The sensor loss preventing the interpretation of the signals parameters were documented.

Results: A total of 262 patients (47.3% male, 46.1 ± 14.7 yrs) were identified and all were included. The results of the total group show significant differences in the following sleep variables, when comparing night 2 with night 1: a decrease of Time in Bed (Δ-17,4 ± 72,1 min; $p = < 0{,}0001$), Total Sleep Time (Δ-10,8 ± 86,6 min; $p = 0{,}04$), Awakenings (Δ-1,6 ± 11,6 per h; $p = 0{,}02$), REM onset latency (Δ-7,4 ± 55,9 min; $p = 0.03$), Sleep Stage NREM 2 (Δ-10,3 ± 54,3 min; $p = 0{,}002$), and increase of Sleep Stage NREM 3 (Δ+3,7 ± 29,2 min; $p = 0.04$). The results did not show a significant difference for Apnea Hypopnea Index, Oxygen Desaturation Index, and PLMI. Ninety-six percent of the H-PSG was of good quality to use for clinical purpose. In the 4% of H-PSGs with a technical problem, the most frequent problem was loss of the saturation signal, 21% of all, and the least frequent loss of the EEG signal, only 3%.

Conclusions: We conclude that when using H-PSG the first night effect does not occur. The small differences in sleep parameters do not influence the diagnostic process. Therefore, a 24 h H-PSG has an advantage when compared to C-PSG. Moreover, this study found that there is a low risk of sensor failure of the H-PSG within a clinical population, which makes it a good alternative for clinical PSG.

Disclosure: Nothing to disclose.

P379 | A novel home-based strategy for obstructive sleep apnoea detection in paediatrics

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Objectives/Introduction: Obstructive sleep apnoea (OSA) in children is a respiratory disorder caused by an obstruction in the upper airway leading to disrupted breathing during sleep. The gold standard for diagnosis is polysomnography (PSG) conducted overnight in a sleep lab. However, the cost, availability and the equipment necessary can be restrictive and the method is not ideally suited to young children. The aim of this project is the development of a simple multi-sensor system for OSA detection which can be used easily in the patient's home yet provide useful physiological information to clinicians to assist in their clinical assessment.

Methods: To simplify the system from the comprehensive approach used in PSG, sensors have been selected which could easily be integrated into a wearable garment, such as a t-shirt, reducing the need for expert-setup. The sensors were selected to be unobtrusive to movement and be discreet for wear by young children. The proposed system incorporates microphones positioned over the trachea to monitor airflow while stretch sensors around the chest and abdomen identify respiratory effort. Accelerometers are integrated to identify sleep position and movement for artefact rejection and pulse oximetry will be included to detect periods of oxygen desaturation and pulse.

Results: Initial bench testing of the prototype system found a positive correlation between airflow information recorded via the microphones and respiratory related movement from the stretch sensors in 10-min recordings from a single individual repeated 10 times, r (Mean (SD)) = 0.997 (0.002). The calculated respiration rate measured by both methods also showed a positive correlation to the actual rate (metronome used to instruct inhalation and exhalation), (stretch sensors) $r = 1$, $n = 10$, $p < 0.01$ (microphone) $r = 0.919$, $n = 10$, $p = 0.03$.

Conclusions: Early work demonstrates the potential of a simple but novel multi-sensor platform designed for home use in detecting OSA events. The next stages of this study will involve testing the prototype sensor system with a population of non-symptomatic individuals and in parallel with an established sleep lab PSG system and development of a suite of suitable algorithms for automatic OSA event detection.

Disclosure: This project is funded by Glasgow Children's Hospital Charity.

P380 | Psychometric properties of the Chinese Epworth Sleepiness Scale among individuals with depressive symptoms: a confirmatory factor analysis

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Objectives/Introduction: The Epworth Sleepiness Scale (ESS) evaluates individuals' daytime sleepiness across situations through their responses to 8 items on a 4-point Likert scale. An aggregate score of the ESS has been widely used to assess daytime sleepiness in healthy and clinical populations, assuming a single-factor structure. However, recent research suggested that the ESS could be measuring multiple dimensions of sleepiness. While excessive daytime sleepiness has been found to associate with depressive symptoms, no studies have evaluated the factor structure of ESS in samples with depression. In view of the above, this study aimed to examine the psychometric properties and the single-factor structure of the ESS among individuals with depressive symptoms.

Methods: This study is part of a longitudinal project titled "Emotional Stability, Positive Worldview, Forgivingness, and Sleep Quality: A Search for Causal Pathways". Participants completed an online survey including the validated Chinese version of the ESS and the depression subscale of the Depression Anxiety Stress Scales-21 (DASS-Depression) measuring depressive symptoms. We selected a sub-sample of the participants (n = 601, mean age=27.45, SD=6.66, 59.4% female, DASS-Depression>9) with depressive symptoms for our current analyses. Among these participants, 41.0% were mildly depressed, 37.5% were moderately depressed, 13.6% were severely depressed, and 8.0% were extremely severely depressed.

Results: Confirmatory factor analysis results supported a single-factor model of ESS (χ^2=75.120, *df*=17, $p < .001$; CFI=.950; TLI=.918; RMSEA=.075, 90% CI=.058-.093; SRMR=.039). In addition, the Chinese ESS had good reliability, Cronbach's alpha=.80. Daytime sleepiness was positively correlated with log-transformed score on DASS-Depression, $r(601)=.082$, $p = .043$.

Conclusions: A single-factor model of the Chinese ESS is validated with good psychometric properties as a reliable measure of daytime sleepiness in adults with depressive symptoms. Our data also corroborated previous studies on the association between daytime sleepiness and depressive symptoms. Future studies are warranted to uncover the mechanisms underlying this association, and whether the presence of excessive daytime sleepiness may be indicative of depression of a different etiology, form or severity.

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P381 | Impact of weak extremely low frequency pulsed electromagnetic field on subjective assessment of sleep quality

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Objectives/Introduction: It seems promising to use the non-pharmacological distant physiotherapy exposure of ELFMF for the correction of sleep disorders and the normalization of circadian rhythms of sleep. The aim of our study was to assess the impact of weak ELFMF on different characteristics of night sleep, the estimation of using subjective assessment of sleep quality.

Methods: In our experiments the device - ELFMF generator "Smart Sleep" was used forming rectangular current pulses supplied to the magnetic field emitter. At a distance of 70-200 cm in the experimental zone field intensity was less than 0.2 μT, which is significantly less than the permissible hygienic standards. The device has 7 modes of pulse frequency: 2, 4, 8, 16, 20, 32, 40 Hz.

The experiment involved 20 healthy volunteers (both sexes, aged 20-30). The operating mode of the ELFMF generator got out arbitrarily. The duration of the night exposition by ELFMF depended on the sleep duration (6-8 h). Time intervals between the experimental nights with and without ELFMF exposure were at least 3-5 days. All the subjects in the morning after awakening filled out the questionnaires on various indicators of the quality of sleep. The average number for each subject: no exposed - 12, with exposed - 12. Total - 480 nights.

Results: The Kruskall-Wallis single-factor rank analysis was used to assess the differences between the results of the questionnaires in the background nights and under the influence of different frequencies of the ELFMF:

$p < 0,05$ for the: health improvement in the awakening (4 Hz, 20 Hz), reducing the fragmentation (8 Hz) and shortening the duration of sleep (20 Hz), the dreams memorizing (4 Hz), quality (2 Hz, 16 Hz), emotions (8 Hz) and awareness (20 Hz).

$p < 0,01$ for the: *shortening sleep duration* (32 Hz), the dreams memorizing (2 Hz), quality (4 Hz) and emotions (2 Hz).

Conclusions: Thus, the obtained results give a reason to believe that ELFMF (2-40 Hz) have a positive impact on the studied indicators quality of sleep and dreams. Further we plan to conduct the polysomnographic studies using the portable EEG system.

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Disclosure: Nothing to disclose.

P382 | Inter- and intra-expert variability in sleep scoring: comparison between visual and automatic analysis

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Objectives/Introduction: Visual sleep scoring (VS) is affected by inter-expert (difference in scoring between experts working on the same polysomnographic recordings) and intra-expert variability (evolution in the way to score of a given sleep scorer when compared with a reference). Here our aim was to quantify inter and intra-expert sleep scoring variability in a group of 6 experts (working at the same sleep center and trained to homogenize their sleep scoring) by using the automatic scoring algorithm Aseega (AS) as a reference.

Methods: Polysomnographic data were collected in 24 healthy young male participants (mean age 21.6 ± 2.5 years) and scored according to the AASM criteria. The first data set (DS1) was composed of 4 recordings, each one scored by 6 experts and AS (28 scorings). Other 88 recordings (DS2) were scored few weeks later by the same experts and AS (176 scorings). The epoch-by-epoch agreement (concordance and Cohen kappa coefficient) was computed between VS and AS.

Results: Inter-expert agreement on DS1 decreased as the number of experts increased, from 86% for mean pairwise agreement down to 69% for all 6 experts. Adding AS to the pool of experts narrowly changed the kappa value, from 0.81 to 0.79. Intra-expert variability was highlighted by the systematic decrease of the agreement between AS and each single expert across datasets (-3.7% on average).

Conclusions: Whatever the approach used, visual scoring induces inter- and intra-expert variability. Even if autoscoring neither provides any ground truth, nor can improve the inter-scorer agreement (as several automated methods exist), it can efficiently cope with the intra-scorer variability, since the AS used is perfectly reproducible and largely insensitive to experimental conditions. These properties are mandatory when dealing with large dataset, making autoscoring methods a sensible option. A number of automatic methods are currently available; however precise assessment and comparison on common datasets using common metrics remain an open question.

Disclosure: C. Berthomier, P. Berthomier and M. Brandewinder have ownership and directorship in Physip, and are employees of Physip. This study was funded by Fonds National de la Recherche Scientifique (Belgium), University of Liège research funds, Swiss National Science Foundation (# 310030_130689) and the European Research Council (ERC).

P383 | Guidelines for the application of the objective sleepiness scale for drowsiness assessment

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Objectives/Introduction: Electroencephalography (EEG) remains the reference method to study drowsiness, but only few objective methods have been proposed based on the visual analysis of wake EEG. Muzet proposed the Objective Sleepiness Score (OSS) [1]. For each 20s-epoch this scale defines 5 states of drowsiness based on the visual analysis of EEGs (C3, O1, P3, Fz) and EOGs. An automatic algorithm (AA) following a single-EEG approach was developed and validated using a database visually scored by Muzet (VA1) using OSS [2]. The objective of this study was to improve and facilitate the use of the OSS by proposing guidelines that explicit the visual scoring criteria.

Methods: 19 volunteers (30 ± 6 years, 12 women) were recorded during 2 h of driving in a simulator, with a Cortical Brain State (CBS) test as a biocalibration at the beginning and end of the session. All recordings (8192 scoring decision epochs) were scored by VA1, which stands as the reference, and by AA. Two sample recordings of 422 and 438 epochs were randomly chosen and visually scored by another expert (VA2).

VA2 applied two scoring procedures: first, literal OSS scoring rules as stated in [1], then adapted the scoring criteria of EEG by taking into account the individual characteristics deriving from the biocalibration. The epoch-by-epoch agreement (concordance, C, and kappa coefficient, K) was calculated.

Results: The agreement between AV1 and AV2 increased from 15% (K = -.40) when applying literal rules to 83% (K = .60) when applying adapted rules. When including AA, the overall agreement variated from K = -.12 to K = .53.

Conclusions: Taking into account the CBS observed during the biocalibration phase is key to enable the scoring of drowsiness using OSS. Alpha and theta rhythms used to determine drowsiness states must be defined by their characteristics as they appear during the CBS test.

[1] Muzet et al. Preventing driver drowsiness at the wheel: can steering grip sensor measurement contribute to its prediction? Proc. of 4th Eur. Congress and Exhibition on Intelligent Transport Systems and Services, Budapest,24-26 May 04.

[2] Berthomier et al., Real-Time Automatic Measure of Drowsiness based on a Single EEG Channel. J. Sleep Res., 17:P434, 2008.

Disclosure: Nothing to disclose.

P384 | High-throughput sleep phenotyping establishes heritability and identifies a novel linkage peak in diversity outbred mice

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Objectives/Introduction: Genetic association studies in outbred mouse populations, such as the Diversity Outbred (DO), required high-throughput phenotyping strategies. We describe a strategy utilizing activity-based measures of sleep and circadian traits, which are then leveraged to identify a novel genetic linkage peak in DO mice.

Methods: Phenotypes were measured in age-matched male DO mice (n = 338) and their 8 common or wild-derived inbred founders [A/J (n = 6), C57BL/6J (n = 14), 129S1/SvlmJ (n = 6), NOD/LtJ (n = 6), NZO/H1LtJ (n = 6), CAST/EIJ (n = 8), PWK/PHJ (n = 8), WSB/EIJ (n = 6)]. Sleep/wake amounts and bout characteristics were quantified, with sleep defined as ≥40 s of continuous inactivity based on infrared beams; latency to sleep (vigilance), multiple sleep latency test (MSLT) and circadian period (using wheel running) were also characterized. Intraclass Correlation Coefficients (ICCs) were calculated from repeated assessments to assess reproducibility. Narrow-sense heritability (h^2; proportion of variability explained by additive genetic effects) was quantified in DO mice and broad-sense heritability (H^2; proportion of variability explained by strain) estimated in founders. Genome-wide quantitative trait analyses were performed on these high-throughput phenotypes in DO mice using a mixed model analysis evaluating the effects of the eight founder genotype probabilities at each locus.

Results: Most phenotypes showed ICC≥0.60, indicating good reproducibility, and there was high correlation (rho>0.85) between sleep/wake traits using the primary sleep definition (≥40 s of inactivity) and alternative definitions of ≥20, ≥60 or ≥80 s. All traits differed among founder strains and there was moderate-high heritability for most phenotypes; sleep/wake characteristics during lights-off and circadian period were most heritable (H^2=54-60%). There was large phenotypic variability in DO mice, with values covering observed ranges in founders. Heritability estimates were lower in DO mice, with circadian period the most heritable (h^2=36%), possibly reflecting unmeasured non-additive genetic effects. Genome-wide analyses identified a novel linkage association with sleep duration in lights-off on chromosome 3 (LOD score ~7.5), encompassing two candidate genes.

Conclusions: A high-throughput phenotyping strategy using activity patterns provides reproducible estimates of heritable sleep and circadian phenotypes. This paradigm was used to identify a novel linkage peak related to sleep duration in DO mice. Follow-up analyses are underway to validate this association and determine the causal gene and variant.

Disclosure: Authors from the University of Pennsylvania (B. Keenan, R. Galante, J. Lian, L. Zhang, D. Lim, A. Pack) declare no conflicts. Authors from Jackson Laboratory (P. Simecek, D. Gatti, K. Svenson, G. Churchill) note that Jackson Laboratory produces and sells Diversity Outbred Mice.

P385 | Pilot assessments of mobile and automated sleep recording and auditory slow-wave stimulation for in-home studies

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Objectives/Introduction: Non-invasive sleep stimulation methods to promote restorative processes of sleep have recently gained considerable interest. Single-night, in-lab studies show that precisely timed tones played during deep sleep can enhance slow wave activity and improve declarative memory. Whether such methods proof transformative to real-life settings remains to be investigated. We developed a portable device that allows for in-home sleep monitoring and individualized auditory stimulation. We report preliminary results on biosignal data quality obtained with this novel device and the achieved effect of auditory stimulation on slow waves.

Methods: We evaluated biosignal quality and stimulation effect of the device in two participants (32 and 26 y.) by measuring one night with (verum) and one without tone application (sham) at participants' home. The device featured one prefrontal EEG (electroencephalography), EOG (electrooculography) and EMG (electromyography) recording channels from which non-rapid eye movement sleep was automatically detected and auditory stimulation triggered. Tones were precisely timed to the up-phase of slow waves using a phase-locked loop and a slow wave amplitude criterion. We visually assessed biosignal quality and evaluated the effect of stimulation on slow waves by investigating the time-locked response of the EEG to the first 200 auditory stimuli using a single-subject statistical approach (unpaired t-test of trials between sham and verum night for each subject).

Results: Recording set-up time for the device (around 5-10 min) was very low compared to in-lab methodologies and was easy to apply for the subjects themselves. The quality and resolution of the obtained biosignals was comparable to lab-based systems. In both subjects, auditory stimuli significantly enhanced amplitude of slow waves, either of the stimulated wave (n = 1, $p < 0.05$) or of a subsequent slow wave (n = 1, $p < 0.05$). None of the subjects reported to hear tones during the night.

Conclusions: Our mobile sleep stimulation device enabled high-quality sleep research outside the sleep lab. Future studies using our device are needed to evaluate the efficacy of slow wave enhancement over longer application periods and in larger populations.

Disclosure: Nothing to disclose.

P386 | Dissecting local sleep spindles in the thalamocortical system

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Objectives/Introduction: Sleep spindles are electroencephalographic (EEG) oscillatory events (9-16 Hz) that are hypothesized to stabilize sleep, gate sensory processing and consolidate memory. Spindle generation relies on transient electrical activity within the reticular nuclei of thalamic neurons that resonate in thalamo-cortical (TC) circuits. Despite considerable characterization of both global and local spindles in the human brain, their occurrence and role in mice remains unclear.

Methods: We developed an optimized spindle detection algorithm to detect spindles in 14 mice and investigated their region-specific correlation with neuronal firing, slow waves, and vigilance state transition using simultaneous thalamic and cortical LFP/unit recordings in freely-moving mice.

Results: We found a strong spike-field coupling during spindles within thalamic reticular nucleus (TRN), anterodorsal (AD) and centromedian (CMT) thalami, and to a lesser extent within ventrobasal complex (VB), cingulate (CING) and somatosensory barrel (BARR) cortices. We further found a strong coupling between slow waves and spindles within the CMT, AD, CING, and visual cortex, but a weaker coupling in the TRN, VB, and the BARR. Thalamo-cortical network analysis showed a high co-occurrence ratio of spindles within the thalamus (82 ± 7%), with fewer spindles propagating to the neocortex (60 ± 11%). Co-occurrence at the cortical level was low (50 ± 16%), indicating a localized control of sleep-spindles in the neocortex. Spindle rate prior to REM sleep onset, but not wakefulness, was significantly increased with maximum probability within a window of 25 s prior transition to REM sleep (~3 times higher than baseline). Finally, optogenetically driving the TRN GABAergic cells using stabilized step-function opsin significantly increased bursting activity in TRN neurons resulted in a significant increase in spindle rate and sleep stabilization.

Conclusions: These results provides a new and improved toolbox for spindle detection and characterization in mice and further indicates a local mechanism for spindle generation in thalamocortical circuits and their role in the sleep-wake state control.

Disclosure: Nothing to disclose.

P387 | Heart rate variability-based sleep staging in healthy subjects and patients with sleep disorders

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Objectives/Introduction: The last few years have seen an increase in publications on sleep staging using cardiac and respiratory features. Some of the best recent algorithms achieved Cohen's kappa coefficients of agreement up to 0.50 in comparison with polysomnography (PSG). However, most studies have focused on the analysis of healthy participants, and the question of how well these algorithms generalize to sleep disordered patients remains unanswered.

The objective of this study is to evaluate and compare the 4-class sleep stage classification (Wake, N1 + N2, N3 and REM) performance of a long short term memory (LSTM) classifier using heart rate variability (HRV) features in healthy subjects as well as sleep disorders patients.

Methods: A total of 136 features describing HRV computed from ECG were used to train an LSTM model for sleep stage classification. The analysis was done in the PSG recordings of the SIESTA dataset, using the manual annotations of 3 experts as ground-truth. The model was trained and evaluated in 4-fold cross-validation with two recordings of each of 195 healthy participants, 51 patients diagnosed with sleep apnea, and 26 with insomnia, all based on the ICD-10 criteria. The performance between different groups and, for the healthy controls, between sexes was compared with a Mann-Whitney U test. Pearson's correlation was used to test correlation with age for the healthy control group.

Results: The overall validation kappa was 0.64. The performance for healthy participants (0.64) was not significantly different than for insomnia (0.66, $p = .18$), but was significantly higher than for sleep apnea (0.60, $p < .001$). Kappa decreased significantly with age (-0.41, $p < .001$) and a significant difference was found between healthy males and females (0.62 vs 0.66, $p < .01$).

Conclusions: With an overall kappa of 0.64 our classifier achieves better performance than recently published algorithms, for healthy and for sleep disordered patients. The slightly lower performance for sleep apnea can be explained by changes in the characteristics of the HRV features which, in the presence of disordered breathing events, fail to completely characterize the differences between sleep stages.

Disclosure: At the time of writing, P. Fonseca, M. Radha, M. Ross, A. Moreau, A. Cerny and P. Anderer were employed by Philips Electronics Nederland B.V. and Philips Austria GmbH. Philips is a manufacturer of consumer and medical electronic devices, and commercializes products in the area of sleep monitoring, diagnosis and therapy.

P388 | Development of predictive models of obstructive sleep apnea by using decision tree

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Objectives/Introduction: Polysomnography as the gold standard diagnostic technique in obstructive sleep apnea (OSA) is cumbersome and costly. Multiple trials in prediction of OSA by clinical and laboratory variables have been done in different data sets. We planned this study to develop predictive models of OSA in our dataset.

Methods: This is a retrospective cross-sectional study on 376 patients suspected to OSA in Ibn-e-Sina and Emam Reza university sleep clinics, Mashhad, Iran. Data mining has been done by decision tree method with algorithms of C5.0, CHAID, C&R in IBM SPSS MODELER14.2. Maximum of 5 depths was considered for all trees. Variables selected by C5.0 tree were: STOP-BANG score, age, and history of depression, cognitive problem and restless leg syndrome. Variables selected by CHAID were: age, neck circumference, sex, Epworth sleepiness scale (ESS) score, STOP-BANG, body mass index, history of restless leg syndrome and cognitive dysfunction. Variables selected by C&R were: age, neck circumference, STOP-BANG score, ESS score, cognitive dysfunction and depression.

Results: CHAID and C 5.0 showed the highest accuracy in predicting OSA, with C 5.0 revealed the highest sensitivity and specificity. According to 97% sensitivity of C5.0 it was the best model in our dataset.

Conclusions: Although our study showed a high performance for some models selecting a model for prediction of OSA should be done with caution.

Disclosure: Nothing to disclose.

P389 | Developing minimum data set for information management systems of obstructive sleep apnea

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Objectives/Introduction: Information systems are an important potential source for gathering knowledge in the field of sleep medicine. In obstructive sleep apnea (OSA) as in other domains, there is a need to define a Minimum dataset (MDS) to fix the meaning of essential domain data and allow sharing data across institutes. The purpose of this study was to design a national MDS underlying information management systems regarding sleep apnea in Iran.

Methods: A descriptive cross-sectional study had been done between May 2014 and 2015, Mashhad, Iran. An item list was extracted by comprehensive literature review, seeking experts' consensus, searching valid websites related to sleep disorders, and defining patient records. A sample of 30 sleep experts were invited to ascertain variables of minimum dataset in two round Delphi method. Variable was accepted based on the level of agreement among experts. Specifically, variables with a median of 4 out of 5 or more were included in the dataset, while those with median 3 and less than 3 were forwarded to the nest stepand excluded, respectively.

Results: Maximum list of data items included 153 variables with 73 variables final MDS categorized into 4 groups. Four groups included diagnosis data elements, global data elements, follow up data elements and treatment data elements. The global data elements category includes two subcategories as administrative and demographic elements. The diagnosis data elements category consists of 4 subgroups including data on history, physical exam, laboratory tests, and polysomnography results. The medical history subgroup consists of smaller subgroups including history of previous diseases, sleep questionnaire, career information, day and night symptoms, smoking and medication history. The physical examination subgroup also consists of 4 subgroups including otorinopharyngology, heart and lung, neurology, and upper airway exams. The treatment data elements category consists of several subgroups including therapy devices, medications, referrals, and lifestyle modification advices.

Conclusions: MDS may be a valuable and organized source of information for assessment, planning, treatment and research in OSA. It also have the potential to prevent a variety of misleading

errors such as inappropriate recording, lack of quick access to medical records, various formats used in recording and lack of standard dataset.

Disclosure: Nothing to disclose.

P390 | Extracting association rules from polysomnographic data of obstructive sleep apnea subjects

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Objectives/Introduction: Under-diagnosis of obstructive sleep apnea (OSA) is quite common. Data mining by association rules can help in early diagnosis of OSA.

Methods: This is a retrospective cross-sectional study on 376 individuals suspected to OSA in Ibn-e-Sina and Emam Reza university sleep clinics, Mashhad, Iran. Date on demographic variables and questionnaire scores (STOP-BANG and Epworth sleepiness scale (ESS)) were gathered. Using WEKA3.7.6 and APRIORI algorithm with min support=0.2 and min confidence =0.9 data divided in 2 main (male, female) groups. For each group 4000 rules extracted. After omitting repeated and inappropriate ones, 50 rules for men and 50 rules for women selected and disposed for experts. In order to extract rules related to apnea severity, target variable evaluated in 4 classes (normal, mild, moderate, severe apnea). A total number of 8000 rules were assigned which severe apnea in the right side of all extracted rules. Mild and moderate apnea had not noticed.

Results: After evaluating rules by experts 4 rules accepted for men and 7 rules for women (min confidence= 0.92 and 0.95, respectively). In all rules STOP-BANG score more than 3 and ESS score more than 8 were from the selected rules.

Conclusions: Association rules are helpful in early diagnosis of OSA.

Disclosure: Nothing to disclose.

BREATHING DISORDERS 3

P391 | The predictive risk factors of cardiovascular events in patients with obstructive sleep aponea and hypopnea syndrome

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Objectives/Instruction: Obstructive sleep apnea hypopnea syndrome (OSAHS) is known to be associated with cardiovascular events. In this study, we use the INTERHEART Risk Score (IHRS) to assess prevalence of cardiovascular risk factors in the OSAHS patients, and to develop valuable factors for routine screening of cardiovascular events in these patients.

Methods: Overnight polysomnography (PSG) was performed to a total of 219 patients in the sleep center of the Second Affiliated Hospital of Soochow University. Based on the results of the AHI, these patients were divided into four groups: primary snoring group, mild, moderate and severe OSAHS groups. INTERHEART Risk Score were caluculated from these aspects: age&sex, diabetes, hypertension, family history, smoking, second hand smoke, psychosocial factors, dietary factors, physical activity, abdominal obesity. Based on IHRS, 219 patients were divided into low risk group, moderate risk group and high risk group for a heart attack. The differences and correlation analysis between the clinical parameters and PSG data of the groups were evaluated.

Results: The severe OSAHS group had significantly higher IHRS, waist hip ratio (WHR), body mass index (BMI), neck circumference than primary snoring group group: [(15.11 ± 6.50) vs(10.54 ± 4.31), (0.950 ± 0.058)vs (0.899 ± 0.088), (27.90 ± 3.23) Kg/m2 vs (24.86 ± 3.35) Kg/m2,(40.47 ± 2.51) cm vs (37.06 ± 2.93) cm, all $p < 0.05$),OSAHS severity had positive correlation with the IHRS parameters in smoking, diabetes, and WHR, (all $p < 0.01$).

The subjects with high IHRS were found with higher AHI, ODI, TS90% and lower LSaO2, MSaO2 than the low IHRS group (all $p < 0.05$). There were positive correlation between IHRS and AHI ($r = 0.245$, $p < 0.001$), ODI ($r = 0.255$, $p < 0.001$), T90% ($r = 0.254$, $p < 0.001$),and negative correlation between IHRS and MSaO2 ($r = -0.218$, $p = 0.001$), LSaO2 ($r = -0.225$, $p = 0.001$), total sleep time (TST) ($r = -0.149$, $p = 0.027$).

Conclusions: Cardiovascular events in patients with OSAHS is correlated with recurrent nocturnal apnea and hypoxia. Severe OSAHS patients had higher IHRS, they may had high risk for heart attack in the future. AHI, ODI and TS90% are important PSG parameters to predict the risk of cardiovascular events.

Disclosure: Nothing to disclose.

P392 | Estimation of obstructive sleep apnea severity using additive Bayesian networks

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Objectives/Instruction: Machine learning-based prediction models are widely used in many different areas, recently. The goal of this study is to develop an additive bayesian network model and to evaluate its results for the classification of obstructive sleep apnea (OSA) severity of patients with suspected sleep disordered breathing as normal, mild, moderate and severe based on non-polysomnographic variables.

Methods: This retrospective cohort study enrolled 338 consecutive patients, who underwent complete polysomnographic evaluation due to suspected sleep disordered breathing at our accredited sleep disorders center between January 2014 and August 2015. The independent variables related to OSA severity were analyzed using additive Bayesian networks model.

Results: The analyses revealed that the size of soft palate and uvula (OR:10.94 [1.87-64.11]) and mallampati score (OR: 4.5 [1.46-43.22]) were the most significant predictor variables in the final model. In addition, results of 10-fold cross-validated tests indicated that the severity of suspected OSA patients can be classified, using additive Bayesian networks, with 0.632 sensitivity and, 0.529 specificity. In addition, the model has 0.777 sensitivity and 0.646 specificity to classify severe OSA patients.

Conclusions: While machine learning methods might be used to improve accurate OSA screening and help to refer only the suspected OSA patients to sleep laboratories for the expensive tests, sensitivity and specificity of the additive Bayesian networks were low. However, this model can be the basis for modeling the relationship of all variables to each other.

Disclosure: Nothing to disclose.

P393 | The effectiveness of remote monitoring in improving CPAP compliance: a randomised, controlled study

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Objectives/Introduction: Adherence to continuous positive airway pressure (CPAP) in obstructive sleepapneu (OSA) is generally 60-70%. Short-term adherence and early perceived benefits are the best predictors of long-term adherence. Former studies of remote monitoring were influenced by a postponed start until after CPAP titration, or a control group without sham. Other studies do not mention the effectiveness of therapy and were only focussed on compliance. This study measures the effect of remote monitoring on compliance and effectiveness of CPAP in the short and long term.

Methods: A single blind, randomised controlled trial, comparing remote monitoring and adjustment using AirView™ versus placebo was performed. AirView™ connects wireless to the Resmed CPAP. Study-parameters were compliance after 10 weeks and 1 year (CPAP use in mean hours/night), number of patients lost and interventions.

Results: A total of 115 patients with newly diagnosed OSA were enrolled in each group (power 80%, α=0.05, β=0.2) with balanced baseline characteristics of mean age (intervention vs control resp. 54;54 yrs), apneu-hypopneu-index (AHI, 47;48/hr), BMI (33;31 kg/m2), sex (man 75;74%), ESS (12;14) and FSS (37;37). Compliance after 10 weeks was equal in mean hours of CPAP use per night as measured during the last week (6:27; 6:35 h, p = 0.569), AHI (2.4; 2.3/hr, p = 0.886), ESS (5.7; 4.9, p = 0.222), FSS (28.2; 28.7, p = 0.804). The number of contacts per patient with a healthcare professional was significantly different during the follow-up from week 3 untill week number 10 (0.25; 0.13, p = 0.025). In the remote monitoring group contacts could be initiated by the healthcare professional or the patient. In the placebo-group all contacts were initiated by the patient. Number of drop-outs after 1 year were equal (12;11, p = 0.827), with compliance equal in mean hours of CPAP use during the last week (6:49; 6:43 h, p = 0.59) and residual AHI (1.9; 2.2/h p = 0.41).

Conclusions: Remote monitoring in CPAP has no additional effect on compliance in our patient group with a high-adherence and intensive support rate from the start. However remote monitoring can simplify and improve teleconsultation and when teleconsultation is as good as regular consultation under certain circumstances this might be more convenient for the patient.

Disclosure: Resmed and VitalAire provided the remote monitoring equipment.

P394 | Home sleep apnea testing with *Polywatch*® - comparison with polysomnography

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Objectives/Instruction: Home sleep apnea testing (HSAT) is an easier, more convenient method for the diagnosis of obstructive sleep apnea syndrome (OSAS) with lower costs in comparison with in-lab polysomnography (PSG) if used properly.

Many devices are currently available for this type of testing. The purpose of our study was to evaluate the specific performance of *Polywatch*®-BMC Medical (PolylogicAnalysis software Version 2.984.0) in our sleep lab, in a group of patients with suspected OSAS.

Methods: Fifty patients with clinical indication for PSG agreed to simultaneous HSAT, adapted by a trained sleep technologist. Technical procedures and scoring of sleep events followed the recommendations of American Academy of Sleep Medicine, version 2.3. For diagnosis of OSAS we considered an apnea hypopnea index (AHI) greater than 15/h or greater than 5/h with daytime symptoms or cardio-vascular risk. A paired t-test was performed, p value of 0.05.

Results: Fourty-seven subjects were included, 31 men and 16 women, age 51.15 ± 10.72 years and body mass index (BMI) of 29.22 ± 5.04Kg/m^2. We found lower number of hypopneas (p = 0.000), higher number of obstructive apneas (p = 0.013), higher average (p = 0.000) and minimum oxyhemoglobin saturation (p = 0.008) and lower time spent with oxyhemoglobin saturation bellow 90% (p = 0.001) in HSAT. This device revealed sensitivity of 66.7% and specificity of 45.5% for the diagnosis of SAOS.

Conclusions: *Polywatch*® showed good diagnostic performance for severe SAOS and in the overall, similar sensitivity and specificity as other studies for the same cut-off values.

The main limitation relates to the device algorithms that do not allow for manual scoring or editing of oxyhemoglobin dessaturation events and failed to identify some measurements.

Disclosure: Nothing to disclose.

P395 | Comparing electrocardiographic differences in patients with complex sleep apnea using four different adaptive servo-ventilation devices

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Objectives/Introduction: Treatment with adaptive servo-ventilation (ASV) was reported to increase the risk of mortality in the SERVE-HF trial, although the causative mechanism remains unclear. One possible explanation involves device-specific performance characteristics ("device-effect"), as opposed to characteristics common among all ASV devices ("class-effect"). Differences in QTc and mean heart rate across devices due to differences in minute ventilation may be a potential mechanism. This study investigated differences in QTc and ECG-derived heart rate across four different ASV devices administered to the same subjects.

Methods: We performed a randomized controlled cross-over trial of fourteen patients (age 69.1 ± 14.9 yr) with complex sleep apnea and preserved cardiac contractility who were adherent to ASV therapy. Patients underwent four nights of laboratory-based polysomnography, randomized to a different ASV device each night, using Philips ASV device (System One), updated Philips ASV device (Dreamstation), ResMed S7 VPAP Adapt (used in the SERVE-HF trial), and ResMed S9 VPAP Adapt. Whole-night ECG analysis was performed using a wavelet-transform-based ECG delineator which output beat-by-beat parameters, including QT interval corrected for heart rate (QTc) using Bazett's formula. Analysis was performed using linear mixed models with repeated measures after adjusting for sleep stage.

Results: Fifty-four device-nights comprising 680,116 heart beats were included in the study. During polysomnography, mean heart rate was significantly greater during therapy with S7 device (66.1 bpm [95% CI 60.6, 71.5]) than S9 device (63.1 bpm [95% CI 57.6, 68.6], Philips ASV (63.7 bpm [95% CI 58.2, 69.2]), and Modified Philips ASV (65.7 bpm [95% CI 60.2, 71.1], all p values < 0.0001). Mean QTc was significantly greater during therapy with S7 device (399 ms [95% CI 398, 399]) than S9 device (397 ms [95% CI 397, 397], and Modified Philips ASV (396 ms [95% CI 396, 396], all p values < 0.0001). Mean QTc during S7 device use was not significantly different than during Philips ASV device therapy (p = 0.074).

Conclusions: Significant differences in heart rate and QTc exist between various ASV devices. While the absolute differences in QTc appear small in magnitude, such differences need to be explored in individuals with systolic heart failure.

Disclosure: This work was funded in part by Philips-Respironics, Inc.

P396 | Effect of gender on obstructive sleep apnea severity change according to age-group

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Objectives/Instruction: Severity of obstructive sleep apnea (OSA) is known to be greater in men compared to women. However, the gender differences in apnea-hypopnea index tends to decrease with increaging age. This may be due to hormonal changes associated with menopause, because reduced levels of estrogen/progesterone is reported to be associated with increased prevalence of sleep disordered breathing. However, whether the change also occur similary in male has not been fully evaluated. Moreover, the changes in individual breathing sessation characteristics have not been evaluated in detail. In this study we aimed to evaluate whether the severity change of obstruction events according to age differ between genders.

Methods: Polysomnogrphic recordings of consecutive patients who was diagnosed for obstructive sleep apnea in KyungHee University Hospital at Gangdong between Dec 2010 ~ Dec 2017 were included. The patients were divided into two groups according to menopausal status (< 55 years old and 55 years old or more). Difference in demographic, clinical, and polysomnographic parameter between gender, and age were compared.

Results: Total 568 patients were analyzed, which included 467 male patients (age< 55, n = 324, age>55, n = 143) and 101 female patients (age< 55, n = 36, age>55, n = 65). As expected, there were significant effect of gender on body-mass index (F = 23.8, p < 0.001), BDI (F = 29.0, p < 0.001), apnea (F = 43.1, p < 0.001), hypopnea

(F = 12.7, $p < 0.001$), apnea-hypopnea index (AHI, F = 51.3, $p < 0.001$), and respiratory disturbance index (RDI, F = 61.7, $p < 0.001$). Effect of age was found only in BMI (F = 4.4, $p = 0.036$), but not in AHI or RDI. However, age x gender interaction was significant in hypopnea index, AHI, and RDI, which showed tendency of increase in female, but tendency of decrease in male patients.

Conclusions: This study shows that the age difference in severity of hypopnea, but not apnea is affected by gender.

Disclosure: Nothing to disclose.

P397 | Distinct EEG-EMG-coherence patterns associated with sleep-disordered breathing severity grade

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Objectives/Instruction: We investigated whether using EEG-EMG-coherence (EEC) as a feature fed to a support vector machine (SVM) algorithm may allow staging of disease severity among sleep-disordered-breathing (SDB) patients.

Methods: EEG-EMG-coherence data resulted by applying a multitaper processing for estimating the power spectrums separately and calculating the coherence on raw C3-/C4-EEG- and EMG- chin data of polysomnographic (PSG) recordings of 102 SDB patients (33 female; age: 53, ± 12,4 yrs) acquired on the second of two consecutive PSG nights in each patient. Four epochs (30 s each, classified manually by AASM 2012- criteria) of each sleep stage (N1, N2, N3, REM) were marked (in total 1632 epochs/night) and were included in the analysis. After multitaper processing, EEC values were fed to a SVM algorithm to classify SDB disease severity based on respiratory disturbance index (RDI). Twenty patients had a mild (RDI ≥ 10/h and < 15/h), 30 patients had a moderate (RDI ≥ 15/h and < 30/h) and 27 patients had a severe OSA (RDI ≥ 30/h). Twenty five patients had a RDI < 10/h. The AUC (area under the curve) value was calculated for each receiver operator characteristic (ROC) curve.

Results: EEG-EMG coherence values could distinguish between SDB-patients without OSA and OSA patients of the above three severity groups using an SVM algorithm. Using PSG data of the second night, in mild OSA the AUC was 0.616 ($p = 0.024$), in moderate OSA the AUC was 0.659 ($p = 0.003$), and in severe OSA the AUC was 0.823 ($p < 0.001$).

Conclusions: Grading disease severity in SDB patients can be performed using PSG-based multitaper-processed EEC values processed with a SVM algorithm.

Disclosure: Nothing to disclose.

P398 | Imaging of obstructive sleep apnoea anatomic risk factors after bariatric surgery weight loss: a pilot study

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Objectives/Introduction: Obesity is a strong, and potentially reversible, risk factor for Obstructive Sleep Apnoea (OSA). However, weight loss results in variable Apnoea Hypopnea Index (AHI) improvement. This is not explained by the magnitude of weight loss and surgical weight loss resolves OSA in only a minority of cases. Specific anatomical factors may explain weight loss effects better than total body weight. These include regional fat, upper airway soft tissues or airway space volume, with mediation by craniofacial skeletal structure. Recently, fat inside the tongue has been specifically implicated in OSA. The aim of this pilot imaging study is to concurrently assess anatomical factors which may relate to OSA improvement following surgical weight loss.

Methods: Participants on the waiting list for bariatric surgery were invited to undergo an in-laboratory polysomnography and a Magnetic Resonance Imaging (MRI) scan (within one week of each other) before surgery. After 6 months of weight loss, both assessments were repeated. The MRI consisted of both abdominal and head regions with two sequences (T1 for visualisation of soft tissue boundaries and Dixon for fat visualisation). Segmentation of the upper airway soft tissue borders and fat were performed using image analysis software (3D slicer). Soft tissue and fat segmentations are overlayed to determine the tongue fat volume. Preliminary descriptive data are presented.

Results: Fifteen participants have been recruited to date, and post-surgery imaging and analysis is complete in N = 5. Of these 5 participants the majority are female (N = 4), 46.8 ± 8.3 (mean ± SD) years, pre-surgery BMI 43.4 ± 6.7 kgm^2, with baseline AHI 25.34 ± 11.4 events/hour. Post-surgery weight loss was 33.5 ± 5.9 kg and total AHI reduced to 9.1 ± 5.0 events/hour. Preliminary data suggest reduction in total tongue volume (-19.8 ± 9.5 cm^3) and tongue fat volume (-13.1 ± 12.1 cm^3) and increase in total upper airway space volume (+3.2 ± 5.1 cm^3).

Conclusions: This preliminary data demonstrates the feasibility of detailed imaging of obese OSA patients pre- and post- bariatric surgery. Work is ongoing to complete analysis of the dataset and assess relationships to OSA improvement following weight loss.

Disclosure: Nothing to disclose.

P399 | Craniofacial photography for assessment of obstructive sleep apnoea risk in an Icelandic general population sample

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Objectives/Introduction: Craniofacial structure can predispose to Obstructive Sleep Apnoea (OSA). However, assessment of craniofacial risk factors for OSA is largely limited to small clinical samples due to specialised imaging requirements. Quantitative facial surface measurements, acquired by photography, predict OSA in sleep clinic populations. However, sleep clinic patients have high suspicion of OSA. It is unknown whether this facial phenotyping method reflects OSA risk in the general population. The aim of this study was to use quantitative facial photography to assess OSA risk in a general population sample.

Methods: Subjects were Icelandic participants in the European Community Respiratory Health Survey (ECRHS), selected from the general population and first studied in 1990. In 2012, they were invited for a sleep assessment (Type 3 ambulatory study) and craniofacial photography (87% of those invited completed these assessments). Facial photographs (front and profile) were analysed using facial landmark coordinates. Eleven linear and angular measurements relating to the face, including eyes, nose, and mandible were analysed. OSA was defined as Apnoea-Hypopnea Index (AHI) ≥15 events/hour (moderate-severe disease). Logistic regression (backward likelihood ratio) was used to assess the relationship of craniofacial measurements (adjusted for age, gender, height, weight) to OSA. Model performance was assessed by the area under the receiver operating characteristic curve (AUC). Statistical significance was accepted at $p < 0.05$.

Results: AHI and photographs were available in 400 subjects (48.3% male), N = 63 (15.8%) had OSA. Compared to controls, OSA subjects were more male (70% vs. 44.2%, $p < 0.001$), obese (BMI 30.5 ± 5.6 vs. 27.5 ± 4.5 kgm^2, $p < 0.001$) and older (56.8 ± 5.9 vs. 53.6 ± 6.9 years, $p < 0.001$). Four facial measurements contributed to the model to classify those with OSA. OSA was related to reduced facial index (wider face for facial height, $p = 0.04$), reduced eye width ($p = 0.025$), increased nose height ($p = 0.001$), and increased maxillary-mandibular relationship angle (suggestive of mandibular retrusion, $p = 0.064$). The model AUC (95% confidence interval) was 0.8 (0.7, 0.9).

Conclusions: Craniofacial measurements obtained by facial photography related to the presence of OSA. This study supports this simple photographic technique as having utility in capturing phenotypic information related to OSA risk in large epidemiological samples.

Disclosure: Nothing to disclose.

P400 | Sleepiness, fatigue, anxiety and depression in overlap syndrome

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Objectives/Introduction: Patients with Chronic Obstructive Pulmonary Disease (COPD) and/or Obstructive Sleep Apnea (OSA) often complain about sleepiness, fatigue, anxiety and depression. However, common screening questionnaires, like Epworth Sleepiness Scale (ESS), Fatigue Severity Scale (FSS) and Hospital Anxiety and Depression Scale (HADS) have not been evaluated in patients with overlap - coexisting COPD and OSA - syndrome versus patients with OSA alone Our study compared ESS, FSS and HADS between patients with overlap syndrome and patients with OSA, before and after treatment with Continuous Positive Airways Pressure (CPAP).

Methods: We examined thirty-eight (38) patients with coexisting COPD and OSA (Group A) versus 38 patients with OSA alone (Group B), in a case-control study (27 men, 11 women). All patients underwent pulmonary function tests (PFTs), oximetry and overnight polysomnography and completed the questionnaires, before and after 3 months of CPAP therapy.

Results: The two groups did not differ significantly in terms of age, Body Mass Index (BMI), neck, waist and hip circumferences, and arterial blood pressure values. They also had similar comorbidities. They differed significantly, as expected, in PFTs (Forced Vital Capacity - FVC, 2.53 ± 0.73 vs 3.08 ± 0.85 lt, $p = 0.005$, Forced Expiratory Volume in 1sec - FEV1, 1.78 ± 0.53 vs 2.60 ± 0.73 lt/min, $p < 0.001$) and in daytime oximetry (94.75 ± 2.37 vs 96.13 ± 1.56%, $p = 0.007$). ESS, HADS - Anxiety and HADS - Depression scores did not differ statistically significant between the two groups ($p = 0.27$, $p = 0.44$, and $p = 0.67$, respectively), whereas overlap syndrome patients expressed significantly more fatigue than OSA patients ($p = 0.02$), that remained even after 3 months of CPAP therapy ($p = 0.015$).

Conclusions: We conclude that sleepiness, anxiety and depression were similar in both groups, whereas fatigue was more prominent in patients with overlap syndrome than in sleep apneic patients and did not ameliorate after treatment.

Disclosure: Nothing to disclose.

P401 | Investigation of the relationship between neutrophil-to-lymphocyte ratio, platelet-to-lymphocyte ratio and obstructive sleep apnea syndrome

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Objectives/Introduction: Previous studies reported the relationship between systemic inflammation and obstructive sleep apnea syndrome (OSAS). The neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) have been widely used and recognized reliable inflammatory markers in the clinical area. This study is aimed to determine the relationship between the OSAS and clinical inflammatory markers (NLR and PLR).

Methods: We performed a retrospective analysis of 103 patients who demonstrated apnea-hypopnea index (AHI) more than 5 in the polysomnography. The control was selected from 6,017 healthy individuals who had visited our health promotion center. The individuals who had history of cancer, chronic inflammatory disorder, acute infection, and cardiac diseases were excluded. By using propensity score, the age-, sex- and body mass index (BMI) matched 103 obstructive sleep apnea (OSA) patients and 206 healthy controls were finally analyzed. The OSA and control groups were compared by NLR, PLR and other complete blood cell count profiles. We also investigated the correlation between inflammatory markers (NLR and PLR) and sleep disorder related parameters (AHI, arousal index, snoring index, and Epworth sleepiness scale).

Results: Although the white blood cell count, neutrophil, and lymphocyte counts were significantly increased, the NLR was not significantly increased in the OSA group ($p = 0.649$). The PLR was significantly decreased in the OSA group ($p = 0.022$). The mean platelet volume (MPV) was significantly decreased in the OSA group ($p < 0.001$). In the correlation analysis, there was no significant correlation between NLR and sleep disorder related parameters. There was a negative correlation between PLR and AHI ($r = -0.229$, $p = 0.020$).

Conclusions: The PLR value can give us valuable information about the severity of OSAS. Further researches may be required to elucidate the role of platelet in inflammation in patients with OSAS.

Disclosure: Nothing to disclose.

P402 | Estimating obstructive sleep apnea in cyprus: a randomized stratified epidemiological study using STOP-BANG questionnaire

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Objectives/Introduction: Obstructive Sleep Apnoea (OSA) syndrome is a highly prevalent disorder. Recent epidemiologic data in Northern Europe estimate the prevalence of moderate and severe OSA to 23,4% in women and 49,7% in men[i].

Estimates of OSA prevalence in Southern Europe are lacking. The aim of the study was to predict the prevalence of OSA in Cyprus.

Prevalence of sleep-disordered breathing in the general population: the HypnoLaus study, R Heinzer et al., *Lancet Respir Med.* 2015 April; 3(4): 310-318.

Methods: The survey was contacted by CATI method (Computed Aided Telephone Interviewing) using STOP-BANG questionnaire. Participants were all adults residing in Cyprus. The randomly selected sample was stratified according to the last demographic report. The estimated sample size needed was less than 2000 but 5000 sample housing units were screened and 4118 eligible responders completed the survey.

The question about Neck Circumference was removed from the final evaluation due to the uncertainty of most of the participants and the risk of bias.

Results: From a total of 4118 participants (2252 males, 1862 females) 46.6% were over 50 years old. Participants responded positively for snoring 29.9%, for feeling tired or sleepy during the day 39.3%, for observed apnoea during sleep 12.3%, and for hypertension 24.6%. BMI index was calculated and 4.7% were found obese class II and III.

From the statistical analysis 2640 participants (64.1%) were at low risk for OSA, 1200 participants (29.1%) at intermediate risk (3-4 positive answers-demographics) and 277(6.7%) at high risk for moderate-severe OSA.

Conclusions: The finding of 50% of male at intermediate to high risk of OSA and 18% of women is similar to the estimation of Hypnolaus study.

Nevertheless, this unrealistically high prevalence in the general population reported in the last epidemiological reports shows that the present sleep apnoea syndrome definition, screening and diagnostic tools are too inclusive and should be revised.

Disclosure: Nothing to disclose.

P403 | Decreased thickness of peripapillary retinal nerve fibre layer and macular layer in patients with moderate and severe obstructive sleep apnoea syndrome

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Objectives/Introduction: Early signs of glaucoma usually manifest as thinning of the peripapillary retinal nerve fibre layer (pRNFL) and macular layer. In this study, we evaluate the thickness of pRNFL and macular layer in patients with obstructive sleep apnoea syndrome (OSA) and further investigate the relationship between the ophthalmologic and polysomnographic variables in patients with different severities of OSA.

Methods: All subjects underwent a full-night a polysomnography (PSG) and then completed ophthalmologic evaluation, including best-corrected visual acuity, intraocular pressure, slit lamp biomicroscopy, gonioscopy, ophthalmoscopy, standard automatic perimetry (SAP) and optical coherence tomography (OCT) exam. Continuous data between two groups were compared using Kruskal-Wallis Test, while categorical data were compared using chi-square test. Correlation between PSG variables and ophthalmologic variables in OSA patients were assessed using Pearson's correlation coefficient. All statistical tests were two-sided. A p *value* < 0.05 was considered significant.

Results: A total of 135 subjects were enrolled in the study (125 patients with OSA, 10 subjects with simple snorer/normal group). The pRNFL thickness was significantly lower for the severe OSA group than for the normal group in the inferior quadrant ($p = 0.031$) and in the nasal-inferior sector ($p = 0.036$).

When normal subjects and mild OSA patients were grouped together and compared with patients with moderate/severe OSA, pRNFL thickness measurements for the latter group were significantly lower in the inferior quadrant ($p = 0.013$) and temporal-inferior sector ($p = 0.040$). Macular layer thickness in the superior and inferior hemispheres, in the superior-outer sector, and in the inferior-outer sector was also significantly thinner in the moderate/severe OSA group than in the normal/mild OSA group (all p values < 0.05). The AHI negatively correlated with the thickness of total macular layer ($r = -0.140$, $p = 0.028$) and the inferior hemisphere of macular layer thickness ($r = -0.137$, $p = 0.031$).

Conclusions: Patients with moderate/severe OSA had lower pRNFL thickness and macular thickness as compared to the normal/mild OSA group. The severity of OSA inversely correlated with total macular layer thickness, and the lowest saturation of oxygen positively correlated with the total macular layer thickness in OSA patients. Clinicians need to consider the possibility of glaucoma in patients with moderate/severe OSA.

Disclosure: Nothing to disclose.

P404 | Improvement of visual sensitivity and retinal thickness after continuous positive airway pressure in patients with obstructive sleep apnoea syndrome

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Objectives/Introduction: Early signs of glaucoma usually manifest as thinning of the peripapillary retinal nerve fibre layer (pRNFL) and macular layer. In this study, we assess whether treatment with continuous positive airway pressure (CPAP) might improve visual sensitivity and pRNFL thickness in patients with obstructive sleep apnoea syndrome (OSA).

Methods: Patients presenting with snoring and daytime sleepiness who underwent overnight polysomnography (PSG) to determine OSA severity were recruited and subsequently referred for ophthalmologic evaluation at baseline and 3 months after CPAP treatment. Each patient underwent visual acuity measurement, Perkins applanation tonometry, slit-lamp biomicroscopy, ophthalmoscopy, and standard automated perimetry (SAP) exam. pRNFL thickness and macular thickness (MT) parameters were measured by spectral-domain optical coherence tomography (OCT). The SAP, pRNFL and MT thickness parameters before and after treatment were compared. Continuous variables were analyzed using Wilcoxon's rank sum test, and categorical Fisher's exact test. Further statistical analysis were performed by Wilcoxon signed rank test for paired data and Spearman's rank correlation. A p *value* < 0.05 was considered significant.

Results: A total of 44 subjects were recruited, including 32 patients with OSA and 12 control subjects. At baseline, the mean deviation (MD) of SAP was -2.15 ± 1.91 dB in the OSA group. After CPAP treatment for 3 months, the MD was improved to -1.38 ± 1.37 dB ($p = 0.014$). As regard the OCT parameters, the inferior quadrant and nasal-inferior sector of pRNFL thickness significantly improved after CPAP treatment for 3 months ($p = 0.019$ and 0.002, respectively). The macular layer thickness in the superior-inner sector, inferior-outer sector, superior hemisphere, inferior hemisphere and the thickness of total macular layer were also significantly improved after CPAP treatment. Improvement of MT in the superior-inner sector positively correlated with apnea/hyponea index ($r = 0.405$, $p = 0.021$) and desaturation index ($r = 0.473$, $p = 0.006$) on pre-treatment PSG.

Conclusions: The treatment of CPAP can improve visual sensitivity and increased retinal thickness in patients with OSA.

Disclosure: Nothing to disclose.

P405 | Does CPAP treatment lead to increased light and moderate-vigorous physical activity in OSA patients with cardiac or cerebrovascular events?

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Objectives/Introduction: OSA is the partial, or complete, closure of the airway during sleep. Gold-standard treatment for OSA is continuous positive airway pressure (CPAP) that keeps the airway open. Unfortunately, compliance to CPAP is low. Numerous small studies have shown moderate-vigorous physical activity as an effective treatment for OSA, whilst only one small study has shown that CPAP lead to a spontaneous increase in physical activity, as measured subjectively by the International Physical Activity Questionnaire, and objectively by pedometers. This study sought to expand on this topic using data collected in a larger randomised control trial (RCT).

Methods: Data were collected as part of the *Sleep Apnea Cardiovascular Endpoints* RCT (the 'SAVE Trial').

2687 participants had experienced a prior cardio- or cerebrovascular event and had untreated OSA. Patients were randomly allocated to receive usual cardiovascular care alone (n = 1341), or with addition of CPAP (n = 1346).

Light and moderate-vigorous physical activity were self-reported at baseline, 6 months, 24 months 36 months, and end of study. Three questions asked "(vigorous/moderate/mild) exercise for more than 15 min (number of times in the past week)?", with examples of activities in each category given. Min of light and moderate-vigorous physical activity per week were calculated.

Mixed models examined whether CPAP led to differences in light and moderate-vigorous physical activity during follow-up, adjusted for baseline confounders, being country region, diabetes status, cardiovascular event type, age, daytime sleepiness, body mass index, apnea-hypopnea index, smoking status and baseline physical activity. A secondary analysis compared compliant CPAP users.

(≥4 h/night), with propensity-matched usual care participants.

Results: Participants allocated to CPAP reported significantly more moderate-vigorous physical activity compared to usual care participants (33.8 min vs 28.4 min, $p < .001$). There was no difference in light physical activity (80.4 min vs 79.9 min, $p = .748$).

In the sub-analysis, compliant CPAP users reported more moderate-vigorous physical activity (33.8 min vs 25.4 min, $p < .001$) and light physical activity (80.3 min vs 75.7 min, $p = .044$), compared to propensity matched controls.

Conclusions: These results indicate that CPAP users, particularly those with good adherence, report increases in physical activity compared to controls.

Disclosure: The SAVE (Sleep Apnea Cardiovascular Endpoints) trial was funded by project grants 1006501 and 1060078 from the National Health and Medical Research Council (NHMRC) of Australia as well as by the Respironics Sleep and Respiratory Research Foundation and Philips Respironics. Supplementary trial funding was provided by Fisher & Paykel Healthcare and the Australasian Sleep Trials Network (enabling grant 343020 from the NHMRC). In-kind donations were provided by Philips Respironics for continuous positive airway pressure equipment and by ResMed for sleep apnea diagnostic devices.

P406 | Prevalence of parasomnias in relation to presence and severity of obstructive sleep apnea. A registry-based cross-sectional study

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Objectives/Introduction: Previous research suggests a positive association between parasomnias and obstructive sleep apnea (OSA). In the present study, we aimed to further assess the prevalence of parasomnias in relation to presence and severity of OSA. We hypothesized higher parasomnia prevalence with higher OSA severity.

Methods: The sample comprised 4,372 patients referred to a Norwegian university hospital with suspicion of OSA (mean age 49.1 years, 69.8% males). OSA was diagnosed and categorized by standard respiratory polygraphy (type 3 portable monitor). The patients completed a comprehensive questionnaire prior to the sleep study, including questions about different parasomnias during the last 3 months. Pearson chi-square tests explored differences according to the presence and severity of OSA. Furthermore, logistic regression analyses with the parasomnias as dependent variables and OSA severity as predictor were conducted (adjusted for sex, age, marital status, smoking, and alcohol consumption).

Results: In all, 34.7% had apnea-hypopnea index (AHI) < 5 (no OSA), 32.5% had AHI 5-14.9 (mild OSA), 17.4% had AHI 15-29.9 (moderate OSA), and 15.3% had AHI ≥30 (severe OSA). The overall prevalence of parasomnias was 3.3% (sleepwalking), 2.5% (sleep-related violence), 3.1% (sexual acts during sleep), 1.7% (sleep-related eating), and 43.8% (nightmares). The overall parasomnia prevalence was highest in the no OSA group. In the chi-square analyses,

including all OSA groups, the prevalence of sleep-related violence and nightmares were inversely associated with OSA severity ($p = 0.02$ and $p < 0.001$, respectively), whereas none of the other parasomnias were significantly associated with OSA severity. When adjusting for multiple confounders in the logistic regression analyses the odds of sleepwalking was significantly higher in severe compared to mild OSA (OR=2.0, 95% CI= 1.12-3.55). The other parasomnias were not associated with OSA presence or severity.

Conclusions: We did not find higher parasomnia prevalences in patients with OSA compared to those not having OSA. With the exception of sleepwalking, the parasomnias were not associated with OSA severity.

Disclosure: Nothing to disclose.

P407 | Positional dependency in mild obstructive sleep apnoea in the European Sleep Apnoea Database (ESADA) study

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Objectives/Introduction: Positional obstructive sleep apnoea (pOSA) is an important sleep apnoea phenotype and seems to be more prevalent in mild OSA patients. The aim of our study was to estimate the prevalence, clinical characteristics and risk factors for pOSA in a group of mild OSA patients of the European Sleep Apnoea Database (ESADA) cohort.

Methods: A multi-centric subsample of 452 mild OSA patients from the ESADA cohort was evaluated. Positional OSA was defined as an overall apnoea-hypopnea index (AHI) ≥5, supine AHI to non-supine AHI ratio of ≥2 and an AHI that normalizes (AHI < 5) in the non-supine posture. We compared clinical and polysomnographic variables between patients with and without pOSA and investigated predictive factors for pOSA using binary logistic regression analysis.

Results: Two hundred twenty (49%) of 452 patients fulfilled the pOSA criteria. These patients were significantly younger (46 vs 51, $p < 0.001$) and leaner (BMI 28 vs 30, $p = 0.006$). Comorbid hypertension (24 vs 33%, $p = 0.033$) and Type 2 diabetes (6 vs 13% $p = 0.004$) were less prevalent in pOSA compared to non-pOSA patients. AHI (8.5 vs 10.4), nadir oxygen saturation (87 vs 88%, $p = 0.02$) and sleep time spent with SaO2 < 90% (0.2 vs 0.8%, $p = 0.004$) were lower in pOSA. Negative independent predictors of pOSA in a mild sleep apnoea population were age [odds ratio (95% CI) 0.98 (0.96-0.99), $p = 0.006$] and lower AHI [odds ratio (95% CI) 0.88 (0.82-0.94), $p < 0.001$]. Daytime sleepiness reflected by Epworth sleepiness scale score (ESS) did not differ between groups (9.1 vs 9, $p = 0.87$).

Conclusions: Positional OSA is highly prevalent and noted in almost half of our mild OSA patients. Since patients with mild OSA are the prevailing group of OSA patients, positional OSA potentially comprises the vast majority of OSA patients. Furthermore, this pOSA phenotype may reflect the milder form of OSA disease spectrum, including younger patients with a low degree of comorbidities.

Disclosure: Nothing to disclose.

P408 | Clinical judgement in mild OSA - data from the European Sleep Apnoea Database (ESADA) study

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Objectives/Introduction: Mild obstructive sleep apnoea (OSA) is highly frequent but the clinical significance is under debate. The Clinical Global Impression Severity (CGI-S) Scale is used to reflect the clinician's overall rating of the condition after consideration of event frequency, symptoms, anthropometrics and comorbidities. Our study aimed to evaluate the usefulness of the CGI-S for evaluation of mild OSA.

Methods: A multi-centric subsample of non-apneic snorers (n = 1969) and mild OSA patients (n = 1986) from the European Sleep Apnoea Database (ESADA) cohort was evaluated. The Clinical Global Impression Severity (CGI-S) Scale is a 7-point *scale* ranging

from 1 (normal) to 7 (extremely ill). The CGI-S scale was transformed to four severity categories: Normal (score=1), mild (score=2-3), moderate (score=4) and severe (score=5-7). Non-apneic snorers and patients with mild OSA were compared with respect to CGI-S score. We also evaluated the capacity of the CGI-S scale to predict treatment recommendation for positive airway pressure (PAP) or oral devices in mild sleep apnea.

Results: The CGI-S score was significantly higher in mild OSA patients compared with non-apneic snorers (21% vs 12% were scored ≥4, $p < 0.001$). Moreover, non-apneic snorers were more frequently rated in the "normal" category compared to mild OSA patients (57% vs 15%, $p < 0.001$). Independent predictors for a higher CGI-S score were age (β=0.05, $p = 0.001$), ESS score (β=0.46, $p < 0.001$), coronary artery disease (β=0.40, $p < 0.001$), cerebrovascular disease (β=0.33, $p = 0.006$), chronic obstructive pulmonary disease (β=0.53, $p < 0.001$), type-2 diabetes (β=0.32, $p < 0.001$) and AHI (β=0.11, $p < 0.001$). A high CGI-S score (≥4) strongly predicted a treatment recommendation with PAP (odds ratio (95% CI) 2.19 (1.50-3.19), $p < 0.001$).

Conclusions: The CGI-S may be a useful tool for assessment not only of OSA event frequency but also to integrate comorbidities and daytime function. CGI-S might provide a better assessment of disease severity in patients with mild OSA.

Disclosure: Nothing to disclose.

P409 | Effect of oxygen supplementation on sleep and nocturnal breathing in patients with chronic obstructive pulmonary disease travelling to high altitude: randomized cross-over trial

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Objectives/Introduction: The current study evaluates whether nocturnal supplemental oxygen therapy improves sleep and breathing disturbances in lowlanders with chronic obstructive pulmonary disease (COPD) staying for 2 nights in a mountain resort at 2048 m.

Methods: 21 patients with COPD GOLD grade 2/3, median(quartiles) age 68(64;70)y, forced expiratory volume in 1s (FEV_1) 55 (48;60)% predicted, living below 800 m were studied at 490 m (Zurich) and during 2 altitude sojourns of 2 days each at 2048 m (St. Moritz), separated by a wash-out period >2 weeks below 800 m. During altitude sojourns nocturnal oxygen (3 L/min) (or ambient air, sham oxygen) was administered by nasal cannula according to a double-blinded, randomized, cross-over design. Questionnaire evaluations and nocturnal polysomnography were performed during nights at 490 and 2048 m. Co-primary outcomes were the mean nocturnal oxygen saturation (SpO_2) and the apnea/hypopnea index (AHI).

Results: Polysomnography at 490 m revealed median (quartiles) SpO_2 92%(91;94), total AHI 16.3/h(9.8;26.0), obstructive AHI 13.5/h (9.8;22.6), central AHI 1.2/h(0.2;3.5), sleep efficiency 83%(69;89). In the night at 2048 m, using sham oxygen, SpO_2 was 86%(84;88), total AHI 27.5/h(13.6;55.4), obstructive AHI 5.6/h(2.2;9.2), central AHI 16.6/h(9.9;41.6), sleep efficiency 70%(64;83), $p < 0.01$ all corresponding comparisons. Compared to sham oxygen, mean changes (95% confidence intervals) induced by oxygen at 2048 m were SpO_2 +9%(+8;+10), total AHI -20.6/h(-28.3;-13.0), obstructive AHI -0.3/h(-3.6;2.9), central AHI -21.4/h(-28.6;-14.2), sleep efficiency +6% (+1;+12). Oxygen therapy tended to improve subjective sleep quality by 8% (-0 to 17), $p = 0.06$ but had no effect on cognitive performance the day after.

Conclusions: Lowlanders with COPD experience pronounced hypoxemia, sleep apnea and sleep fragmentation when spending a night at 2048 m. Since nocturnal oxygen supplementation improves these changes, it may be useful to prevent severe hypoxemia, breathing and sleep disturbances in mountain tourists with COPD staying overnight at high altitude.

Disclosure: Nothing to disclose.

BREATHING DISORDERS 4

P410 | Mild cognitive impairment and its risk factors in Chinese patients with obstructive sleep apnea

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Objectives/Introduction: Obstructive sleep apnoea (OSA) is known to be associated with impairment in cognitive function.The aim of this study was to characterize neurocognitive impairment in a cohort of Chinese patients with varying severities of OSA, and to investigate the risk factors of mild cognitive impairment (MCI) in patients with OSA.

Methods: Eligible male OSA patients ($n = 2101$) were categorized into a MCI group and a non-MCI group, based on the Montreal Cognitive Assessment (MoCA). Characteristics of participants between the groups were compared with Mann-Whitney U-test. Additionally, we constructed a multivariable logistic regression model to identify risk factors associated with MCI in OSA patients.

Results: Group differences in age (45 years versus 38 years, $P = 0.000$), levels of education (12 years versus 14 years, $P = 0.000$) and the Epworth Sleepiness Scale (ESS) score (10 versus 9,

P = 0.033) were found between the subjects with and without MCI. Concerning polysomnography variables, the subjects with MCI had a poor sleep efficiency (87.40% versus 89.85%, P = 0.000), spent more time in light sleep (76.20% versus 73.60%, P = 0.000) and less time in slow wave sleep (SWS) (8.30% versus 9.65%, P = 0.006) compared to the control group. Furthermore, in multivariate logistic regression model, aging was associated with an increased odds of MCI in OSA patients (45 ≤ age ≤59 years versus age ≤ 44 years: *OR* = 2.43, 95% *CI* 1.92-3.06; age ≥ 60 years versus age ≤ 44 years: *OR* = 3.21, 95% *CI* 2.25-4.58), higher education status protected the patients cognitive function (*OR* = 0.46, 95% *CI* 0.37-0.56), and severe excessive daytime sleepiness (EDS) was indicated as the risk factor of MCI in patients with OSA (ESS ≥ 16 versus ESS ≤ 10: *OR* = 1.37, 95% *CI* 1.05-1.79).

Conclusions: Our results demonstrate that MCI in patients with OSA may be depend on the increasing age, educational level and EDS. It remains unclear that the relationship of MCI to sleep fragmentation, intermittent hypoxia and sleep architecture.

Disclosure: Nothing to disclose.

P411 | Characterization and severity assessment of patients with obstructive sleep apnea

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Objectives/Introduction: Obstructive sleep apnea (OSA) is increasingly prevalent. Most patients remain undiagnosed until the disease progresses. Early detection plays an important role in management and treatment.

To characterize patients with OSA and reveal distinctive features in their profile which will help to predict the diagnosis and disease severity.

Methods: Patients conducted sleep study for detection of OSA. They were added to a registry and statistical analysis was performed.

Results: A total of 255 patients took part in the study - 26 of them performed polysomnography and other 229 were evaluated using polygraphy. Men prevailed with 81.6%. In only 12 (4.7%) of patients the preliminary diagnosis was not confirmed. Smokers were 84.1%. Patients with comorbidities prevailed - 88.2% had arterial hypertension, 23.1% had COPD, 33.4% had diabetes, 13.3% were with thyroid disorders.

Patients' most frequent symptoms were - snoring in 95.1%, excessive daytime sleepiness 71.0%, restless sleep in 70.6%, awakenings in 70.2%, nocturnal dyspnea 68.2%.

Significant correlation ($p < 0.05$) was found between AHI and weight (r = 0.25), neck circumference (r = 0.38), waist circumference (r = 0.32), Mallampati score (r = 0.30), Epworth score (r = 0.34), time with nocturnal SpO_2 below 90% (r = 0.41). The patients with cardiac arrhythmias, excessive daytime sleepiness and nicturia had higher AHI ($p < 0.05$).

Conclusions: Patients with OSA had high percentage of comorbidities and most often complained of snoring, daytime sleepiness, restless sleep, awakenings and nocturnal dyspnea. Disease severity correlated with body weight, neck circumference, Epworth and Mallampati scores. Waist circumference correlated well with disease severity and could be useful if no data for neck circumference is available. Cardiac arrhythmias, daytime sleepiness and nicturia could also predict higher severity of the disease.

Disclosure: Nothing to disclose.

P412 | Comparison of apnea detection using nasal pressure transducer, oronasal thermal airflow sensor, and tracheal sound sensor

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Objectives/Introduction: Our study aimed to investigate flow estimation by a tracheal sound (TS) sensor during sleep in patients with sleep related breathing disorders (SRBD). TS signal was used for apnea detection and results were compared to those obtained by oronasal thermal airflow sensor (Therm) and by nasal pressure transducer (NP) signals.

Methods: In addition to in lab polysomnographic recordings, TS were recorded using the PneaVoX technology (CIDELEC, France). Data from 32 SRBD patients (25 males, mean age 67 ± 15 years, and mean BMI 30 ± 4 kg/m²) were used to compare the detection of apneas by the three independent methods TS, Therm, and NP. Signals were scored visually according to AASM rules by two independent scorers (S1, S2) in random order.

Results: Both scorers detected more apneas with NP and TS than with Therm (S1: NP=4508, TS=4243, Therm=3766 and S2: NP=4717, TS=4279, Therm= 3884). A total of 3508 apneas for S1 and 3402 for S2 were detected simultaneously with all three sensors. TS and NP had the most apneas in common (4057 for S1 and 3824 for S2), followed by NP and Therm (3860 for S1 and 3792 for S2). TS and Therm had least number of apneas in common (3535 for S1 and 3453 for S2). Finally, apnea duration was slightly longer for NP than for the TS and the Therm.

Conclusions: With the sensor placed properly on the suprasternal notch, it seems that tracheal sound flow analysis is on the one hand capable to detect apneas otherwise missed by oronasal thermal airflow sensor and on the other hand disregards apneas that are

overestimated by nasal pressure. Stud results suggest that tracheal sound sensors can be used for apnea detection.

Disclosure: This study was supported by an unrestricted grant from CIDELEC, France.

P413 | Age-related differences in the ability of c-reactive protein to detect cardiometabolic risk in mild-to-moderate obstructive sleep apnoea

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Objectives/Introduction: Mild-to-moderate obstructive sleep apnoea (OSA) affects 15-40% of the adult general population. However, it remains unclear when and how to best treat mild-to-moderate OSA, given that in most cases the disorder is asymptomatic. It has been shown that CRP in young and middle-aged adults with OSA improves the prognostic value of AHI to assess individual risk for cardiovascular and metabolic aberrations associated with mild-to-moderate OSA. In this study we examine whether age modifies the association of CRP with cardiometabolic aberrations in patients with mild-to-moderate OSA.

Methods: A sample of 103 adults 28-84 years old (54.39 ± 11.96 years) with mild-to-moderate OSA (AHI between 5 and 29 events per hour) underwent 8-h polysomnography, a clinical history and physical examination, including measures of blood pressure and body mass index, and a fasting morning blood draw to assessed HbA1C and CRP levels.

Results: CRP was associated with greater odds for hypertension (OR = 2.48, 95% CI = 1.41-4.38, p = 0.002) compared to AHI (OR = 1.02, 95% CI = 0.94-1.12, p = 0.599) in adults 28-59 years old. In contrast, neither CRP nor AHI were associated with hypertension in adults 60-84 years old (OR = 1.51, 95% CI = 0.72-3.17, p = 0.282 and OR = 1.07, 95% CI = 0.96-1.19, p = 0.205, respectively). CRP was also associated with greater Hb1AC levels (β = 0.39, p = 0.002) compared to AHI (β = 0.01, p = 0.932) in adults 28-59 years old, while in adults 60-84 years old there was no significant association for either CRP or AHI (β = 0.17, p = 0.350 and β = 0.12, p = 0.527, respectively). All results remained significant after adjusting for gender and BMI.

Conclusions: Our data suggest that including a measure of CRP improves the ability for clinicians to detect cases of mild-to-moderate OSA with true cardiometabolic risk. Importantly, the utility of this measure is strongest in young and middle-aged adults. These results also suggest a different phenotype in older adults with mild-to-moderate OSA compared to young and middle-aged adults.

Disclosure: Nothing to disclose.

P414 | Is the stop-bang questionnaire a good clinical predictor for sleep-disordered breathing in the general population?

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Objectives/Introduction: To identify patients at high risk for sleep-disordered breathing (SDB), various screening tools have been tested, among which the STOP-BANG questionnaire (SBQ). However, this questionnaire has been mainly evaluated in clinical populations and small sample sizes.

We aimed to validate the STOP-BANG questionnaire as a screening tool for SDB in a large general population cohort.

Methods: Our study population consists of 2252 participants of the Asklepios cohort, a prospective general population study, of which the second measurement round was conducted between 2011 and 2016. All subjects were submitted to extended clinical assessment, a home polygraphy (HP) and self-administered sleep questionnaires. Diagnostic accuracy of the STOP-BANG questionnaire as well as other SDB screening tools was assessed.

Results: The diagnostic accuracy of the SBQ was suboptimal, with an area under the curve (AUC) of 0.67 (95% CI 0.63-0.72) for moderate and 0.71 (95% CI 0.64-0.78) for severe sleep apnea (SA) in the male population. At the pre-set SBQ cut-off of $\geq$ 3 the sensitivity was 86.7% and the specificity was 30.5% for moderate to severe SA in men. As sex is an inherent part of the questionnaire, selecting a different cut-off in total score for both sexes increased both sensitivity and specificity. Neck circumference was also reevaluated, as the mean neck circumference was 40.4 cm in men and 34.7 cm in women. At the currently used cut-off of 40 cm, 97.4% of our female population has a negative score.

Conclusions: A validation study of the STOP-BANG questionnaire showed poor diagnostic accuracy to detect patients at high risk for moderate to severe sleep apnea. Adding a sex-specific cut-off for neck circumference increased the diagnostic accuracy. As the impact of age and body mass index (BMI) on SDB were also dependent of sex, a sex-specific screening tool is desirable and should be further investigated.

Disclosure: Nothing to disclose.

P415 | Severe obstructive sleep apnea: positional patients (PP) vs. non-positional patients (NPP)

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Objectives/Introduction: In sleep clinic populations, the prevalence of Positional Patients (PP) is about 60% and this prevalence decreases with increasing severity of obstructive sleep apnea (OSA). However, it is not fully understood which characteristics determine positional dependency in severe OSA (apnea-hypopnea index, AHI≥30) patients. We aimed to investigate the prevalence of PP in severe OSA, to assess the differences between PP and Non-Positional Patients (NPP) and to examine the main predictors of positional dependency in those patients. We hypothesize that the OSA phenotype is clinically different between PP and NPP with severe OSA.

Methods: Polysomnographic recordings of 309 consecutive patients with severe OSA were analyzed. Positional OSA was defined according to a common classification (i.e. PP: supine-AHI/lateral-AHI≥2 and NPP: supine-AHI/lateral-AHI< 2).

Results: 35.0% of the patients were classified as PP. NPP were more obese ($p < 0.001$) and had a more severe OSA disease compared to PP (AHI 61.0 vs. 41.1, respectively, $p < 0.001$). Furthermore, obstructive apneas were slightly longer (25.6s vs. 24.4s, $p = 0.024$) and the percentage of total apnea/hypopnea time from total sleep time (AHT%) was higher in NPP compared to PP (45.5% vs. 28.7%, respectively, $p < 0.001$).Based on stepwise binomial logistic regression model, the most significant predictor for positional dependency was AHT% (β=-0.147, $p < 0.001$) followed by BMI (β=-0.093, $p < 0.001$) and total apnea time (β=0.011, $p = 0.021$). This indicates that when AHT% and BMI increases (ORs 0.911 and 0.863, respectively), the probability to be PP decreases. In contrast, when total apnea time increases (OR=1.011), the probability to be PP also increases. The model classified correctly 75.6% of the patients to be either NPP or PP with a sensitivity of 82.0% and specificity of 63.9%. The area under ROC curve was 0.842 (95% CI: 0.799-0.885, $p < 0.001$) indicating good predictive accuracy of the model.

Conclusions: More than a third of the patients with severe OSA were PP. They were leaner and had a less severe disease compared to NPP. These PP could achieve a significant decrease in the amount and severity of apneas/hypopneas when adopting the lateral posture suggesting that positional therapy may be beneficial also for these patients.

Disclosure: Study was financially supported by the Academy of Finland (decision number 313697), the Research Foundation of the Pulmonary Diseases, Kuopio University Hospital, the Research Committee of the Kuopio University Hospital Catchment Area for the State Research Funding (projects 5041767 and 5041768), and the Respiratory Foundation of Kuopio Region. The authors declare that they have no other conflicts of interest.

P416 | Sleep disturbances and asthma control among Bulgarian asthmatic patients

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Objectives/Introduction: The aim of this study was to assess asthma control among asthmatic outpatients with sleep disturbances (SD).

Methods: A questionnaire was filled in by 334 outpatients with bronchial asthma. Sleep disturbances (snoring, daily sleepiness and apneas) were self reported by 174 patients. One hundred and one patients with sleep disturbances (SD group) and 101 patients without sleep disturbances (non-SD group) matched for age, BMI (body mass index), asthma severity and smoking status were followed-up. Asthma control was assessed by ACT (asthma control test) and ACQ (asthma control questionnaire). Data was statistically processed. Values for $p < 0.05$ were considered significant.

Results: The median age of the studied patients was 60.0 (18- 87) yrs, median value for BMI was 27.5 (18.7- 51.1) kg/m^2. Non-smokers were 77 (76.24%) in each of the studied groups. In the SD group 3 (2.97%) patients were with mild asthma, 77 (76.24%) with moderate, 21 (20.79%) with severe. In the non-SD group mild asthma was found in 5 patients (4.95%), 77 (76.24%) had moderate asthma, 19 (18.81%) - severe.

The most common sleep disturbances were: snoring (36.6% of the patients); daily sleepiness (26.7%), respiratory pauses and apnea (12.9%) and other (23.8%).

In the SD group the ACT score was 16 (5- 25) which was significantly lower compared to ACT score of the non-SD group- 23 (5-25) (KW= 46.02; $p < 0.001$).

In the SD group the ACQ score was 2.29 (0.14- 5.29) which was significantly higher compared to ACQ score of the non-SD group- 0.86 (0.14- 4.86) (KW= 48.01; $p < 0.001$).

Conclusions: Sleep disturbances were an additional factor for poor asthma control. Asthmatic outpatients may require more careful clinical assessment for sleep disturbances as comorbidity.

Disclosure: Nothing to disclose.

P417 | Cerebral white matter and cognitive decline in middle-aged and older adults with obstructive sleep apnea

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Objectives/Introduction: Recent studies have linked obstructive sleep apnea (OSA) to an increased risk of developing dementia,

leading to a growing interest in studying early cerebral changes in older adults with OSA. Our preliminary data demonstrates that white matter (WM) characteristics are associated with OSA severity in the elderly, suggesting brain oedema, i.e. increased fractional anisotropy and decreased diffusivities on diffusion tensor imaging. However, whether these WM characteristics predict cognitive decline over time remains unknown. The aim of this study was to explore whether WM characteristics are associated with cognitive decline over an 18-month period in non-treated middle-aged and older adults with OSA.

Methods: 16 adults (mean age: 63.2 ± 4.5 years, 12 men) with an apnea-hypopnea index >5 events/h and who refuse the treatment were included at baseline and at 18-month follow-up.

At baseline, subjects were evaluated with overnight polysomnographic recording, comprehensive neuropsychological assessment and magnetic resonance imaging session, including diffusion weighted imaging sequence. Using Tract-Based Spatial Statistics within FSL, diffusion tensor image metrics were extracted and included whole white matter fractional anisotropy, axial diffusivity, radial diffusivity, and mean diffusivity. Subjects were evaluated again at 18-month follow-up with a neuropsychological assessment. The cognitive decline was measured by the difference between the raw scores at follow-up and baseline for the different tests representing attention, executive functions, working memory, learning and memory, language, and visuo-spatial functions. Correlations were performed between WM characteristics and changes in cognitive performance.

Results: White matter characteristics showed significant correlations with the cognitive decline on the Digit Span, a test involving attention and working memory. More specifically, more severe declines on the Digit Span total score were correlated with lower radial and mean diffusivities (r values between 0.548 and 0.554, p values between 0.026 and 0.028) and with higher fractional anisotropy.
(r = -0.512, p = 0.043) at baseline.

Conclusions: Our results suggest that white matter characteristics generally linked to brain oedema predict cognitive decline on an attention and working memory task in adults with non-treated OSA.

Disclosure: Nothing to disclose.

P418 | Analysis of continuous positive airway pressure adherence in obstructive sleep apnea subjects: a mixed qualitative and quantitative approach

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Objectives/Introduction: Poor adherence to CPAP as the gold standard treatment of OSA is reported from 45 to 75%. In this study we evaluated CPAP adherence in an Iranian adult OSA population and assessed barriers to CPAP use in non-adherent group.

Methods: This is a mixed method study (quantitative and qualitative) on adult OSA subjects who had used CPAP device. Adherence rate was evaluated by a retrospective cross-sectional method on available data of CPAP memory card analysis of Emam Reza and Ibn-e-Sina university sleep clinics, Mashhad, Iran. Data on CPAP adherence were assessed in short-term (previous 14 days), long-term (90 days) and total usage periods. Poor-adherence was defined as less than 4 h per night, less than 70% of the nights of each period. Descriptive statistics, independent t-test, and chi-square test were used with p-values of < 0.05 considered as statistically significant. A qualitative content analysis with data collected by in-depth interviews by telephone call in order to find barriers of CPAP usage.

Results: *Quantitative part:* CPAP usage records of 81 patients (with mean ± SD age 56.1 ± 11.4 years, AHI 30.5 ± 7.5, minimum oxygen saturation during sleep study 74.6 ± 13.8%) were included in the study. Totally 41(50.6%) patients were defined as poor-adherent; with 42.5% and 67.7% poor-adherence in short and long-term periods, respectively. Poor-adherent group were younger (53.6 ± 12.6 vs. 58 ± 9.2 years) and less hypoxic than good-adherent subjects (minimum saturation 78.6 ± 10.2% vs. 70.5 ± 15.8%) (p = 0.044 and 0.008, respectively). *Qualitative part:* 17 accessible patients from poor-adherent group were interviewed. Barriers to CPAP usage extracted in 3 main themes: knowledge (concerns about disease cure, optimum usage, time to change mask), side effects (discomfort with mask, problems when travelling) and cost of care.

Conclusions: A high percentage of our OSA patients had poor short-term and long-term adherence to CPAP. Most of the barriers for CPAP usage rate are from those aspects of patient education which can simply be overcome by giving complementary information in follow-up visits.

Disclosure: Nothing to disclose.

P419 | Patient barriers in acceptance of polysomnography ordered by doctor - a qualitative study

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Objectives/Introduction: Undiagnosed obstructive sleep apnea (OSA) has been well known for its significant neurocognitive and cardiovascular morbidity. A relatively high rate (7 to 62%) of disobedience from doctor's order suggests that simply advising polysomnography is not enough. This is a qualitative study on patients' barriers to perform polysomnography ordered by sleep specialists.

Methods: A qualitative content analysis was done. Data were collected by in-depth interviews with 12 purposively selected patients. After detailed explanation of methods, benefits, possible complications and cost of polysomnography to individuals referred by sleep specialists, they were asked whether they will come for test or not. Those who refused polysomnography were interviewed about reasons of refusal of sleep study.

Results: Barriers for performing sleep study were categorized in 5 groups: risk perception (neglecting OSA significance, not admitting having OSA), knowledge (treatment length, linking OSA symptoms to other disorders, dreams visible during study), cost (study and treatment), environmental factors (unfamiliar environment, unwilling to be tested in clinic or hospital, unable to sleep with wires, unawareness about treatment outcomes, being distressed by device).

Conclusions: Even after detailed explanation of polysomnography, individuals highly suspected to OSA report multifaceted barriers to acceptance of PSG ordered by physicians. Knowledge about different patients concerns can help to improve rate of test performance.

Disclosure: Nothing to disclose.

P420 | Obstructive sleep apnoea syndrome with cranio facial abnormalities:case report and review of literature

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Objectives/Introduction: Obstructive sleep disordered breathing (SBD) includes a spectrum of clinical entities with variable severity of intermittent upper airway obstruction. The term "obstructive SDB" is used when symptoms of intermittent upper airway obstruction during sleep are present and can be defined by objective measures such as polysomnography (PSG).

Methods: This case is about a 4-year-old male child who since he was 3 years old presented asthma with at least four hospitalization and chronic snoring with prolonged periods of sleepleeness and sleeping upright. On exam, he was obese with audible snoring even upright. A lateral neck X-ray demonstrated massive adenoid hypertrophy with only a thread of air nasopharynx with tonsillar hypertrophy partially obstructing the oropharynx. He was referred to ENT and following a tonsillectomy and adenoidectomy 1 month later, he desaturated to 75-80% on room air, but apparently recovered and was sent home after monitoring in 24 h. Ten days later the child arrested at home and was resuscitated and transferred to hospital where he was intubated. His prognosis was poor and ventilator support was withdrawn per the parents' desires. The autopsy revealed enlarged right ventricle consistent with corpulmonale. Preoperative monitoring of pulse oximetry and pre and postoperative PSG is recommended to avoid complications of surgery.

Results: The prevalence of OSAS is between 1 and 4% but most studies demonstrated a high frequency in children with achondroplasia. Apnoea-Hypopnoea Index (AHI) is the most commonly reported PSG parameter describing SDB severity in the literature and recommended to avoid complications of surgery. Therapy may necessitate uvulopalatoplasty and continuous positive airway pressure. There are no high-quality studies supporting the validity of OSAS definition in children with craniofacial abnormalities.

Conclusions: In the present case PSG-is highly recommended to avoid complications of surgery. OSAS treatment is a priority in the presence of major craniofacial abnormalities.

Disclosure: Nothing to disclose.

P421 | Psychometric properties of the 9-item Ethos brief among obstructive sleep apnea patients

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Objectives/Introduction: Continuous positive airway treatment (CPAP) is the recommended treatment for patients with obstructive sleep apnea (OSA). Outcome measure often focus clinical and/or self-rated variables related to medical condition. However, a brief validated instrument focusing the whole life situation (i.e., ethos) suitable for clinical practice is missing. The aim was to investigate factorial structure, categorical functioning of the response scale and differential item functioning (DIF) across sub-populations of the Ethos brief scale among patients with OSA before and after treatment with CPAP is initiated.

Methods: Prospective design, 180 OSA patients (68% men, 59,66 years, sd 11,51) from CPAP clinics at two hospitals, one university and one county hospital. A clinical assessment and overnight polysomnography scored by a sleep physician was used to diagnose patients. Questionnaires used before treatment initiation, after 6 months and 12 months CPAP treatment were; Ethos brief (9 items), Epworth sleepiness scale (ESS, 8 items), Hospital anxiety and depression scale (HADS, 14 items), and short form-12 (SF-12, 12 items). Validity and reliability of the Ethos was investigated using Rasch and confirmatory factor analysis (CFA) models. In addition measurement invariance, unidimensionality and differential item functioning (DIF) across gender groups, Apnea hypopnea index (AHI) groups and ESS were performed. The reliability of the Ethos was confirmed using both Composite reliability (0.90) and Cronbach's Alpha (0.90).

Results: The results supported unidimensionalily of the Ethos in both CFA and the Rasch model. Moreover, no DIF was found across gender, AHI and ESS groups. The results of the DIF were conformed in multigroup CFA. Finally, a latent profile analysis (LPA) was performed to examine the profiles of patients based on their scores in the Ethos. The LPA yielded 2 profiles of the patients with low (n = 42) and high (n = 151) Ethos. Patients in the low profile group were younger, had higher depression scores, lower perceived health, poorer adherence after 6 month and higher BMI.

Conclusions: The Ethos brief scale seems to be a valid tool with robust psychometric properties suitable for use among patients with OSA before and after treatment with CPAP is initiated. Future studies should focus on its predictive validity.

Disclosure: None.

P422 | A patient with concomitant catathrenia, snoring and central sleep apnea events. The polysomnographic differences between them

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Objectives/Introduction: Catathrenia (nocturnal groaning) is a rare condition characterized by monotonous irregular sounds that occur during sleep. Not infrequently, catathrenia has been confused with snoring and central sleep apnea.

Methods: Case report.

Results: A healthy 33 year-old man presented with the chief concern of "abnormal breath sounds" that occur during sleep for the past two decades, unaware for the patient, but especially disturbing for his family and current partner. He has good sleep hygiene, but reports some sleepiness with an Epworth sleepiness scale score of 11/24. There was no past medical history of note and he was on no regular medications. His partner reports two different types of sounds, one compatible with mild regular snoring, and another different "funny noise" while exhaling, no witnessed apneas were noted. Overnight Polysomnography (PSG) with sound and video recorded, was performed. PSG findings showed normal apnea/hipopnea index (4.1/h), 4 central sleep apnea events were registered, with normal sleep efficiency and well-preserved sleep architecture. Light inspiratory snoring was recorded during NREM sleep, mainly within the first half of the study. Expiratory groaning sounds were noted mainly during REM sleep predominantly during second half of the study (8 events were recorded, ranging from 15 to 170 s of duration), beginning with deep inspiration followed by protracted expiration during which a monotonous vocalization of groaning was produced, associated with an arousal 80% of the times. The PSG findings closely resembled central apneas, but the abnormal respiratory pattern of bradypnea, with preceding deep inspiration and subsequent vocalizations during the prolonged expiratory phase, without oxygen desaturation, differentiate catathrenia from true central apnea (also documented during the study with characteristic graphic distinction on PSG, same consideration as with inspiratory snoring).

Conclusions: We recommend video-audio PSG as the investigation of choice to diagnose catathrenia, having special caution in order to differentiate the PSG findings associated with these three different entities, which could be confused and let us to misdiagnosis, especially when they coexist in the same patient.

Disclosure: Nothing to disclose.

P423 | Obstructive sleep apnea-hypopnea syndrome and comorbidities: a retrospective Moroccan study

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Objectives/Introduction: In the general population, Obstructive sleep apnea-hypopnea syndrome (OSAHS) is by far the commonest form of sleep apnea. It's considered as a public health concern because of its high prevalence and its association with numerous comorbidities causing a high morbidity and mortality risk which impose their assessment. The disease is characterized by periodic partial or complete recurrent upper airway obstruction during sleep despite ongoing respiratory effort leading to micro-arousals and/or desaturation.

The objective of this study is to assess the prevalence of comorbidities in a group of Moroccan patients diagnosed clinically and polysomnographically with OSAHS and its association with Apnea-Hypopnea Index (AHI).

Methods: This is a retrospective study of 53 charts from patients diagnosed with OSAHS in the pulmonology department of Ibn Sina Hospital between October 2016 and December 2017.

Results: We evaluated 53 patients with OSAHS (38 men and 15 women) with a mean age of 47.8 ± 12,9 years. The prevalence of comorbidities was 71,7%. Cardiovascular comorbidities were present in 41,5% (from whom hypertension in 39,6%), obesity in 48,1%, ENT comorbidities in 20,8%, diabetes mellitus in 15,1%, depression under medical supervision in 5,7% and asthma in 3,8%. Comorbidities occurred in 29,4% of patients with AHI lower than 30/h (mild to moderate OSAHS), and in 70,6% of patients with AHI upper or equal to 30/h (severe OSAHS) (p: 0,04).

Conclusions: As for Caucasian studies, we showed high prevalence of comorbidities in a Moroccan sample of patients diagnosed with OSAHS and the presence of these comorbidities was significantly associated to severity of OSAHS. Larger studies are necessary to comfort these findings.

Disclosure: Nothing to disclose.

P424 | Vitamin D deficiency by obstructive sleep apnea (OSA) severity: the importance of an adequate supplementation.

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Objectives/Introduction: Recent studies report a link between obstructive sleep apnea (OSA) syndrome and vitamin D levels.

Methods: We enrolled all new OSA patients referred to our Sleep Centre in the last three years. All selected patients had a clinical/instrumental evaluation including polysomnography, anthropometric values (Body mass index, BMI), daytime somnolence by Epworth Sleepiness Scale (ESS), vitamin D assessment, comorbidity, therapy.

Results: Three hundred twenty patients (215 M,105 F) were enrolled. Mean age 61 ± 11.5, range 16-86, mean BMI 31.6 ± 6.3. Comorbidities were hypertension in 58.1%, diabetes in 23.7%, thyroid disease in 12.9%, migraine in 3.1%, COPD in 28%. All patients have been diagnosed for OSA by means of cardiorespiratory ambulatory monitoring. Mean ESS score were 8.4 ± 4.9 and mean AHI 32.5 ± 20.2. We divided all sample in three subgroups by severity: sixty patients had mild OSA, 69 moderate OSA and 191 severe OSA. Serum vitamin D mean values were 23.2 ± 13.9, no differences among the three subgroups. Vitamin D supplementation was prescribed in 164 patients and CPAP therapy in 32 patients.

Multivariate analysis showed an inverse correlation between vitamin D and AHI (p = 0.04, r = 0.8, CI 5%), both in all sample and in each subgroup. A trend of inverse correlation was also found among vitamin D and BMI, AHI and ESS (r = 0.005, 0.07, 0.006, respectively). Re-evaluation of all patients after 6-month supplementation therapy is currently on going.

Conclusions: Vitamin D deficiency seems to increase by apnea severity and may play a role on co-morbid symptoms such as obesity and excessive daytime somnolence. An adequate supplementation could play a valid role in a multi approach treatment of OSA patients.

Disclosure: Nothing to disclose.

P425 | Central sleep apnea and cardiovascular burden: sex differences in a retrospective romanian population

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Objectives/Introduction: Sleep-related breathing disorders are highly prevalent in patients with established cardiovascular disease. Central sleep apnea (CSA) shares several pathophysiological features of obstructive sleep apnea (OSA) and good working knowledge about these association is important for optimal clinical care.

Methods: We retrospectively (2009-2016) examined association between CSA and self-reported CVD in 19 individuals who underwent overnight, unattended polysomnography at home. After exclusion of other sleep pathologies (insomnia, circadian rhythm, hypoventilation syndromes, obstructive and mixed sleep apnea, upper airway resistance syndrome), other respiratory, metabolic acute/uncontrolled pathologies, or chronic prescription opioid use, we compared male vs female patients regarding demographics, OSA

symptoms, heart ration (HR), blood pressure (BP), comorbidities and sleep studies. SPSS 20 (Chi test, T-test).

Results: 829 patients screened; 19 patients (13 male, 68%) with CSA analyzed. Mean parametres: age 60.5 ± 32.52, Epworth sleepiness score (ESS) 7.05 ± 3.75, BMI 30.43 ± 7.56 kg/m^2, diagnostic AHI 43.32 ± 25.53/h. They were properly PAP titrated and medical treated. The most frequent cardiovascular comorbid diseases were hypertension (74%), ischemic coronary artery disease (42%) and chronic heart failure (32%). There were no significant differences between genders regarding age, ESS, symptoms, CSA severity or comorbidities. The male group differs only by mean DBP pressure (87 ± 7.07 vs 67.5 ± 7.07 mmHg, p = 0.002), although normal and similar mean DBP pressure (130 ± 14.14 vs 122.5 ± 21.21, p=NS), suggesting proper control of hypertension. This data are more or less similar with some other literature findings.

Conclusions: Knowledge about these distinct gender-related differences in features of a Romanian sleep cohort must draw attention to the differences between the various parameters specific to the CSA pathology according to the type of patients, pertinent interpretations even if the differences between the two populations were not statistically significant, leaving considerable room for improvement for future investigators to target.

Disclosure: Nothing to disclose.

P426 | Hypertension in obstructive sleep apnea is associated with increased carbonic anhydrase activity

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Objectives/Introduction: The catalytic function of the enzyme carbonic anhydrase (CA) plays a fundamental role in carbon dioxide, proton, and bicarbonate homeostasis. Increased blood CA activity has been associated with obstructive sleep apnea (OSA). In the current study, we investigated the influence of comorbid hypertension on CA activity in patients with OSA. The effect of positive airway pressure (PAP) therapy on CA activity was also studied.

Methods: 20 hypertensive patients and 12 normotensives controls were recruited from a sleep clinic OSA cohort (27 males, age 52 ± 10 years, body mass index 37.3 ± 6.7 kg/m^2, apnea-hypopnea index 48 ± 31 events/h) and followed up after PAP treatment (duration 9 ± 18 months). Patients treated with diuretics were excluded. Blood CA activity was assessed at baseline and PAP therapy follow-up by an *in vitro* colorimetric method.

Results: At baseline, hypertensive OSA patients, compared with normotensive controls, had a higher CA activity (1033 ± 204 vs. 862 ± 201 units, p = 0.028). In a generalized linear regression model adjusting for gender, age, smoking, body mass index and apnea-hypopnea index, hypertension status was significantly associated with CA activity (β= 198, 95%CI 82-1475, p = 0.014). PAP treatment did not significantly change CA activity over time (976 ± 216 vs. 956 ± 199 units for the whole patient group, p = 0.39).

Conclusions: CA activity was higher in OSA patients with comorbid hypertension compared with normotensives. PAP was not found to modify CA activity in OSA suggesting that increased CA activity constitutes a physiological trait for hypertension development in OSA. Future larger scale studies are needed to better map the potential influence of CA on respiratory and hemodynamic function in OSA.

Disclosure: Nothing to disclose.

P427 | Association between sleep disordered breathing symptoms, sleep apnea and socio-economic status: a systematic review of the literature

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Objectives/Introduction: Socioeconomic health disparities persist despite improvements in health and health care in the last decades. Low socio-economic status (SES) is associated with worse health outcomes, such as obesity, diabetes, metabolic syndrome and cardio-cerebrovascular disease and greater mortality. The aim of this systematic review is to summarize previous studies obtained in literature about the association between SES and obstructive sleep apnea (OSA)/sleep disordered breathing (SBD) symptoms risk.

Methods: The review was realized following the PRISMA statement. A literature search in Medline, PubMed, PsycInfo, Scopus, Web of Science and Google Scholar was conducted. Articles published in English, without time publication limits, aimed to analyze the association between SDB symptoms or OSA diagnosis and SES, were selected.

Results: Of 156 abstracts identified, 21 met inclusion criteria, of which only one was longitudinal study and the remainder part was cross-sectional research. In 6 (28,6%) articles the sample was composed by children. In 15 studies (71,4%) OSA was diagnosed by polysomnography. Low SES are indicate as risk factor for the presence of SDB symptoms in 13 (61,9%) of the articles. With respect to pediatric population, subjects from low SES presented an increased risk of OSA respect to higher SES ones in all the research selected.

In adults subgroups studies nevertheless, the association between SDB and socio-economics aspects is more controversial.

Conclusions: The results of this systematic review point out that low SES could be a risk factors for OSA, especially in pediatric population. Physical activity and others health behaviors could mediate the association between low SES and SBD symptoms. Socioeconomic circumstance should receive more attention in research of the sleep medicine area.

Disclosure: Nothing to disclose.

P428 | Daytime dyspnea is a strong predictor of sleep apnea in an unselected population of COPD patients

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Objectives/Introduction: Sleep disordered breathing (SDB) is a prevalent but frequently overseen condition in patients with Chronic Obstructive Pulmonary Disease (COPD) and may have detrimental effects on outcome. However, the best way to recognize this condition is yet not established. We therefore studied the prevalence of SDB in stable COPD by means of an overnight tonometry. We hypothesized that COPD severity, anthropometric measures, and daytime sleepiness predict SDB.

Methods: Patients (n = 32, mean age 70 ± 6 y, BMI 27 ± 7 kg/m2, FEV1% 44 ± 14) were studied with overnight arterial tonometry (Watch-PAT 200, Itamar Medical, Israel). Phenotyping including pulmonary function test (body plethysmography), arterial blood gases, and anthropometric data was performed. Daytime symptoms were evaluated with the COPD Assessment Test (CAT), the Medical Research Council (MRC) Breathlessness Scale (COPD symptoms) and the Epworth Sleepiness Scale (ESS, daytime sleepiness). Independent predictive factors for significant SDB (defined as Apnea Hypopnea Index (AHI) ≥15n/h) were assessed by General Linear Modelling.

Results: Mean AHI, Rapid Eye Movement sleep (REM)-AHI, ODI, REM-ODI were 14.1 ± 9, 23.7 ± 12, 5.9 ± 5, and 11.7 ± 8 n/h, respectively. Mean saturation was 91.9 ± 3%. SDB prevalence was 29% in female (n = 20) and 44% in male (n = 12) COPD patients and increased from 18% to 40% in patients with mild compared to severe airway obstruction (FEV1 class 70-50% versus < 30%). Arterial PO2 correlated with REM-ODI (r = -0.45, p = 0.018) and REM-AHI (r = -0.36, p = 0.06). Daytime sleepiness correlated with the number of nocturnal awakenings (r = 0.48, p = 0.044). In the adjusted model, daytime dyspnea (MRC score) was the only predictor of significant SDB in COPD patients (Odds ratio 3.2, CI 1.04-9.9, p = 0.04) independent of age, gender, BMI, FEV%, CAT, and ESS. One patient failed to perform the sleep test, no device-related technical drop-out occurred.

Conclusions: Daytime dyspnea, but not increased sleepiness or obesity, predicted moderate to severe SDB in this clinical cohort of patients with COPD. We identified significant SDB in almost one-third of the cohort and the prevalence progressed with COPD severity. Arterial tonometry proved to be a reliable and user-friendly sleep diagnostic tool. Our data demonstrates that novel diagnostic algorithms which integrate sleep in the routine phenotyping of COPD patients need to be developed.

Disclosure: Nothing to disclose.

INSOMNIA 3

P429 | Time estimation following a nap condition in good sleepers

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Objectives/Introduction: The quarter-of-an-hour rule (QHR) is an effective component of stimulus control; however it requires patients to be able to accurately determine the passage of time. Belleville (2001) found that insomnia patients misperceived a time interval of 12.5 min after a nap. Misperception of time intervals may mean that patients stay in bed longer than the recommended QH, potentially negating the therapeutic effects of stimulus control. We propose that sleep inertia is the reason individuals misperceive the time interval. The study aimed to manipulate the levels of sleep inertia to measure the effects thereof on time estimation.

Methods: In a randomized, cross-over design, twelve good sleepers underwent both a nap condition (slept until reaching stage 3 sleep, or asleep for 60 min) and a wake condition (laid awake for 30 min) in a bedroom in a laboratory setting. Following each condition, participants were required to estimate when 15 min had elapsed. The co-variate sleepiness was assessed with the Stanford Sleepiness Scale before and after each condition.

Results: In the nap condition, five participants reached stage 3 sleep, six reached stage 2 sleep, and one participant did not fall asleep and was removed from the analyses. Our manipulation check confirmed that sleepiness after the nap condition was higher than before the nap (3.8 vs. 5.3), whereas in the wake condition sleepiness remained unchanged (3.3 vs. 4). The difference between the post-nap sleepiness and post-wake sleepiness was significant (p < .05). Participants in the nap condition produced a time estimation (mean=10.2 min, SD=4.6) which was significantly different to the estimation after the wake condition (mean=16.5 min, SD=5.8, t(10)=2.9, p < .05).

Conclusions: Unexpectedly, individuals underestimated the passage of time after the nap condition compared to the wake condition, presumably because of increased sleep inertia. The results need

to be replicated with insomnia patients to determine the implications for adherence to the QHR in patients.

Disclosure: Nothing to disclose.

P430 | Modelling sleep state misperception at sleep onset

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Objectives/Introduction: Insomnia patients often overestimate their sleep onset latency (SOL). The mechanism underlying this type of sleep state misperception is not fully understood. We hypothesize that the length of uninterrupted sleep fragments after sleep onset influences the perception of the SOL because too short sleep fragments might be overlooked. We attempt to make a model of the minimum length that a sleep fragment should have in order to be perceived as sleep, and we fit the model to subjective data of insomniacs and healthy controls.

Methods: Standard in-lab polysomnographic recordings were performed in 20 elderly, untreated insomniacs and 21 age-matched self-defined good sleepers. Recordings were visually scored according to R&K criteria. In the model sleep onset was defined as the first epoch of the first sleep fragment longer than L minutes, with L varying from 0.5 to 40. We selected the length L that resulted in the smallest Mean Square Error (MSE) of the difference between modelled SOL and SOL perceived by the subject. This was done for both subject groups separately.

Results: For insomniacs, the lowest MSE was found for a length L of 30 min (MSE without model: 7195 vs. L = 30: 3927). In the healthy subjects, applying the model only resulted in small improvements of the MSE. The lowest MSE was found for L = 10 (MSE without model: 1185 vs. L = 10: 969), although the results for all model parameters L below 20 were very similar.

Conclusions: The aim of this study was to investigate the mechanisms underlying sleep onset misperception, by modelling the influence of sleep interruption on subjective SOL. The results indicate that in insomnia patients the perception of sleep onset can be influenced if a sleep fragment is interrupted after less than 30 min. The different results for the two groups suggest that, for the perception of sleep onset, insomniacs are more sensitive to sleep interruption than healthy subjects. In order to extend our findings to the general population, the analysis should be repeated in different age groups. Additionally, other parameters could be added to the model, for instance sleep depth and the duration of the sleep disruption.

Disclosure: Nothing to disclose.

P431 | Sleep quality related with exercise duration and timing in community dwelling adults

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Objectives/Introduction: Epidemiological studies have indicated physical exercise improved the sleep quality and quality of life. Physical exercise has been proposed as a non-photic zeitgeber with a positive impact on sleep and mood through its circadian effect. Some studies suggest the effect of exercise on sleep can vary depending on the intensity and timing of exercise, and light exposure. We investigated whether the subjective and objective sleep quality differs according to the duration and timing of exercise in community dwelling adults.

Methods: Participants were recruited from 3 Public Health Centers in a rural area of Korea. The Beck depression inventory (BDI), Korean version of Morningness-Eveningness Questionnaire (MEQ-K), Pittsburgh Sleep Quality Index (PSQI) and Short Form-12 (SF-12) were administered. The exercise group (EG) was divided into EG $\leq$ 1 h (one hour or less) and EG $>$ 1 h (more than one hour) by its duration, and into morning EG and afternoon EG by its timing. The actigraphy (Actiwatch 2; Philips Respironics, Murrysville, USA) recording was conducted at home for 7 days. Eighty five subjects in the non-exercise group (NEG) (60.0 ± 13.1 years), 69 in EG $\leq$ 1 h (60.3 ± 11.3 years) and 30 in EG $>$ 1 h (61.3 ± 14.7 years) were analyzed. The data were compared between the groups by ANCOVA controlling for BDI scores. The $p < 0.05$ was defined as significant.

Results: Among the NEG, EG $\leq$ 1 h and EG $>$ 1 h, there was no difference in MEQ-K and PSQI scores. The EG $>$ 1 h had higher physical component summary (PCS) scores from SF-12 than the NEG. There was no difference in sleep parameters among three groups. The afternoon EG had no difference in PSQI and PCS/MCS scores, and sleep parameters compared to the morning EG. Compared to the morning outdoor EG, the afternoon outdoor EG showed no difference in sleep parameters, but lower MEQ-K and PSQI scores.

Conclusions: The subjective and objective sleep quality was not different according to the exercise duration in our study. However, our finding suggests the exercise of longer duration would improve the physical health-related quality of life. And doing exercise in the afternoon rather than morning could bring a better subjective sleep quality.

Disclosure: Nothing to disclose.

P432 | Patient's perception of comorbid anxiety and insomnia: a qualitative approach

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Objectives/Introduction: Insomnia and anxiety are common comorbid psychological disorders. Most of research and etiologic models address them independently and do not discuss about the context of the comorbidity. This qualitative study explores the perception of patients who suffer from insomnia and anxiety.

Methods: Thirteen individual interviews (7 women, 6 men; mean age 45) were conducted with patients after their psychological assessment in a sleep clinic. The participants were diagnosed with an insomnia disorder [ID] and had anxiety [A] causing significant clinical distress or impairment functioning. Participants were asked to describe their experience of the symptoms of ID and A (apparition, course, maintenance, consequences, and help-seeking). Interviews were digitally recorded and transcribed. Interviews were analyzed using thematic analysis with an interrater agreement procedure.

Results: Three salient themes emerged from this analysis: 'ID and A: a vicious circle', 'ID a fertile ground for A', and 'worrying instead of sleeping'. First, participants reported that the disorders enable each other's in a vicious circle. They explained that a lack of sleep makes it harder to stay alert during the day. They added that the stress from the extra effort needed to stay alert prevents them from sleeping. Secondly, patients said they must cure their ID to have the energy to solve their anxiety. Furthermore, patients observed that fatigue caused by ID makes them more sensitive to external events which enables their A. In all cases, the patients felt that their ID prevents them to reach their personal goals and it makes them feel anxious. Finally, patient reported having thought they developed an ID because they were already A. They explained that trying to solve problems, having thoughts racing through their mind, and questioning themselves at night prevent them to sleep well.

Conclusions: The results highlight the complexity of the relations between ID and A. According to participants, these comorbid disorders seem to be interrelated as they provoke, enhance or maintain each other. Integrating results in further research could improve clinical etiology models and favor a transdiagnostic approach to treat ID and A.

Disclosure: Nothing to disclose.

P433 | The efficacy of cognitive and behavior therapies for insomnia on daytime symptoms: a systematic review and network meta-analysis

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Objectives/Introduction: Insomnia is a highly prevalent disorder worldwide. Besides nocturnal symptoms, insomnia patients also experience diurnal symptoms. In fact, diurnal symptoms are often the reason insomnia patients seek help. Nevertheless, it is not clear whether standard treatments for insomnia are effective on daytime symptoms. The aim of this systematic review and network meta-analysis is to provide evidence on the efficacy of cognitive and behavior therapies for insomnia for daytime symptoms of insomnia.

Methods: PubMed, PsycINFO, PsycARTICLES, MEDLINE, CINAHL and Web of Science were searched from 1987 (data of publication of DSM-III-R) to March 2017 to identify randomized controlled trials investigating the effect of cognitive and behavior therapies for insomnia on daytime symptoms such as fatigue, sleepiness, quality of life, mood disturbance and reduced cognitive functions. Eight classes of treatments (behavioral or cognitive-behavioral therapy for insomnia administered either face-to-face individually or in group setting or through self-help/internet) and 8 classes of control interventions (waiting list, treatment as usual, active contact control, sleep hygiene education, pharmacological interventions for insomnia or other condition, pharmacological placebo, psychological placebo, behavioral and psychological interventions) were identified in the network. Risk of bias was assessed through the Cochrane Collaboration's Tool. Cohen′s d at 95% confidence interval (CI) was calculated to assess the effect sizes of each class as compared with waiting list.

Results: Fifty-eight studies met inclusion criteria. Risk of bias assessment indicated a possible high risk of attrition bias in our sample of studies. For fatigue as outcome, no significant effect was found (for all comparisons in the network $p > 0.05$). Results showed significant effects for self-help cognitive-behavioral therapy for insomnia on quality of life (d = 0.25, 95% CI: 0.07; 0.42) and depressive symptoms (d = -0.24, 95% CI: -0.45; -0.02) and individual face-to-face behavioral therapy for insomnia on depressive symptoms (d = -0.73, 95% CI: -1.45; -0.02).

Conclusions: Preliminary findings suggest potential effects of individual face-to-face behavioral therapy on depressive symptoms and potential effects of self-help cognitive-behavioral therapy on depressive symptoms and quality of life.

Disclosure: Nothing to disclose.

P434 | Neural correlates of cognitive control functioning in individuals with insomnia disorder

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Objectives/Introduction: Individuals with insomnia disorder (ID) commonly report associated complaints of cognitive functioning. Conversely, both behavioral and neurological evidence supporting subjective cognitive impairments in ID remain remarkably scarce and inconclusive. To investigate this discrepancy, the present study used next to behavioral measures, event-related potentials (ERPs) to assess proactive control (i.e., maintenance and updating of task-relevant information) and reactive control (i.e., interference monitoring and resolution) in individuals with ID. ERPs will allow for a more sensitive investigation of these proactive and reactive control processes, which may be difficult to fully understand using only behavioral measures.

Methods: Eighteen individuals with ID (mean age: 32 ± 11.36y, 83% women) and 15 good sleeper controls (GSC; mean age: 32 ± 10.94y, 87% women) completed the AX-Continuous Performance Task. This task required participants to maintain specific cue-information active in order to prepare an adequate response to a subsequent probe.

Results: The results indicate that, although ID show a comparable level of performance as GSC, they show a reduced proactive engagement of cue-induced maintenance and response preparation processes (as reflected by the P3b ($p < .05$) and the contingent negative variation ($p < .05$) components. Moreover, in contrast to GSC, ID fail to engage reactive control (as indexed by the N2 component ($p < .05$)) in order to overcome invalid response tendencies.

Conclusions: As such, these findings advocate for neurological impairments in cognitive control functioning in ID. Our study contributes to a better understanding of the discrepancy between the commonly reported cognitive impairments in ID and the scarce objective evidence for these cognitive complaints.

Disclosure: Nothing to disclose.

P435 | Tracking nightly changes in pre-sleep cognitive arousal during sleep restriction therapy

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Objectives/Introduction: Although cognitive arousal before bedtime is believed to account for the maintenance of insomnia, we know little about how it is modified by the key components of cognitive-behavioral treatment for insomnia. Here, we profile nightly changes in self-reported pre-sleep arousal during sleep restriction therapy (SRT) for insomnia.

Methods: As part of an ongoing study, ten participants (5 male, mean age = 38.1 ± 7.67) with insomnia disorder completed 5 cognitive items from the pre sleep arousal scale (PSAS) every morning for 2 weeks before and 4 weeks during SRT. A linear mixed-model analysis was conducted on the sum score of all 5 arousal items. Fixed effects included time of the intervention (baseline = week 1-2; early treatment = week 3-4; late treatment = week 5-6) and random effects were run to account for between-subject variation.

Results: The completion rate for all arousal items was highly satisfactory at 95.3%, yielding 428 data points (of a possible 449). Linear mixed-model analysis revealed significant results for the time of the intervention on arousal ($F_{(2,\ 416)} = 5.13$, $p = .006$). Pairwise comparisons between time points yielded a significant decrease in arousal from baseline (mean arousal = 10.72 ± 3.86) to late treatment (mean arousal = 9.35 ± 3.88; $p = .002$), while there was no significant decrease from baseline to early treatment (mean arousal = 9.96 ± 3.92, $p = .067$) or from early to late treatment ($p = .197$).

Conclusions: Our preliminary findings show that cognitive pre-sleep arousal diminishes during the course of SRT, and therefore, reveals a potential mechanism of action for the treatment of insomnia by restricting time in bed.

Disclosure: Nothing to disclose.

P436 | Internet-based CBT for insomnia in the general population - a description of design, measurements and interventions in recent RCT studies

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Objectives/Introduction: Internet-based cognitive behavioural therapy for insomnia (ICBTi) has been proposed as an effective, accessible, non-pharmacologic treatment for insomnia disorder. The objective was to perform a literature review of published randomized controlled trials (RCT).

Methods: Literature review. PubMed was used to identify RCTs of ICBTi published since 2013. Keywords were insomnia, ICBT and RCT. The search resulted in 40 hits. Papers with study designs and methods not relevant to the objective were removed ($n = 29$). Reasons for exclusion were: only study protocol, not internet-based, and results based on old data.

Results: Design: Recruitment were done via e-mail, from websites, online ads, and advertisements in local newspapers.

Inclusion criteria: Six studies based their inclusion only on ISI score (from >7 to >=15). 3 studies used a combination of ISI and DSM-IV. Two studies used DSM-IV only.

Sample sizes: 4 studies had less than 100 participants, and 2 studies over 200, the mean number was 139 participants (48-303). The mean age varied from 15 to 52 years. Significantly more female participants in all studies.

Data collection: ISI combined with sleep diary was the most commonly used primary or secondary outcome measurements (n = 7), 2 used ISI only, and 2 used sleep diary only. Other common instruments were, PSQI, HADS, DBAS-16 and CES-D. All studies had pre- and post-treatment measurements, but none during the intervention. The follow-up period varied between 8 weeks and 3 years. The most common follow-up time was 6 months (n = 4), with a range from 4 weeks-3 years.

Intervention: Most of the studies (n = 10) used traditional ICBTi-treatments (i.e., stimulus control, sleep restriction, relaxation, sleep hygiene). One study did not include stimulus control. The treatment duration were six weeks (n = 8), eight weeks (n = 2) and nine weeks (n = 1). All except one used therapist guided support.

Results: All studies showed significant post treatment improvements on sleep outcomes.

Conclusions: All studies showed significant improvement with regard to sleep. The total number of participants in the studies was relatively low. Most studies are not based on clinical samples, which may affect the generalizability of the findings.

Disclosure: Nothing to disclose.

P437 | "You can't always get what you want" - methodological challenges with an internet-based CBT intervention for insomnia among patients with cardiovascular disease

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Objectives/Introduction: Internet-based cognitive behavioural therapy for insomnia (ICBTi) is a frequently used intervention. Published studies are promising, but methodological limitations (e.g., heterogeneity, low number of participants, unclear adherence to the intervention) have been reported. The aim was to describe methodological challenges perceived in the Hit-IT study, an ongoing ICBTi study for patients with insomnia and cardiovascular disease (CVD).

The Hit-IT study: Design: RCT with 1-year follow-up. All patients with CVD (i.e., myocardial infarction, heart failure, atrial fibrillation and angina) from 6 primary care centers are screened for insomnia and during a clinical examination diagnosed according to DSM-V criteria.

Intervention: 9 weeks I-CBTi (1-week introduction, 2 weeks psychoeducation on CVD/insomnia, 6 weeks of sleep hygiene, stimulus control and sleep restriction) vs 3 weeks internet-based sleep hygiene education.

Questionnnaires: Sleep (Pittsburg Sleep Quality Index, Insomnia Severity Index, sleep diary), depressive- and cardiac symptoms (Patient Health Qurestionnaire-9, Cardiac Anxiety Questionnaire) and Quality of Life (SF-12) at baseline, during and after intervention (after 6 and 12 months).

Methods: Interim analysis with descriptive statistics.

Results: Out of 2170 approached patients with diagnosed CVD 1508 (70%) responded (No=1330/Yes=178). Of the 178 approvals (124 men/54 women), 54 did not complete internet-based screening (no e-mail, declined participation and for unknown reasons). Of the 124 participants who completed screening, 40 (34 men/6 women, age range 42-84 years) were excluded (ISI < 8). In addition, 32 were excluded after telephone contact and clinical examination (declined participation n = 10, no clinical insomnia n = 14, sleep apnea n = 4, restless legs n = 2, epilepsy n = 1, pharmacological side effect n = 1). Currently 46 participants have been randomized in the Hit-IT study (15 females, 31 males, mean age 71 years/Range 41-92 years). 19 participants have completed control group (1 dropout related to technical problems, 3 in treatment). In the intervention group, 6 have completed, 4 intentions to treat, 3 dropouts (n = 2 unknown reason, n = 1 technical problems), 10 participants in treatment.

Conclusions: Clear methodological challenges with regard to the strenuous patient inclusion process are identified. The current study has a higher mean age and higher number of participating men than current ICBTi studies in general population.

Disclosure: Nothing to disclose.

P438 | The association between insomnia, stress reactivity and hyperarousal in women in menopausal transition

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Objectives/Introduction: Sleep difficulties are common during the menopausal transition. Among the many biological and psychological factors contributing to sleep difficulties, stress reactivity and hyperarousal are important risk factors in the general population. This study examines the role of stress reactivity and arousal predisposition as moderators of insomnia during the menopausal transition.

Methods: Data for this study were derived from a longitudinal study on insomnia. Participants for this study were 475 women aged 40 to 60 years who were divided into three age-matched groups: pre-menopausal (n = 119) or post-menopausal (n = 154) throughout the five-year follow up period, or in menopausal transition during

that same period (n = 202). Annual follow up were conducted over a five-year period, with participants completing questionnaires assessing the quality of sleep (Pittsburgh Sleep Quality Index, PSQI), the severity of insomnia (Insomnia Severity Index, ISI), the probability of experiencing sleep difficulties in response to stress (Ford Insomnia Response To Stress Test, FIRST) and predisposition to activation (Arousal Predisposition Scale, APS). Linear mixed models using a condition (3) x time (5) design were performed on the sleep variables. To investigate moderation, a median score of 30 for APS or of 20 for FIRST at baseline was used to create APS and FIRST moderating factors (low vs. high).

Results: A significant group (menopausal status) X time interaction was found on the PSQI (p = .028) and ISI (p = .014). Simple effects of menopausal status revealed that insomnia severity increased and sleep quality decreased in the two years before and during the menopausal transition ($p < .05$). In addition, no significant differences of the moderator X group X time interaction were observed for the ISI (p = .489 and p = .781, respectively) or the PSQI (p = .962 and p = .313, respectively) according to APS or FIRST clinical levels at baseline.

Conclusions: These results suggest that sleep disturbances and insomnia severity increase during the menopausal transition and become more important during menopause. However, stress reactivity or arousal predisposition do not seem to moderate the relationships between menopause status, time and these sleep disturbances.

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P439 | Racing thoughts in insomnia are associated with insomnia severity and mood instability: towards a better characterisation of a key clinical symptom

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Objectives/Introduction: To our knowledge, racing thoughts, usually described in manic episodes of bipolar disorder (BD), have never been specifically assessed in patients with primary insomnia, despite being a common hyperarousal symptom reported by patients, especially at bedtime. We investigated racing thoughts in patients with insomnia compared to healthy controls and manic patients with BD, and assessed the relationship between racing thoughts, affective temperaments, and insomnia severity.

Methods: 62 patients with primary insomnia, 119 controls, and 53 manic BD patients filled out the Racing and Crowded Thought Questionnaire (RCTQ; Weiner et al., 2018), a 34 item self-report scale (range 0 to 136). Circadian variability of racing thoughts was assessed via a Likert scale. Insomnia severity was assessed via the Insomnia Severity Index (ISI; Bastien et al., 2001), and affective temperaments, including cyclothymia, dysthymia, and anxiety, were investigated via the TEMPS-A (Akiskal et al., 2005).

Results: RCTQ score was higher in patients with insomnia compared to controls (48.21 vs. 12.00; $p < .001$), and similar that of manic patients (49.92, ns). Patients with insomnia reported that racing thoughts were more severe in the evening and at bedtime ($p < .001$). Moreover, in insomnia, RCTQ score was positively correlated with ISI scores (r = .34, $p < .05$), and cyclothymic temperament scores of the TEMPS-A (r = .34, $p < .05$).

Conclusions: Self-reported racing thoughts are an important clinical feature of primary insomnia, higher than in controls, and similar to those reported by manic patients with BD. Yet most studies focusing on the thinking patterns involved in insomnia have only considered rumination and worry, linked to depressive and anxious mood, which are respectively more prominent in daytime and in the evening (Carney et al., 2010). Our results are the first to suggest that racing thoughts are part of the clinical picture of insomnia, and that they are associated with mood instability of the cyclothymic kind in these patients. Future studies should further address racing thoughts in patients with insomnia to determine whether they are related to a specific phenotype linking insomnia and BD vulnerability.

Disclosure: Nothing to disclose.

P440 | Evaluation of Insomnia among workers of a cast iron factory

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Objectives/Introduction: Integrating sleep medicine in occupational settings and further attention towards this important issue is required in different industries, especially those with various occupational exposures. Sleep problems such as insomnia lead to decreased performance and productivity and increased workplace accidents. However, limited studies are conducted to evaluate sleep problems among industries with multiple hazardous occupational exposures. This study aimed to assess insomnia among workers of a smelting factory.

Methods: All workers of a smelting factory, producing cast iron, were recruited in this cross-sectional study. After obtaining consent form, participants completed a questionnaire including demographic information and a validated Insomnia Severity Index (ISI) questionnaire. Insomnia was categorized to subthreshold, moderate, and

severe based on ISI score. Data analysis was performed by using descriptive statistics.

Results: A total of 200 participants were evaluated. All workers were male and mean (SD) of age was 39.1 (8.9) years. Smoking was reported by 72 (36%) of workers. Workers' shift was from 6AM to 5PM. Ninety (45%), 15 (7%), and 3 (1%) of workers had subthreshold, moderate, and severe insomnia, respectively. Married workers and the ones with higher education (diploma and upper) were more likely to have subthreshold and moderate insomnia, 69 (76.7%) and 10 (66.7%) vs. 26 (28.9%) and 3 (20%), respectively. Sixty three (31%) of participants had early morning awakening and maintenance insomnia and 15% reported initial insomnia.

Conclusions: High proportion of workers in studied smelting factory had insomnia. Further evaluation of associated sleep disorders and comprehensive assessment of hazardous occupational exposures including metal fumes, solvents, and shift work schedules with appropriate interventions seem warranted.

Disclosure: Nothing to disclose.

P441 | Searching for paradoxical insomnia

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Objectives/Introduction: To compare the polysomnographic macrostructure data in insomnia and paradoxical insomnia patients and to evaluate their misperception/Among insomnia patients there is a group characterized by all the clinical complaints of insomnia, although without objective changes in the polysomnography parameters called paradoxical insomnia. Sleep misperception (SM), a key feature of insomniacs with particular dimension in paradoxical insomnia, remains quite unexplained.

Methods: The retrospective cohort study (n = 332) included: 276 patients (65.9% of women; mean of 47.3 ± 14.8 years age) with the clinical diagnosis of insomnia and 56 patients (75.4% of women; mean of 40.9 ± 13.2 years age) with paradoxical insomnia. All patients performed a polysomnographic (PSG) study type I. The analyzed variables were the PSG data. To evaluate SM three formulas were used based on objective and subjective total sleep time (Δdelta=objectiveTST-subjectiveTST; index=objectiveTST-subjectiveTST/objectiveTST and coefficient=objectiveTST/subjectiveTST).

Student t-test or Mann-Whitney, was used according to data distribution; significance was settled at $p \leq 0.05$. Variables presenting statistical differences in both groups, logistic regression models were tested in order to determine if some of these parameters could be associated to the different misperception indexes used.

Results: Most of the PSG parameters were different between groups ($p < 0.05$) (exception of N3, N2 percentages and mean heart rate). The subjectiveTST was 228.56 ± 105.61 min for insomnia and 326.86 ± 118.36 min for paradoxical insomnia (p = 0.003). Concerning the three formulas analyzed for SM no differences were found between groups. For all variables presenting statistically significant difference a regression model was performed. In the Insomnia group Δdelta was explained by the TST ($p < 0.001$) and by sleep efficiency ($p < 0.05$); there was no association with the index; the coefficient was explained by sleep efficiency ($p < 0.003$). In paradoxical insomnia group there was no association between any misperception measures and PSG parameters.

Conclusions: Sleep misperception does not influence the diagnosis of insomnia and paradoxical insomnia. In spite of similar measures of misperception in both groups, paradoxical insomnia demonstrated higher subjective sleep time. For insomniacs associations between misperception and PSG were found; this was not the case for paradoxical insomnia, what implies the need of future research. From our data paradoxical insomnia is a clear-cut entity.

Disclosure: Nothing to disclose.

P442 | Sleep quality in shift workers of offshore petroleum industry

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Objectives/Introduction: Shift work especially night work has negative outcomes for workers, their families, and relevant organizations. Working at night is associated with shortened and disturbed sleep, daytime sleepiness, fatigue, impaired performance, and increased risk of accidents. In this study we aimed to evaluate sleep quality in Iranian workers of offshore drilling rigs.

Methods: One hundred and ninety-two offshore workers of two oil rigs were enrolled in this cross sectional study. They were asked to fill out the validated and reliable Persian version of Pittsburg sleep quality index (PSQI). Data regarding age, marital status, and education level, smoking, the shift work schedule, and BMI (Body Mass Index) were recorded.

Results: The Mean age and mean work experience of the participants were 37 ± 9.3 and 10 ± 8.6 years, respectively. Fifty-six (29.2%) of participants were fixed day shift workers, 111 (57.8%) were swing shift workers (7 days/7nights), 6 (3.1%) were fixed night shift workers and 19 (9.9%) were standby shift workers. Mean PSQI score of all workers was 6.73 ± 3.61. In 69% of subjects, total score of PSQI was ≥ 5. Night shift workers had greater score of PSQI than other three groups of shift workers.

Conclusions: This study showed that more than half of oil rig workers had poor sleep quality and the mean PSQI score was higher in fixed night shift workers. This warrants comprehensive evaluation of studied participants in sleep clinic setting.

Disclosure: Nothing to disclose.

P443 | Insomnia and cognitive function in older adults: a cross-sectional analysis of the Canadian Longitudinal Study on Aging

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Objectives/Introduction: Mounting evidence suggests that disturbed sleep in later life may contribute to cognitive decline and dementia. While insomnia has been associated with deficits in memory and executive function, these relationships in older adults are still unclear as previous research has been mainly conducted in small samples, have not accounted for medical comorbidities associated with insomnia, or have not assessed insomnia symptoms specifically. This study aimed to examine the association between insomnia and cognitive function in a large nationally representative dataset of older adults. We hypothesised that insomnia shares unique relationships with memory and executive function independent of other health and lifestyle factors.

Methods: 28,612 participants >45 years completed the baseline assessments of the Canadian Longitudinal Study on Aging. These assessments included health questionnaires, physical examinations, and neuropsychological testing by a trained interviewer. An 8-question instrument was administered to assess participants' sleep habits and detect insomnia symptoms. Insomnia was defined as sleep onset >30 min (early insomnia) and/or waking during the night or early morning (late insomnia) for more than 3 times per week, in concurrence with interference in daily functioning. The associations between insomnia and cognitive performance (across declarative memory, executive function and psychomotor speed) were examined with general linear regression models to obtain adjusted means and 95% confidence intervals. Bonferonni adjustment for multiple comparisons was applied to all models.

Results: Insomnia was identified in 1,202 subjects (4.2% of the whole sample). Analyses adjusting for age, sex, education, body mass index, as well as lifestyle factors and comorbidities associated with insomnia (e.g. hypertension, depression) demonstrated that those with insomnia performed worse on tests of memory (Rey Auditory Verbal Learning Test, 3.6 vs 3.9 words, $p < 0.001$) and executive function (Mental Alternation Test, 25.9 vs 24.6 s, $p = 0.001$). These remained significant even when adjusting for sleep duration. There were no differences in cognitive performance across insomnia subtypes.

Conclusions: These findings indicate that insomnia in older adults is associated with worse cognitive functioning, even when accounting for comorbidities and sleep duration. Future longitudinal analyses are warranted to assess whether insomnia is associated with prospective changes in cognitive function.

Disclosure: Nothing to disclose.

P444 | Chronic insomnia in morning and evening persons, and short and long-term effects of unguided internet-based cognitive behavior therapy for insomnia

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Objectives/Introduction: Internet-delivered Cognitive Behavior Therapy for Insomnia (CBT-I) has shown promising effects for people in need of treatment for insomnia, albeit more research is needed to identify those who might not benefit from such treatment. The aim of the present study was to investigate if morning and evening persons with chronic insomnia responded differently to internet CBT-I.

Methods: Adult patients ($N = 95$; mean age=45.0 [SD=12.4], 64.2% female) with insomnia were offered internet CBT-I lasting for 9 weeks (Sleep Healthy Using the Internet [SHUTi]), and were assessed with sleep diaries, the Insomnia Severity Index (ISI), the Bergen Insomnia Scale (BIS) and the Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS-16), the Hospital Anxiety and Depression Scale (HADS) and Chalder Fatigue Questionnaire (CFQ). Patients were characterized as morning or evening persons based on a median split of the Horne-Östberg Morningness Eveningness Questionnaire. Short (9 weeks) and long-term (18 months) effects of treatment were examined with mixed model repeated-measures analyses.

Results: The two groups did not differ in terms of age, gender or educational status. At baseline, morning persons had more wake time after sleep onset (WASO, $d = 0.62$, $p < .01$), and evening persons had longer sleep onset latency (SOL, $d = 0.60$, $p < .01$), compared to each other. Results showed a significant group × time effect of WASO to posttreatment, whereas no effects were observed on any of the other outcomes. ISI scores were reduced from 17.4/17.3 (morning/evening persons) at baseline to 9.1/8.5 (Cohen $d_{pre\text{-}post}$=2.33, $p < .001$/$d_{pre\text{-}post}$=2.47, $p < .001$) for post, and remained relatively stable at 10.7/8.5 at 18-month follow up ($d_{pre\text{-}post18\ m}$=1.88, $p < .001$/$d_{pre\text{-}post18\ m}$=2.45, $p < .001$). Similar results were found on the BIS, DBAS, HADS, CFQ and sleep diary data.

Conclusions: Despite different insomnia symptomatology across the two groups at baseline, the current study suggests that internet CBT-I is an effective treatment irrespective of a persons placement along the morningness-eveningness dimension.

Disclosure: Nothing to disclose.

P445 | Smartphones may serve as efficient sleep therapists

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Objectives/Introduction: Insomnia is highly prevalent and is associated with daytime impairment and secondary morbidities. The widely recommended and efficient Cognitive Behavioral Therapy for Insomnia remains inaccessible to most sufferers. We present a mobile application solution that provides digital e-coaching for insomniacs who seek self-help solutions.

Methods: 250 subjects with Insomnia complaints and a PSQI over 8 were offered the SleepRate app that consists of a first week of information gathering to allow for evaluation, including sleep questionnaires, nightly sleep diary providing subjective data, objective measures derived from a wearable device, and reported sleep related habits. This week is followed by weekly cycles of e-coaching that implement standard protocols of cognitive behavioral therapy aiming to realign sleep drive and biological clock, reduce hyperarousal, improve sleep related habits, and provide sleep education.169 subjects completed the first assessment week. All complained of difficulties falling asleep, or being awake at night, early awakenings, or non-refreshing sleep. 96 of those met the criteria of having longer than 30 min average Sleep Onset (SO, N = 36), Wake After Sleep Onset (WASO, N = 26), or both long SO and long WASO (N = 17). 32 subjects had also Sleep Efficiency (SE) lower than 85%; 90 had normal average SO, WASO and SE, with several abnormal nights.

Results: 69% of the 169 who completed the first week, completed therapy and got their end of therapy report. Statistical analysis was performed using paired t-test between first week, and end of therapy. Average SO decreased significantly in all ($p < 0.01$) from 28.16 min to 21.12 min, more if initial SO was high, from 60.66 to 30.91. Same findings for WASO: decreased from 21.16 min to 17.41 min in all, and from 47.77 to 24.70 in those with initial high average WASO. SE improved more in those with abnormal SE.

Conclusions: Digital CBTi using a mobile application proved to be an efficient aid for people affected by Insomnia, and the improvement is larger when the initial complaints are worse. The main challenge remains engagement and compliance with the guidance provided by an e-coach.

Disclosure: A Baharav, S Eyal work at HypnoCore, a company that has developed the SleepRate solution.

P446 | The genetic liability for insomnia is associated with the number of awakenings during sleep in young and healthy individuals

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Objectives/Introduction: Identifying risk factors for insomnia in individuals that are likely to develop insomnia is needed to develop prevention strategies. Novel genetic tools using results of large case-control genome wide association studies (GWAS) allow to predict the liability for complex diseases based on full-genome common genetic variations. Here, we applied such tools to assess the link between the genetic liability of developing insomnia and sleep phenotypes in young and healthy adults not reporting any sleep complain.

Methods: Electroencephalography was recording during 8 hr baseline sleep in 200 healthy young male volunteers with normal sleep (aged 22.07 years ± 2.71). Sleep architecture, the percentage and latency of each sleep stage, and the total number, hourly rate and mean duration of awakenings were extracted from automatic sleep scoring (Aseega, Physip). Blood samples were collected in all participants to assess common Single Nucleotide Polymorphisms (SNPs) over the entire genome. Individual liability for insomnia was computed based on whole genome SNPs using the summary-statistics of a case-control GWAS seeking for genetic determinants of insomnia (Hammerschlag et al. Nat Genet 2017;49:1584-1592, https://ctg.cncr.nl/software/summary_statistics).

Results: Generalized linear mixed model reveal significant associations of one's genetic risk score for insomnia with the total number (r = –0.23, p = 0.004) and hourly rate (r = –0.25, p = 0.002) of awakenings: higher liability for insomnia was associated with less awakenings. Although not significantly, increased liability for insomnia was positively associated with mean duration of awakening (r = 0.13, p = 0.06), suggesting insomnia liability is associated with less awakenings of longer duration. The associations remain significant after adjusting for age. In fact, the genetic liability for insomnia was also significantly associated with age despite the limited age-range of our young sample (r = –0.18, p = 0.008). Association with other sleep metrics were not significant.

Conclusions: These results show that individual genetic liability for insomnia is linked to macroscopic sleep fragmentation as indexed by

awakenings during sleep in young and healthy individuals. Further analyses will consider other aspects of sleep in a larger sample. Identification prior to disease onset could help identifying novel prevention targets for insomnia.

Disclosure: FNRS, ULiège, ARC, FEDER, Welbio, FMRE, Clerdent Foundation.

HYPERSOMNIA 2

P447 | Serum of narcolepsy type 1 patients does not decrease hypocretin receptor 2 function

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Objectives/Introduction: The loss of hypocretin-producing neurons leading to narcolepsy type 1 is suggested to be caused by an immune response. Even though several studies in narcolepsy type 1 patients found autoantibodies targeting molecules that are moderately specific for hypocretin-producing neurons, such as Tribbles homolog 2, or the hypocretin receptor 2, the functional effect of these antibodies is not clear. Therefore, we assessed the effect of narcolepsy type 1 patient serum on hypocretin receptor 2 functioning.

Methods: Chinese hamster ovary cells transfected with a human hypocretin receptor 2 were incubated with serum from narcolepsy type 1 patients and healthy controls. Hypocretin-1 was subsequently administered to the incubated cells and intracellular Ca^{2+} concentration was measured using flurorescence microscopy and dedicated imaging software. Administration of ATP was used as a positive control. Ratios of Ca^{2+} concentration upon hypocretin-1 and ATP administration was used for standardisation of the results.

Results: 9 narcolepsy type 1 patients and 9 sex- and age-matched healthy controls were included in this study. Mean hypocretin-1/ATP ratios were 1.47 ± 0.76 in experiments with narcolepsy type 1 serum and 1.05 ± 0.56 in those with healthy control serum. Mann-Whitney *U*-tests showed no significant differences between both groups.

Conclusions: An effect of narcolepsy type 1 patient serum on hypocretin receptor 2 functioning could not be demonstrated. These results do not support the hypothesis that hypocretin receptor 2-specific antibody-mediated auto-reactivity is present in narcolepsy type 1 patients. Future research on the possible role of autoantibodies to hypocretin receptor 2 in the development of narcolepsy type 1 is warranted.

Disclosure: Nothing to disclose.

P448 | Sleep-state and dream perception in sleep disorders

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Objectives/Introduction: Sleep-state misperception is a common phenomenon among primary insomnia patients with a prevalence ranging between 9.2 and 50%. In obstructive sleep apnea, inverse sleep-state misperception has been reported. These studies depend on polysomnography measures for the identification of sleep-state misperception and predicting patient-related factors. We assessed factors influencing sleep-state perception during the 20-min naps of a multiple sleep latency test.

Methods: In this prospective observational study, 247 consecutive patients undergoing a routine multiple sleep latency test between March 2014 and October 2017 in SEIN Heemstede, a tertiary sleep-wake centre in the Netherlands, were included. Sleep and dream perception was assessed by questionnaires after each nap. Mixed models were applied to assess the influence of patients' clinical data on sleep-state and dream perception.

Results: Patients fell asleep in 82.3% of nap opportunities. Patients reported to have slept in 72.8%. A lower age (β = –0.042/years ± 0.017; p = 0.014), the occurrence of N2 stage sleep (β = 2.106 ± 0.842; p = 0.012) and a shorter sleep onset latency (β = –0.225/min ± 0.052; $p < 0.001$) were significant predictors for correct sleep-state perception. Sleep diagnosis did not predict correct sleep-state perception (p = 0.575). In 28.0% of naps in which patients did not reach REM sleep, patients reported to have dreamed. On the contrary, patients reported not to have dreamed in 26.4% of naps in which REM sleep did occur. Dream perception percentage was not significantly different between diagnosis categories.

Conclusions: Sleep-state perception is better in younger patients with shorter sleep onset latencies during a nap in which N2 sleep occurred. Sleep-state perception does not differ between sleep diagnosis categories during the short naps of the multiple sleep latency test. Notably, the perception of dreaming is influenced by, but definitely not limited to the occurrence of REM sleep.

Disclosure: Nothing to disclose.

P449 | Personality traits in subjective perception of hypersomnolence

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Objectives/Introduction: In hypersomnia patients, many factors seem to contribute to their subjective perception of daytime

sleepiness. Our aim was to investigate potential effect of specific personality traits, assessed by Temperament and Character Inventory (TCI), in particular novelty seeking (NS), harm avoidance (HA) and persistence (PS) on subjective perception of daytime sleepiness, assessed by Epworth sleepiness scale (ESS) in hypersomnia patients.

Methods: Our exclusion criteria included all sleep comorbidities that could contribute to daytime sleepiness, such as sleep apnea or periodic leg movements in sleep. We also excluded all narcolepsy type 1 patients or severely depressed participants (assessed by Beck Depression Inventory; BDI). After applying these criteria, we investigated 21 hypersomnia patients (14 females, mean age = 35.8 years, SD = 11.4; BMI = 24.3, SD = 4.5; mean ESS score = 16.14, SD = 4.3). In order to objectively assess sleepiness, we performed Multiple sleep latency test, which revealed mean sleep latency of 7.2 min (SD = 4.3). Mean BDI score was 11.5 points (SD = 9.0). We firstly calculated frequencies of scores in TCI domains that fell within the normal limits (15–85th percentile). Secondly, we analysed the correlations between these traits and BDI and ESS scores, adjusted for age.

Results: From our participants, NS fell within the normal limits in 61.9%, HA in 52.4% and PS in 66.7% of cases. We found only a negligible relationship between ESS and NS (Pearson's $r = -0.097$; $p = 0.683$) and weak negative relationship between ESS and HA (Pearson's $r = -0.279$, $p = 0.234$) and ESS and PS (Pearson's $r = -0.284$, $p = 0.224$), all of which were non-significant. However, we found statistically significant strong negative relationship between ESS and BDI (Pearson's $r = -0.479$, $p = 0.033$). Furthermore, we found statistically significant strong positive relationship between BDI and HA (Pearson's $r = 0.0.445$, $p = 0.0.043$).

Conclusions: We conclude, that specific temperament dispositions, such as novelty seeking, harm avoidance or persistence do not have a major impact on perception of daytime sleepiness in hypersomnia patients. However, temperament might contribute to other aspects of psychological well-being, such as subjective perception of depression in this cohort. Thus, considering particular personality traits could be useful in adjusting specific personally-tailored psychotherapeutic forms of treatment.

Disclosure: Nothing to disclose.

P450 | Disturbed nighttime sleep in patients with central disorders of hypersomnolence

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Objectives/Introduction: Narcolepsy type 1 (NT1), narcolepsy type 2 (NT2) and idiopathic hypersomnia (IH) are central disorders of hypersomnolence where the main complaint is the inability to stay awake and alert, are not better explained by others causes. Describe demographic data and compare the clinical spectrum, including psychological tests and PSG-MSLT parameters of patients diagnosed as NT1, NT2 or IH in our center.

Methods: 40 consecutive patients diagnosed with NT1, NT2 or IH. Demographic and anthropometric data [body mass index (BMI) non-obese <30 kg/m^2, obese ≥30 kg/m^2]; scores on sleep-questionnaires [Epworth Sleepiness Scale (ESS) {no EDS ≤10, mild (11–15), severe (≥16)}; positive Ullanlinna Narcolepsy Scale (UNS) (≥14); Insomnia Severity Index (ISI) to evaluate the presence of disturbed nighttime sleep (DNS) {no insomnia/subthreshold (0–14), moderate-severe (≥15)}]; psychological tests [Beck depression inventory (BDI-II) {no-mild ≤19, moderate-severe (20–63)}; the state-trait anxiety inventory (STAI) considered positive above 50th percentile]. We also looked HLA results. Parameters were obtained from a diagnostic nocturnal PSG-MSLT reports recorded in drug-free patients.

Results: From our cohort, 8 were diagnosed as NT1, 17 as NT2 and 15 as IH. Sex distribution was 25 females and 15 males. Obesity was present in 12.5% of NT1 category, 0% NT2 and 20% IH. About sleep questionnaires, 100% of the patients reported EDS as mild to severe (ESS: 18.8, 15.5, 16.6). UNS was higher in NT1 ($p < 0.001$). DNS measure trough ISI show moderate-severe insomnia in 88% of NT1 group, 33% NT2 and 60% IH. In terms of psychological tests, 38% of the cohort who score for moderate-severe depression was from NT1 group and 12% from NT2 and 13% IH. Anxiety state/trait in NT1 was (25 and 25%), NT2 (28 and 14%) and IH (20 and 50%). The percent of positive HLA was higher in NT1 (100, 33, 33%). Wake after sleep onset was higher in NT1 ($p = 0.043$). No statistically significant differences were observed in others parameters as sleep efficacy, sleep latency, change of phases or proportion of different stages of sleep. 25% of NT1 had severe obstructive sleep apnea.

Conclusions: Disturbed nighttime sleep is common in patients with central disorders of hypersomnolence.

Disclosure: Nothing to disclose.

P451 | The role of emotion regulation in narcolepsy with cataplexy

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Objectives/Introduction: Narcolepsy with cataplexy (NC) is a neurological sleep disorder characterized by irresistible daytime sleepiness and a sudden loss of muscle tone triggered by strong emotions (cataplexy). Psychiatric disorders such as depression are frequent comorbidities. While this makes the role of emotion regulation (ER) essential in this clinical condition, surprisingly little is known about ER in patients with NC. The purpose of this study is to

explore the use of different ER strategies in NC-patients and their associations with mental health.

Methods: Forty-one NC-patients (31f, age: 35.4), 42 patients with stress-related sleep disorders, mainly insomnia (37f, age: 37.1), and 48 healthy controls (37f, age: 36.6) completed questionnaires on ER strategies and mental health outcomes. ANOVAs with Bonferroni corrected post-hoc tests were performed.

Results: In contrast to the other groups, NC-patients showed significantly impaired mental health ($p < 0.001$). At the same time, NC-patients reported some enhanced ER skills, like significantly less self-blame ($p = 0.045$), more acceptance ($p = 0.003$) and by trend less rumination ($p < 0.084$). In contrast to the two control groups, some maladaptive strategies, like emotional suppression, were not related to negative mental health outcomes in NC-patients.

Conclusions: NC-patients may improve their ER-skills to cope with the disease. However, this does not protect them against depression or decreased quality of life. Moreover, the associations between maladaptive ER strategies and mental health seem to have some unique variations in NC, probably due to the functionality of suppressing emotions. As adaptive ER is a core feature for coping with chronic diseases, disease-specific patterns should be further explored and considered in psychological NC treatments.

Disclosure: Nothing to disclose.

P452 | Anterior hippocampus volume loss in narcolepsy with cataplexy

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Objectives/Introduction: Narcolepsy with cataplexy (NC) is a lifelong disease due to the loss of hypocretin neurons in the hypothalamus but the structural changes are not limited to the hypothalamus. We previously revealed an overall hippocampal volume loss in NC. The aim of this study is to measaure the volume loss of the anterior and posterior part of the hippocampus in NC patients.

Methods: In total 48 patients with NC and in 37 controls were examined on the same 1.5 T MR scanner, the measurement was carried out as T1W 3D image with the slice thickness of 1.0/0 mm. Manual MRI hippocampal volumetry was performed using manual delineation in ScanView programme. Only subjects with HLA DQB1*06:02 allele positivity were included. Subjects with brain morphological abnormaities and with any severe neurological or psychiatric comorbidities were excluded.

Results: There was a significant absolute loss of the total volume of the anterior hippocampus (sum of left and right) in NC patients as compared to the controls (10.5%, $p = 0.03$ ANCOVA after correction for total brain volume and multiple testing). Related to the total brain volume: right anterior hippocampus was 6.2% smaller in NC patients ($p = 0.09$), left anterior hippocampus was 6.8% smaller ($p = 0.04$). We found a negative correlation between the total anterior hippocampus volume and the duration of the disease ($R = -0.4036$, $p = 0.016$ - corrected for multiple testing).

Conclusions: The anterior hippocampal volume loss was found in NC. This volume loss positively correlates with duration of disease.

Disclosure: Nothing to disclose.

P453 | Relationship between efficacy endpoints and measures of functional status and health-related quality of life (HRQoL) in narcolepsy patients treated for excessive sleepiness

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Objectives/Introduction: A 12-week, double-blind, randomized, placebo-controlled Phase 3 trial in patients with narcolepsy associated with excessive sleepiness showed that solriamfetol at doses of 150 and 300 mg resulted in statistically significant, clinically meaningful improvements on Epworth Sleepiness Scale (ESS), Maintenance of Wakefulness Test (MWT) and Patient Global Impression of Change (PGI-C). Significant improvements in some functional status and health-related quality of life (HRQoL) measures were also observed with the 150 and 300 mg doses. Because significant improvements in efficacy endpoints do not always translate into improvements in functional/ HRQoL outcomes, the relationship between efficacy and functional/HRQoL outcomes was examined.

Methods: In all participants, the ESS, MWT, Functional Outcomes of Sleep Questionnaire-short version (FOSQ-10), Work Productivity and Activity Impairment Questionnaire (WPAI), EuroQoL 5-Dimension (EQ-5D-5L), Short-Form (SF)-36v2 and PGI-C were administered at baseline (except PGI-C), Weeks 4, 8 and 12. Pearson correlation coefficients were calculated, pooling across all treatment groups, to assess the relationship between changes in efficacy and functional/ HRQoL outcomes between baseline and Week 12 (change scores). Correlations were reported for functional/HRQoL outcomes with significant improvements (nominal) at any dose at Week 12. Values of 0.10 to <0.30, 0.30 to 0.50, and >0.50 reflect low, moderate, and high correlations, respectively.

Results: Data from the modified intent to treat population were analyzed ($n = 231$). Correlations (rho) for change scores were high between ESS and FOSQ-10 (−0.703), SF-36v2-Vitality (−0.559), and

work productivity loss (WPL) measured by WPAI (0.503), and moderate between ESS and SF-36v2-Role-Physical (RP) (−0.484), activity impairment (AI) measured by WPAI (0.436), and SF-36v2 Physical Component Score (PCS) (−0.352). Correlations were low between MWT and SF-36v2 Vitality (0.291), WPL (−0.249), FOSQ-10 (0.242), RP (0.239), and AI (−0.215). PGI-C correlations were high with FOSQ-10 (−0.504), and moderate with SF-36v2 Vitality (−0.499), AI (0.477), WPL (0.417), and RP (−0.405), and low for PCS (−0.297).

Conclusions: Changes in efficacy endpoints for ESS, MWT and PGI-C from baseline to Week 12 were associated with changes in several functional and HRQoL outcomes for solriamfetol-treated narcolepsy patients. Associations between self-reported efficacy endpoints (ESS and PGI-C) and measures of functional/HRQoL status were stronger than associations with the objective efficacy endpoint (MWT).

Disclosure: TE Weaver received research support as a site for the clinical trial of solriamfetol. She also received royalty fees for use of the Functional Outcomes of Sleep Questionnaire from Philips Respironics, Nyxoah, ResMed, Jazz Pharmaceuticals, Bayer AG, Night Balance, and Cook Medical. S Mathias is employed by Health Outcomes Solutions which received compensation from Jazz Pharmaceuticals for conducting these analyses. R Crosby serves as a paid Statistical Consultant to Health Outcomes Solutions. M Bron is an employee of Jazz Pharmaceuticals who, in the course of this employment, has received stock options exercisable for, and other stock awards of, ordinary shares of Jazz Pharmaceuticals plc. S Bujanover is an employee of Jazz Pharmaceuticals who, in the course of this employment, has received stock options exercisable for, and other stock awards of, ordinary shares of Jazz Pharmaceuticals plc. D Menno is an employee of Jazz Pharmaceuticals who, in the course of this employment, has received stock options exercisable for, and other stock awards of, ordinary shares of Jazz Pharmaceuticals plc. KF Villa is an employee of Jazz Pharmaceuticals who, in the course of this employment, has received stock options exercisable for, and other stock awards of, ordinary shares of Jazz Pharmaceuticals plc.

P454 | Delayed diagnosis and burden of excessive sleepiness associated with obstructive sleep apnea

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Objectives/Introduction: Obstructive sleep apnoea (OSA) is associated with excessive sleepiness (ES), which may go undiagnosed and can significantly impair a patient's quality of life (QOL). This research examined timing and reasons patients sought medical care for their ES and OSA symptoms, and the impact of ES on QOL.

Methods: Semi-structured 2-hr focus groups, segmented by gender, were conducted in 3 US cities with a total of 42 participants who were currently experiencing ES with OSA. Transcripts were coded using qualitative analysis software and analysed for content by theme using an adapted grounded theory approach common to qualitative research. An Independent Review Board approved the study.

Results: Over half of the sample (*n* = 23, 55%) reported sleeping ≥7 hr a night on average, and 74% (*n* = 31) were currently receiving treatment for OSA. Twenty-two participants (52%) reported experiencing OSA symptoms for ≥1 year, with an average duration of 11.4 (median 8.0, range 1–37) years before seeking medical attention. During this period, those participants reported snoring (*n* = 20, 91%) and ES (*n* = 13, 59%) as the most frequent symptoms. Several participants (*n* = 7, 32%) considered their symptoms to be "normal," rather than a sign of a serious medical condition. For all 42 participants, the primary reasons for ultimately seeking medical attention were: input from their spouse/partner, another family member, or friend (*n* = 21, 50%); their own concern about particular symptoms (*n* = 7, 17%); and/or falling asleep while driving (*n* = 5, 12%). Four participants (10%) reported being misdiagnosed prior to receiving their OSA diagnosis. QOL domains impacted by ES included: physical health and functioning (*n* = 40, 95%); daily life functioning (*n* = 39, 93%); cognition (*n* = 38, 90%); social life/relationships (*n* = 37, 88%); and emotions (*n* = 30, 71%).

Conclusions: These findings suggest that patients may be unaware that their symptoms could indicate OSA requiring evaluation and treatment. Among these patients, there was an average of over 11 years between symptom onset and seeking medical attention. Even following diagnosis, ES associated with OSA can continue to substantially affect both the range and seriousness of QOL and daily functioning. Further research is needed to address diagnostic delays and unmet treatment needs for patients with ES associated with OSA.

Disclosure: LT Waldman has received research funding from Jazz Pharmaceuticals. M Brod has received research funding from Jazz Pharmaceuticals. KF Villa is an employee of Jazz Pharmaceuticals who, in the course of this employment, has received stock options exercisable for, and other stock awards of, ordinary shares of Jazz Pharmaceuticals plc. M Bron is an employee of Jazz Pharmaceuticals who, in the course of this employment, has received stock options exercisable for, and other stock awards of, ordinary shares of Jazz Pharmaceuticals plc. S Bujanover is an employee of Jazz Pharmaceuticals who, in the course of this employment, has received stock options exercisable for, and other stock awards of, ordinary shares of Jazz Pharmaceuticals plc. S Parthasarathy has received consultancy fees from Philips, Nightbalance, Vapotherm, Bayer, and Merck; and research funding from Phillips.

P455 | Impact of narcolepsy on educational skills in young Polish patients

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Objectives/Introduction: Narcolepsy is a rare hypersomnia of central origin with the symptoms onset usually in the second and third decade of life. In many cases the proper diagnosis is delayed by years. Despite of therapeutical interventions, the disorder affects daily-life activity. Aim of the study was to assess the influence of narcolepsy symptoms on the educational performance in Polish population of teenagers and young adults.

Methods: Thirty consecutive patients (13 females) aged 13–25 years (mean 19.3 ± 3.6) diagnosed with narcolepsy type 1 (n = 26) and type 2 (n = 4) during last 3 years in Sleep Disorders Center in Warsaw were surveyed for their educational performance, revision of future plans, getting social services.

Results: The group consisted of 12 school teenagers, 11 university students, 6 workers and one patient on disablement pension. Mean age at diagnosis was 14.4 ± 2.5 years and mean time from the disorder onset to the diagnosis was 5.3 ± 3.0 years. Twenty-three patients (76.6%) declared learning difficulties, in 7 (58.3%) teenagers leading to one-to-one tuition. University students had also many problems with education and 6 of them (54.5%) paused or terminated the studies or changed the field of study. Six patients who didn't continue education after primary or secondary school had to choose physical work. Eight patients (26.6%) received various kinds of social benefits because of the disorder. According to Sheehan Disability Scale narcolepsy had the most negative impact on education/work (mean value = 6.8), less effect on social life and domestic duties (mean values: 5.4 and 4.3). More than half narcoleptic subjects presented mild or moderate depressive symptoms assessed by Beck Depression Inventory.

Conclusions: Narcolepsy has a marked negative impact on all aspects of daily-life, especially on education performance, resulting in tutorial support, changing of future plans, getting social services.

Disclosure: Nothing to disclose.

P456 | Relationship between efficacy endpoints and measures of functional status and health-related quality of life (HRQoL) in obstructive sleep apnea patients treated for excessive sleepiness

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Objectives/Introduction: A 12-week, double-blind, randomized, placebo-controlled Phase 3 trial in patients with obstructive sleep apnea associated with excessive sleepiness showed that solriamfetol doses 37.5, 75, 150 and 300 mg resulted in statistically significant, clinically meaningful improvements on the Epworth Sleepiness Scale (ESS), Maintenance of Wakefulness Test (MWT), and Patient Global Impression of Change (PGI-C) (except 37.5 mg PGI-C). In addition, significant improvements in functional status and health-related quality of life (HRQoL) were observed with the 150 and 300 mg doses. Given that significant improvements in efficacy endpoints do not always translate into improvements in functional/HRQoL outcomes, the relationship between efficacy and functional/HRQoL outcomes was examined.

Methods: In all participants, the ESS, MWT, Functional Outcomes of Sleep Questionnaire-short version (FOSQ-10), Work Productivity and Activity Impairment Questionnaire (WPAI), EuroQoL 5-Dimension (EQ-5D 5L), Short-Form (SF)-36v2 (SF36-v2) and PGI-C were administered at baseline (except PGI-C), Weeks 4, 8 and 12. Pearson correlation coefficients were calculated, pooling across all treatment groups, to assess the relationship between changes in efficacy and functional/HRQoL outcomes between baseline and Week 12 (change scores). Correlations were reported for those functional/HRQoL outcomes with significant (nominal) improvements at Week 12. Values of 0.10 to <0.30, 0.30 to 0.50, and >0.50 reflect low, moderate, and high correlations, respectively.

Results: Data from the modified intent to treat (mITT) population were analyzed (n = 459). Correlations (rho) for change scores were high between ESS and FOSQ-10 (–0.541), and moderate between ESS and SF-36v2 Vitality (–0.489), activity impairment (AI) measured by WPAI (0.441), work productivity loss (WPL) measured by WPAI (0.334) and SF-36v2 Role-Physical (–0.332). Correlations were low between MWT and SF-36v2 Vitality (0.273), SF-36v2 Role-Physical (0.184), FOSQ-10 (0.163), AI (–0.136) and WPL (–0.091). PGI-C correlations were high with SF-36v2-Vitality (–0.581) and FOSQ-10 (–0.529), and moderate between PGI-C and AI (0.476) and WPL (0.398) and SF-36v2 Role-Physical (–0.371).

Conclusions: Changes in the efficacy endpoints for ESS, MWT and PGI-C from baseline to Week 12 were associated with changes in several functional and HRQoL outcomes for solriamfetol-treated OSA patients. Associations between self-reported efficacy endpoints

(ESS and PGI-C) and measures of functional/HRQoL status were stronger than associations with the objective efficacy endpoint (MWT).

Disclosure: S Mathias is employed by Health Outcomes Solutions which received compensation from Jazz Pharmaceuticals for conducting these analyses. R Crosby serves as a paid Statistical Consultant to Health Outcomes Solutions. C Drake has received grant support and consulting fees from Jazz, Merck, Pernix and Eisai. KF Villa is an employee of Jazz Pharmaceuticals who, in the course of this employment, has received stock options exercisable for, and other stock awards of, ordinary shares of Jazz Pharmaceuticals plc. M Bron is an employee of Jazz Pharmaceuticals who, in the course of this employment, has received stock options exercisable for, and other stock awards of, ordinary shares of Jazz Pharmaceuticals plc. S Bujanover is an employee of Jazz Pharmaceuticals who, in the course of this employment, has received stock options exercisable for, and other stock awards of, ordinary shares of Jazz Pharmaceuticals plc. D Menno is an employee of Jazz Pharmaceuticals who, in the course of this employment, has received stock options exercisable for, and other stock awards of, ordinary shares of Jazz Pharmaceuticals plc.

P457 | Motor vehicle accidents in patients with excessive daytime sleepiness

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Objectives/Introduction: Excessive daytime sleepiness (EDS) is a common problem in patients referred to sleep clinics which could result in adverse consequences in their personal and social activities including Motor vehicle accidents (MVAs). Epworth Sleepiness Scale (ESS) and Multiple Sleep Latency Test (MSLT) are known subjective and objective methods for measuring EDS, respectively. In this study, we aimed to evaluate the relationship between EDS and MVAs.

Methods: Medical records of 144 patients (106 male) with EDS referred to Baharloo sleep clinic, Tehran, Iran were assessed in this cross-sectional study. All participants filled out a questionnaire including demographic characteristics, ESS and history of MVAs due to sleepiness in last 5 years and underwent full night polysomnography and MSLT. Sleepiness was categorized to normal, moderate, and severe according to Mean sleep latency (MSL) in MSLT.

Results: Patients with history of MVAs had a significantly lesser MSL and higher ESS score than those without MVAs (6.6 ± 3.9 vs. 9.3 ± 6.5, p value = 0.038 and 17.9 ± 4.4 vs. 15.6 ± 5.5, p value = 0.030, respectively). MVAs were reported in 41.9%, 31%, and 16.1% of patients with severe, moderate, and normal sleepiness, respectively. There was a significant relationship between severity of sleepiness and history of MVAs (p value = 0.02). Regression analysis showed that after adjustment for age and sex, ESS and MSL remains significantly different between patients with and without MVAs.

Conclusions: ESS score and MSL would help sleep clinicians to find high risk patients for safety sensitive jobs, the issue which should not be overlooked by them during visits in sleep clinic.

Disclosure: Nothing to disclose.

P458 | Suboptimal adherence to treatment is common in patients with narcolepsy

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Objectives/Introduction: Narcolepsy is a chronic neurological disorder, which usually requires lifelong therapy. Adherence to treatment is a critical factor in the management of chronic disease, however, we know little about adherence in narcolepsy. We aimed to assess adherence, and predictors of adherence, in narcolepsy patients attending a tertiary sleep centre.

Methods: We retrospectively assessed patients undergoing treatment for type 1 (NT1) and type 2 (NT2) narcolepsy, obtaining demographic and clinical information from their electronic files. Adherence was assessed by comparing prescription collection rates with prescribed therapy in the last year. Three levels of adherence were defined: poor (≤50%), intermediate (49–79%), and good (≥80%). Refractory daytime sleepiness was defined as persistent Epworth score >12 despite trials of at least three wakefulness-promoting agents, in monotherapy or combined. Exclusion criteria were uncontrolled sleep comorbidity and changes of medication within 6 months prior to last consultation. Regression analyses were performed to identify predictors of poor adherence, and to examine the relationship of adherence with symptom control.

Results: A total of 90 patients with narcolepsy were included, 56.7% females, with a mean age of 39.21(±13.88) years. 72 patients (80%) had a diagnosis of NT1 and 18 of NT2. Cataplexy was persistent in 48.6% of NT1 patients. Psychiatric comorbidities were present in 24.4% of patients, and 43.3% had refractory sleepiness. Good adherence was seen in 55.6% of patients, whilst 13.13% were intermediately and 31.1% poorly adherent. No difference was seen in likelihood of good adherence between patients with refractory and non-refractory symptoms (56.2 vs. 54.9%; $p > 0.05$). In multivariate regression, NT2 diagnosis was an independent predictor of poor adherence (adjusted OR 3.23; 95% CI 1.04–10.1; $p = 0.042$), but no relationship was seen with gender, age, refractory sleepiness, or psychiatric history. Refractory sleepiness was present in 28.6% of poorly adherent patients, compared to 44% of those with good adherence. Regression analysis identified NT1, but not poor adherence, as a predictor of refractory symptoms (AOR 5.64; 95% CI 1.40–3.14; $p = 0.015$).

Conclusions: Suboptimal adherence to prescribed therapy is common in narcolepsy patients, including those with apparent refractory symptoms, and particularly in subjects with NT2. Adherence to treatment should be routinely assessed in narcolepsy prior to any step-up in therapy.

Disclosure: Nothing to disclose.

P459 | Kleine-Levin syndrome or migraine with brainstem aura?

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Objectives/Introduction: Kleine-Levin Syndrome (KLS) is a rare entity included within Central Hypersomnia in the International Classification of Sleep Disorders (ICSD-3). Historically, it has been defined as a severe recurrent hypersomnia with hyperphagia/hypersexuality, however, these symptoms aren't considered essential nowadays. Migraine with brainstem aura (MBA) may share clinical features with KLS, so the differential diagnosis should be considered in a patient with recurrent headache and hypersomnia.

Methods: 16-year-old right-handed girl with a history of biparietal oppressive headache and family history of migraine. Since 18 months, she reported changes in her headache associating irresistible drowsiness and sleeping more than 20 hr/day. These episodes lasted 6–8 days every 3–4 weeks being asymptomatic between episodes. Amitriptyline had decreased headache intensity and episodes were more spaced over time. During episodes, she was confused and apathic but she didn't present hyperphagia. Headache usually associated tinnitus and slight hearing loss. Weight 59.7 kg and size 161 cm. Mallampati I. Evening chronotype. Psychopathological exploration normal.

Results: Supplementary tests: -Blood tests including thyroid hormones and autoimmune tests were normal. - HLA-I A*02,B*07,*15; C*02,*07 were negative. -HLA-II DRB1*07, *15;DQA1*01, *02; DQB1*02, *06; DQ2 (2.2), DQ6 were negative.

- Auditory evoked potentials normal.
- Brain MRI normal.
- Brain SPECT showed right temporal hypoperfusion.
- Genetic study of ATP1A2 and CACNA1A negative.
- Intercritical PSG showed high-amplitude low-frequency waves in bilateral frontal and frontotemporal areas. No other remarkable findings.
- PSG+MSLT at the end of an episode showed night with sleep onset in REM and MSLT with average sleep latency>8′ and 1 SOREM.

Conclusions: This case raises the differential diagnosis between KLS (supporting by recurrent hypersomnia, PSG and SPECT) and MBA (headache with tinnitus, hearing loss and the improvement after migraine treatment although it's true that diplopia, dysarthria or ataxia were absent). Headache is described in many patients with SKL and drowsiness can appear as a migraine aura. It has been recently described that the common mechanism could be the hypothalamic modulation present in both pathologies. In our case, patient's symptoms, PSG findings and the rest of the tests were decisive to support the diagnosis of KLS. We believe that it's essential to carry out sleep studies to guide the diagnosis in these patients.

Disclosure: Nothing to disclose.

P460 | Polysomnographic features related to REM sleep of patients with narcolepsy

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Objectives/Introduction: REM sleep behavior disorder (RBD), REM without atonia (RWA) and periodic limb movements in sleep (PLMS) are known as symptoms of Narcolepsy. The purpose of this study is to summarize polysomnographic features related to REM sleep of patients with Narcolepsy diagnosed in our sleep clinic.

Methods: We enrolled 139 patients (80 male, 59 female patients, 9 to 72 years, an average of 24.4 ± 10.8 years) are diagnosed with Narcolepsy who undergone polysomnography and multiple sleep latency test (MSLT) from the period of 2011 to 2016. They are classified into the group with symptom of cataplexy and the group without cataplexy. The group with cataplexy is 48 patients (22 male, 26 female patients, 9 to 72 years, an average 26.6 ± 14.9 years). The group without cataplexy is 91 patients (58 male, 33 female patients, 12 to 56 years, an average of 23.6 ± 7.7 years). We compared it about a difference of PSG and MSLT features, %RWA, PLMS, mean sleep latency (mSL), number of sleep onset REM period (SOREMP) between Narcolepsy with cataplexy group and Narcolepsy without cataplexy group. In addition, we compared presence of abnormal behavior between these two groups.

Results: It was found in group with cataplexy that they have a higher %RWA, and they display symptom of REM sleep behavior disorder. They have disruption of nocturnal sleep, and PLMSI is increased on PSG and increased SOREMP in MSLT findings.

Conclusions: Our study showed that was evident Narcolepsy with cataplexy group having more REM related findings in PSG and MSLT.

Disclosure: Nothing to disclose.

NEUROLOGICAL DISORDERS 2

P461 | Sleep disorders in patients with Leber hereditary optic neuropathy

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Objectives/Introduction: Sleep disturbances associated with primary mitochondrial disorders were described but limited data are still available. The aim of the study was to evaluate sleep disorders and sleep structure in patients with Leber hereditary optic neuropathy (LHON).

Methods: 17 patients (8 male, mean age 32.4 ± 17.4, age range 7–60 years) with a diagnosis of LHON genetically confirmed were included (10 LHON-affected patients, 7 asymptomatic LHON carriers). A detailed interview, the Pittsburgh Sleep Quality Index, the Epworth Sleepiness Scale, the Horne and Ostberg Morningness/Eveningness Questionnaire and nocturnal polysomnography were used to assess sleep problems and sleep quality.

Results: 10 patients (59%) reported chronic insomnia, 5 patients (29%) excessive daytime sleepiness. Nocturnal polysomnography revealed sleep disruption (arousal index >15) in 5 cases (29%), sleep related breathing disorder in 4 (24%), parasomnia in 3 cases (18%) and periodic limb movements in 1 patient (6%). Statistically significant reduction of NREM 3 sleep was found in symptomatic patients compared with carriers (17.6 ± 6.7 vs. 23 ± 7.4, p = 0.02).

Conclusions: Sleep disturbances (chronic insomnia, subjective excessive daytime sleepiness, nocturnal sleep disruption) were found in symptomatic/asymptomatic LHON. Reduction of NREM 3 sleep was present in symptomatic patients.

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P462 | Does the excessive daytime sleepiness in advanced Parkinson`s disease depend on the quality of night time sleep?

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Objectives/Introduction: 40–50% of patients with Parkinson′s disease (PD) have excessive daytime sleepiness (EDS). One of the controversial issues of the pathophysiology of EDS in PD is its connection with night`s sleep disorders.

Objective: to assessment the connections of the EDS with the clinic and polysomnographic characteristics of night`s sleep.

Methods: 19 patients (7 men and 12 women) with PD disease without dementia (mean age- 65.9 ± 8.1 years; duration of disease: 10.8 ± 4.4 years, stage – 2.5 ± 0.4 on Hoehn -Yahr) with the subjective feeling of sleepiness were enrolled in the study. 17 patients received dopamine agonists (DA) and levodopa (LD) treatment (mean daily dose –628.9 ± 122.8 mg), 2 received LD with no DA treatment. UPDRS (parts 2–3), Parkinson Disease Sleep Scale (PDSS), Epworth Sleepiness Scale (ESS), the over night polysomnography (PSG) and Multiple Sleep Latency Test (MSLT) were performed in all patients. Mann-Whitney *U*-test, unpaired Student's *t*-criteria were used to assessment of significance of inter-groups differences. Assessment of interconnections between indices wasprovided by Spearman's correlation matrix.

Results: The prevalence of significant subjective sleepiness level (ESS > 10) was 10 (53%).8 (47%) patients have mild subjective sleepiness (EDS ≤ 10). The low mean value of sleep efficiency –63.5 ± 13.6%, high mean value of the sleep fragmentation (17 ± 11.4 awakenings) at the night was observed. 8 patients with the greater degree of daytime sleepiness (the mean value of MSLT <5 min) had a higher ESS score (16 ± 5.7 compared 9.4 ± 5.2 in patients with mean value of MSLT >5 min (p = 0.01). Patients with ESS > 10 differed from the patients with mild sleepiness (EDS ≤ 10) by the smaller representation of the sleep stage 3 (9.7 ± 11.3% as compared with 17 ± 2.3% in patients with EDS > 10, $p < 0.05$). The prevalence of REM sleep behavior disorder (RBD) was 7 (37%). The mean MSLT sleep latency in patients with RBD was 8.8 ± 2.4 min as compared with 16 ± 4.2 min in patients without parasomnia ($p < 0.05$).

Conclusions: The connections of EDS with some night`s sleep disorders, the smaller representation of deep sleep, RBD in patients with advanced PD without dementia were found.

Disclosure: Nothing to disclose.

P463 | Insomnia, nightmares and daytime sleepiness in university students with ADHD

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Objectives/Introduction: This study examined associations between ADHD in university students and sleep disturbances, namely insomnia, daytime sleepiness and nightmares as well as diurnal preference.

Methods: 70 university students took part in the study. All participants completed standardized questionnaires with regard to ADHD, sleep disturbances and diurnal preference. Furthermore, they took part in certain attention related subtests of the Testbatterie zur Aufmerksamkeitsprüfung (TAP).

Results: 32.9% of all participants exhibited symptoms of ADHD. Furthermore, on average, insomnia symptomology was clinically

significant elevated (p = 0.007). Associations between ADHD, insomnia and nightmares were significant based on questionnaires (all $p < 0.001$). Beyond, students showed significant rates of impaired attention (p = 0.045).

Conclusions: Insomnia and nightmares as well as daytime sleepiness were enhanced in participants with ADHD symptomatology. This association was strong in students suffering from ADHD symptomatology in childhood and nowadays. Further investigations should deepen insight in this field of research and introduce the findings into treatment and therapy.

Disclosure: Nothing to disclose.

P464 | Alteration of cyclic alternating pattern correlates with impairment of heart rate variability in patients affected by amyotrophic lateral sclerosis

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Objectives/Introduction: Amyotrophic lateral sclerosis (ALS) is a progressive and fatal neurodegenerative disease characterized by an almost exclusive impairment of motor neurons, although involvement of other systems, such as autonomic nervous system, cognitive function and sleep, has been described. The main aim of this study was to evaluate sleep quality/quantity, sleep stability by means of CAP assessment, and cardiac autonomic control by means of heart rate variability assessment. Moreover, we evaluated the correlation between CAP and autonomic function during sleep.

Methods: 49 consecutive ALS patients (33 M; 15 F) referred to our sleep disorders center were enrolled. All subjects underwent a complete history with sleep questionnaire, neurological and general examination, and a full-night video-PSG assisted in lab. 31 subjects were selected for CAP analysis and HRV assessment, basing on exclusion criteria (EEG/ECG artifacts, concomitant therapies with cardio-active drugs or BDZ, diagnosis of sleep-disordered breathing). Control group consisted of 26 sex and age-matched healthy subjects. The study has been approved by local ethic committee, and all the subjects enrolled signed the written informed consent.

Results: Compared to controls, ALS subjects had an altered sleep structure with reduction of TST ($p < 0.0001$), increased WASO ($p < 0.0001$), and reduced N2 (p = 0.0217), N3 (p = 0.0181) and REM (p = 0.04) phases. Regarding CAP patients showed reduction of A phases ($p < 0.0001$) mostly due to reduction of A1 phases ($p < 0.0001$). HRV assessment showed a significant reduction of tot-power, SDNN, pNN50, pNN20, LF and HF both in NREM and in REM sleep. Correlation analysis of CAP and HRV of patients showed a linear positive correlation between A1, A2 and A3 indexes and SDNN, RMSSD and pNN50, which are influenced by vagal activity.

Conclusions: Sleep in ALS patients is altered both in stability and structure. Moreover, ALS patients present an impaired cardiac autonomic function mostly due to vagal components, that positively correlates with reduction of A components of CAP, indicating a rigidity of both autonomic and cerebral function during sleep in ALS patients. PSG study of ALS patients should be performed early in order to identify and treat any sleep disorders, and subclinical disautonomia.

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P465 | Sleep fit: a new app to assess sleep symptoms in Parkinson's disease

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Objectives/Introduction: Sleep and wakefulness complaints are extremely common in patients with Parkinson's Disease (PD) and show high day-by-day variability. Ecological momentary assessment of sleep-related symptoms by mean of prospective, repeated home-based measures is crucial to better characterize and understand these phenomena. To assess current subjective symptoms, technological interfaces are required to exactly record the timestamps in which information is collected. However, new technologies might not be easy to use by patients with PD.

Methods: Sleep Fit is an app for tablets especially conceived for patients with PD. *Sleep Fit* core structure consists in a PD-oriented sleep diary, an electronic finger tapping test and subjective scales on sleepiness, emotional state and motor symptoms. In its latest version, *SleepFit* provides enhanced ergonomics for patients with reduced hand dexterity, enriched graphics, automated flows that guide the patients in performing tasks throughout the 24 hr, secured real-time data collection and possibility of consultation by the researchers. We tested Sleep Fit asking a group of PD patients to perform multiple assessments four times a day and also after each nap, for 2 weeks, at their home. A sleep diary was included within these tasks, and had to be completed once daily. Patients' adherence was computed as the percentage of completed tasks on the total of expected tasks. We also evaluated the

satisfaction in a subgroup of patients having used the final version of the app.

Results: Sleep Fit was tested by 43 PD patients (10 females, mean age 67.7 ± 9.8). Of them, 19 used the alpha version, 7 an intermediate version and 17 the final v1.1.4 version. Patients' adherence was 90% on all the proposed tasks. It increased from 88% (alpha) to 94% (v1.1.4) with the final version. Sleep diary was completed in 96.5% of the cases. Ninety-four percent of the patients having used the final version of Sleep Fit declared they would use it again for the same period (76.5%) or longer (17.7%).

Conclusions: *Sleep Fit* is a well-accepted, easy-to-use tool to accurately assess sleep symptoms in PD that can be employed for both research and clinical purposes.

Disclosure: Nothing to disclose.

P466 | Nocturnal stridor treated with continuous positive airway pressure in a patient with multiple system atrophy: a case study

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Objectives/Introduction: Patients with multiple system atrophy (MSA), additionally to autonomic failure and waking motor symptoms, often present with numerous sleep disorders. Sleep-related breathing disorders including nocturnal stridor belong to the most common. According to some studies, stridor has been considered a poor prognostic factor. There are two main options to treat stridor in MSA patients: tracheostomy and continuous positive airway pressure (CPAP). There are limited data on CPAP treatment in MSA patients with nocturnal stridor, herein we discuss our experience with an MSA patient suffering from nocturnal stridor.

Methods: We present the case of a 71-years old woman who was diagnosed with MSA at 61 years of age. Stridor was present only during nights and was classified as late onset (i.e. emerging more than 3 years after waking motor symptoms). Stridor, as well as, other sleep disorders (REM sleep behaviour disorder, NREM parasomnia, periodic limb movement syndrome, mild obstructive sleep apnea) were confirmed by videopolysomnography. Moreover, the occurence and features of stridor were detected by the presence of fundamental frequency in signal, using post hoc computer assisted acoustic analysis with software PRAAT.

Results: CPAP pressure was titrated during night polysomnography. The pressure was set by the technician according to visual and acoustic on-line observations with the best efficacy achieved at the pressure setting of 14 mbar. The stridor nearly disappeared according to this clinical observation. In the 2 hr analyzed section of both initial and under CPAP polysomnography, the stridor percentage time decreased with CPAP treatment from 11.5% to 4.1%, the stridor rate from 21.7 to 14.8 stridors/min and the stridor regularity changed from 0.022 to 0.080 min. The patient referred a better sleep quality and lower daytime sleepiness at clinical follow-up 6 months after treatment initiation with adequate compliance.

Conclusions: In our report, we demonstrate that CPAP can be used as an effective method of nocturnal stridor treatment in patients with MSA. Furthemore, we recommend to evaluate the presence of stridor by objective acoustic analysis as milder forms under CPAP appear to be neglected by human hearing alone.

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Disclosure: Nothing to disclose.

P467 | A young man with multiple system atrophy – how does polysomnography help?

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Objectives/Introduction: To describe the case of a young man with an important dysautonomic profile and how the whole investigation leaded to a supported diagnosis of probable Multiple System Atrophy(MSA).

Methods: MSA is a complex neurodegenerative disorder. Its diagnostic requires association of dysautonomic phenomena to a cerebellar or a parkinsonian syndrome. The prognosis is poor, with a fast progression to disability and reduced potential of therapeutic response. Besides criteria limits its onset at 30 years old, there are few cases before 40 years old. REM-Sleep Behaviour Disorder(RSBD) is a characteristic feature of MSA and other synucleinopathies.

Results: A 36 year-old man with a progressive slowness of the right hemibody for 8 months, beginning in the post-op of a ureteral stenosis dilatation. The urinary urgency leaded to the urodynamic study which revealed bladder hyperactivity with ureteral stenosis. He refers an occasional left limb resting tremor, hypophonia without dysphagia. He also concerned about fatigue, sleep pattern dysfunction with abnormal movements of sleep, erectile dysfunction and subjective memory complaints. On neurological examination we observe an asymmetric akinetic-rigid parkinsonian syndrome (mUPDRS-29), generalized hyperreflexia without any other pyramidal or cerebellar signs. Genetic and secondary causes of Parkinsonism where excluded. However, Polysomnography revealed RSBD and Periodic Movements of Sleep and we proceeded with the study approach to synucleinopathies. In fact, Brain MRI revealed MSA characteristics - the linear hyperintense signal laterally to the lenticular nuclei and in the transverse pontocerebellar fibers in T2 scan, putaminal hypointense signal in SWI scan and diffuse cerebellar atrophy. DATSCAN showed a highly reduced dopamine pre-synaptic transporters mainly in right nuclei. Cardiac Scintigraphy with 123I-

MIBG did not evidence cardiac sympathetic denervation. Response to Levodopa was poor, even with increasing dosage.

Conclusions: This is an interesting documentation of a man with probable MSA-P, because of its age of onset associated to a characteristic brain image and richness of non-motor symptoms which lasted the diagnosis until the emergence of the parkinsonian syndrome. RSBD is not included yet in diagnostic criteria of MSA, but we believe that the path is through it, as it is a relevant marker of synucleinopathies.

Disclosure: Nothing to disclose.

P468 | Brain white matter damage and its association with neuronal synchrony during sleep

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Objectives/Introduction: The restorative function of sleep partly relies on its ability to deeply synchronize cerebral networks to create large slow oscillations observable with electroencephalography. These are notably essential to synaptic plasticity underlying learning and memory consolidation. However, whether a brain can properly synchronize and produce a restorative sleep when it underwent massive and widespread white matter damage is unknown.

Methods: Here, we answered this question by testing 23 patients with extensive white matter damage secondary to traumatic brain injuries (TBI) and compared them to 27 healthy subjects using diffusion tensor imaging and electroencephalographic analyses of full-night polysomnography. All four diffusion metrics were used to infer whole-brain voxel-wise white matter structure. Slow waves morphology and slow-wave activity were analyzed to infer on neuronal synchrony during stages N2 and N3 of sleep.

Results: We showed that greater white matter damage over large frontal and temporal brain regions correlated with a pattern of higher neuronal synchrony characterized by slow waves of larger amplitudes (r = 0.32–0.64, $p < 0.05$ FWE-corrected) and steeper slopes (r = 0.42, $p < 0.05$ FWE-corrected) during non-rapid eye movement sleep. In the first sleep cycle of the night, a significant positive correlation was also found between white matter damage and slow-wave activity power (r = 0.39–0.42, $p < 0.05$ FWE-corrected). All associations were only ever found for the TBI group, and not for the control group. TBI patients consistently scored higher in self-reported measures of fatigue (t = 2.4, p = 0.02), which were also significantly correlated with greater white matter damage (r = 0.42, $p < 0.05$ FWE-corrected).

Conclusions: This study reveals that more damaged brains are associated with accentuated neuronal synchrony during sleep and more severe fatigue during the day. This could be caused by cerebral disconnection or by elevated homeostatic sleep pressure in TBI patients. These results challenge the idea that large slow waves are the reflection of a healthy brain and the current hypotheses regarding the role of white matter structure on the brain's ability to synchronize its cortical regions during sleep and produce restorative sleep.

Disclosure: Nothing to disclose.

P469 | Visual dysfunction and neurodegeneration in Rem sleep behavior disorder and Parkinson's disease: a visual evoked potentials study

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Objectives/Introduction: Visual dysfunction, covering a multilevel involvement of different structures, is often reported in patients with Idiopathic Rem Behavior Disorder (IRBD) and Parkinson's disease (PD), and it proves to occur at an early stage of PD and be associated to a more pronounced cognitive deficits at follow up. We investigated visual evoked potentials (VEPs) as a possible marker of neurodegeneration in IRBD and PD patients.

Methods: Fifty-nine Parkinson's Disease (IPD) patients, divided in 32 patients at onset (IPD-onset) and 27 IPD-advanced and 46 IRBD patients were submitted to Luminance-contrast VEPs, to red-green color VEPs and to motion-onset VEPS. For the IRBD patient group follow-up data were available in order to assess overtime conversion to PD or dementia (range 1–6 years; mean follow-up duration 4.2 years). The mean age of the 3 groups of patients (IPD-advanced 71.3 years; IRBD 68.3 years; IPD-onset 63.4 years) were significantly different (p = 0.002) and the age factor as a covariate proved to be statistically significant for all the latencies but for none of the amplitude of the N70-P100 and the N1 and N2 components.

Results: Concerning VEPs as a whole, IPD-advanced group showed a higher occurrence of P100 latency and N1 latency abnormalities than the other two-groups. In the IPD-advanced group, not significant differences were detected according to the presence of hallucinations, whereas the P100 latency with 15' check was longer in patients with than in those without cognitive dysfunction (p = 0.033). The same held true for the latency of N1 chromatic component (p = 0.036). Ten IRBD patients converted to IPD and/or to cognitive dysfunction showed P100 latency with 15' check (p = 0.025) and of N1 latency of chromatic component (p = 0.011) longer than those found in non-converted RBD.

Conclusions: VEPs alterations proved to be present in IRBD patients and PD patients at an early stage of the disease with the rate of dysfunction correlating with overtime conversion to PD in IRBD groups and the rate of cognitive dysfunction in IPD-advanced group.

Disclosure: Nothing to disclose.

P470 | Total sleep deprivation unmasks subjective daytime sleepiness and impairments in alertness unique to mild traumatic brain injury

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Objectives/Introduction: Mild traumatic brain injury (mTBI) has been extensively linked to self-reported sleepiness and poor cognitive performance. However, post-mTBI sleep profiles and the effect of total sleep deprivation (TSD) on sleepiness and performance remained unstudied.

Methods: Thirteen participants, with (n = 7) and without (n = 6) mTBI underwent 40 hr of total sleep deprivation (TSD) anchored by baseline and recovery 8-hr sleep opportunities with polysomnography. Objective and subjective sleepiness was assessed by the maintenance of wakefulness test (MWT) and Stanford Sleepiness Scale (SSS) and performance was measured using the psychomotor vigilance test (PVT) across the daily rhythm. Group differences were assessed using t-tests, analysis of variance, and hierarchical linear modeling.

Results: At baseline, those with mTBI experienced significantly less total sleep time (TST), t (6.43) = −3.804, p = 0.008, greater waking after sleep onset (WASO), t (6.41) = 2.78, p = 0.03, shorter rapid eye movement (REM) latency, t (11) = −2.239, p = 0.047, and less slow wave sleep (SWS), t (11) = −2.524, p = 0.028, compared to controls. We report a lack of significant differences between groups during recovery sleep. This may be due to a reduced homeostatic response to sleep deprivation. Overall, there was no significant group differences in objective sleepiness during TSD. Few time points reached statistical significance, with controls having a longer sleep latency compared to those with mTBI ([25 hr: M_C = 1.92, SD_C = 0.48; M_T = 0.79, SD_T = 0.16], [29 hr: M_C = 2.25, SD_C = 0.46; M_T = 1.21, SD_T = 0.26], [33 hr: M_C = 2.25, SD_C = 0.54; M_T = 1.07, SD_T = 0.27]); however, these findings were not clinically meaningful. The mTBI group experienced greater subjective sleepiness, F (2, 47.20) = 4.22, p = 0.020, during TSD than controls. Further, the mTBI group experienced significantly more false starts, F (2, 43.29) = 4.58, p = 0.016, and minor lapses, F (2, 35.12) = 3.47, p = 0.042, during TSD compared to controls.

Conclusions: TSD unmasked greater subjective daytime sleepiness and impaired vigilance after mTBI compared to non-mTBI counterparts. No change in the daily rhythm of objective sleepiness was observed between groups. However, those with mTBI may still have lower level compensation of sleep and circadian processes, which will be the focus of our future work.

Disclosure: The opinions and assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the US Army or of the US Department of Defense. This abstract has been approved for public release with unlimited distribution.

P471 | Daytime sleepiness in patients with chronic fatigue syndrome

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Objectives/Introduction: One of disabling symptoms in daily life of patients with chronic fatigue syndrome (CFS) is daytime sleepiness. The night sleep is non-restorative and many patients sleep daytime. However, they still feel an excessive fatigue. The aim of this study was to find parameters correlating with daytime sleepiness.

Methods: The main variables describing daytime sleepiness were Epworth Sleepiness Scale (EES) and appreciated time of daytime sleep per week in minutes (ATDSW). Karolinska Sleep Questionnaire (KSQ), Insomnia Severity index (ISS), mood (Hospital and Depression Scale, HADS), CFS symptom questionnaire and objective measurements of temperature, saturation and pulse during rest or physical activity were studied using correlation analysis. Results were considered as significant if both EES and ATDSW showed significant ($p < 0.05$) correlations with chosen parameters.

Results: 92 patients with CFS (43 ± 2 years old, 84% women, BMI 26 ± 0.5) fulfilled a battery of questionnaires and underwent clinical investigation with measure of mouth temperature, pulse and saturation during rest and short physical activity. EES (median 11) and ATDSW (377 ± 33) were pathological for the group. EES and ATDSW correlated positively with self-rated CFS symptoms: headache, sensitivity to light, orthostatic intolerance and breathing difficulties during physical activity; with depression scores (HADS) and with indexes of fatigue/sleepiness and awakening nighttime in KSQ. No associations were found between ESS/ATDSW and insomnia as well as objective measures of physiological parameters.

Conclusions: Results indicate that excessive daytime sleepiness in CFS is a severe sleep disturbance and maybe is not dependent on insomnia. Daytime sleepiness is associated with severe CFS symptoms and need further investigation.

Disclosure: Nothing to disclose.

P472 | Positional difference between patients with obstructive sleep apnea with and without Parkinsonism

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Objectives/Introduction: Obstructive sleep apnea (OSA) is common sleep disturbances in patients with Parkinsonism. We aimed to estimate nocturnal positional differences between OSA patients with and without Parkinsonism.

Methods: Fifty three patients, who met the criteria for idiopathic Parkinson's disease or atypical Parkinsonism as well as diagnosed to OSA by polysmonography, were included. Fifty one OSA patients without Parkinsonism (age, sex, apnea-hypopnea index were matched) were also enrolled as controls. Various clinical and polysomnographic parameters were evaluated. Positional difference and success rate of CPAP titration were compared between two groups.

Results: Patients with OSA and Parkinsonism (OSA+P) were mean 67.8 ± 8.6 years (men, 49.1%), and OSA without Parkinsonism (OSA-P) were 68.6 ± 6.8 years (men, 47.1%). Body mass index was not different between OSA+P and OSA-P groups (23.9 ± 3.2 and 24.5 ± 3.5, respectively). AHI was 19.4 ± 14.6/hr in OSA+P group and 19.7 ± 17.2/hr in OSA-P group. OSA+P group revealed significantly lower proportion of patients with positional change during sleep, compared to OSA-P group (64% and 82%, $p = 0.047$). The proportion of 100% supinal position during sleep was 36% in OSA+P group and 18% in OSA-P group ($p = 0.047$). The success rate of continuous positive airway pressure titration was lower in OSA+P group than that of OSA-P group (43% and 88%, $p = 0.119$).

Conclusions: Patients with OSA+P showed decreased positional change and higher proportion of 100% supinal position during sleep, compared with OSA-P patients. The severity of OSA increases during supine position than lateral or prone positions. We have suggested the impaired positional change and supinal sleeping tendency from nocturnal akinesia or dyskinesia may play a role in the development of OSA in Parkinsonism.

Disclosure: Nothing to disclose.

P473 | Effects of ischemic stroke on sleep architecture: a retrospective study

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Objectives/Introduction: Sleep in patients after suffering from a stroke is a topic of high interest, which has not been widely studied yet. In this retrospective study we compared the sleep architecture, as measured by AASM 2007 criteria, of 95 stroke patients with that of age and sex matched controls, in order to quantify such an influence.

Methods: Polysomnographic (PSG) data from 95 patients in the acute phase of an ischemic stroke (1 to 10 days after a stroke occurred), acquired at the 1st Department of the Neurology, Comenius University, Bratislava between the years 2014 and 2016, was available for this study. The PSG montages did not perfectly match the requirements by the AASM (American Academy of Sleep Medicine) manual. In particular, there were no frontal electrode signals in the recordings. Scoring was performed with the computer-supported system Somnolyzer, after substituting frontal channels with copies of corresponding central electrode channels. For comparison, PSG data from 95 healthy controls from the SIESTA database, matched to the stroke population in sex and age, was scored in exactly the same way. From two consecutive nights available for each SIESTA subject, the first night was chosen, to match the assumption that stroke patients were PSG-naïve at the time of recording. 12 major sleep variables (including sleep efficiency, sleep stage latencies and percentage in each sleep stage) were analyzed. To test mean differences between the two groups a *t*-test for independent samples was used and *p*-values were corrected according to the Bonferroni method before comparing them to the significance level of 0.05.

Results: Besides having a lower sleep efficiency (68.5% vs. 76.7%, $p = 0.028$) the main difference in the sleep of stroke patients was a strongly reduced REM sleep (7.2% vs. 18.4%, $p < 0.001$) and increased NREM-stages N1 (27% vs. 21.1%, n.s.) and N2 (50.1% vs 44.6%, $p = 0.035$).

Conclusions: Ischemic stroke was shown to have an effect on average sleep architecture in terms of less sleep. Percentage-wise, REM sleep was significantly reduced following the stroke, balanced by an increase of the light sleep stages N1 and N2. Deep sleep N3 was unaffected.

Disclosure: Georg Dorffner and Georg Gruber are employees of The Siesta Group, a service provider for sleep scoring in clinical trials, and also hold shares in the company. The other authors do not have anything to disclose.

P474 | Regular exercise program impacts positively on sleep disturbances, depression and fatigue in female patients with multiple sclerosis

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Objectives/Introduction: Multiple Sclerosis (MS) is a chronic progressive autoimmune disease impacting both body and mind. Sleep disturbances, fatigue, depression and paresthesia are typical complains in patients with MS. Beside growing evidence that exercise programs have a positive influence on sleep disturbances, there is lack of evidence about the impact of an exercise program on sleep in patients with MS. We tested the hypothesis that, as in addition to the standard immune regulatory medication, either a workout or a coordinative exercise can improve sleep disturbances in patients with MS compared to a control group.

Methods: Fifty-two women with MS (mean age: M = 38.48 years, SD = 4.63) were randomly assigned to one of the following conditions: workout; coordinative exercise; control condition. Their existing immune modulatory therapy remained unchanged. Participants completed questionnaires covering sleep disturbances, symptoms of fatigue, depression, and paresthesia, both at baseline and at the end of the study 8 weeks later.

Results: Compared to the control group and over time, sleep disturbances, fatigue, depression, and paresthesia decreased significantly in the workout and coordinative exercise groups (p's $< .001$; $N = 52$). At the end of the study, compared to the control group, the reported depression symptoms decreased in the intervention conditions (p's < 0.001).

Conclusions: The pattern of results suggests that for females with MS and treated with standard immune regulatory medication, exercise training programs such as workout and coordinative exercise positively impacts on sleep disturbances, core symptoms of MS, namely fatigue, depression, and paresthesia. Exercise training programs should be considered in the future as possible complements to standard treatments.

Disclosure: Nothing to disclose.

P475 | Among patients with multiple sclerosis (MS) both objective and subjective sleep, depression, fatigue and paresthesia improved after 3 weeks of intense rehabilitation

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Objectives/Introduction: There is growing evidence that regular physical activity has a favorable effect on psychological functioning and sleep. However, as regards patients with MS, evidence is still scarce. The aim of the present study was therefore to investigate the impact of a regular physical activity program on psychological functioning and subjective and objective sleep in patients with MS.

Methods: A total of 46 patients (mean age about 51 years; EDSS: 5.3, 78.4% females) took part in this longitudinal and 4 weeks lasting intervention study. At baseline and 4 weeks later, patients completed self-rating questionnaires covering depression, mental toughness, subjective sleep, and subjective physical activity. Further, sleep was assessed via sleep-EEG-recordings at both time points. Patients had physical activity programs every weekday for 1 to 4 hr.

Results: Compared to baseline (BL), at the end of the study (SE), subjective sleep complaints decreased (BL: M = 15.17, SD = 5.70; SE: 14.00 (SD = 4.58); $t(45) = 2.03$, $p = 0.048$). Over time, depression (BL: M = 2.8, SD = 2.6; SE: 1.8 (SD = 2.04); $t(45) = 3.48$, $p = 0.001$), fatigue (BL: M = 42.18, SD = 14.34; SE: 36.11 (SD = 14.91); $t(45) = 3.21$, $p = 0.002$), and paresthesia scores (BL: M = 4.15, SD = 2.89; SE: 3.26 (SD = 2.50); $t(45) = 2.75$, $p = 0.009$) improved. Over time, subjective vigorous physical activity (min) increased (BL: M = 90.00, SD = 31.26; SE: 507.14 (SD = 161.09); $t(45) = 2.64$, $p = 0.011$). Descriptively, ($N = 18$) sleep onset latency decreased, light sleep decreased, and deep sleep increased.

Conclusions: In patients with MS, regular physical activity has the potential to impact positively on psychological functioning and both subjective and objective sleep.

Disclosure: Nothing to disclose.

P476 | SLOW wave activity (SWA) under conditions of microgravity: the effects of 7 days of whole body unloading using a hyperbuoyancy floatation (HBF) bed

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Objectives/Introduction: The effects of microgravity during spaceflight, or with prolonged bed rest, on the brain have received attention in relation to a visual impairment and intracranial pressure syndrome in astronauts returning from the International Space Station. However, the associated changes in neuroanatomy, cognition, neuroelectrical activity and connectivity during wake and sleep have not been studied extensively. In addition, significantly shortened and disrupted sleep has also been consistently reported in space missions. The aim of the present study was to determine the effects of 7 days of supine unloading on a hyper-saline filled water bed (hyper buoyancy floatation, HBF), an Earth-based novel analogue of microgravity, on the topography of slow wave activity (SWA) (1–4 Hz).

Methods: Twelve healthy male subjects, aged (27.2 ± 4.2 years), with no previous neuro/psychiatric history, underwent overnight in-laboratory polysomnography (PSG/EEG) recordings during 7 days of an unloading period, collected with CPz referencing (64-EEG-channels; Ant Neuro, Germany). Sleep staging was performed according to standard criteria. For the duration of the intervention period, the subjects remained supine, followed set sleep/wake schedules, and received a controlled diet. They were allowed a maximum of 15 min per day off the HBF (for personal hygiene etc).

Results: The unloading period of 7 days resulted in a significant ($p < 0.05$) change in SWA over centro-frontal regions relative to the rest of the brain. Global EEG power spectra (power spectral density averaged across all scalp channels) did not differ between the first and last night recording, for any of the sleep stages (N1, N2, N3, REM sleep, Wake). The significant decrease in SWA power spanning the frequency range 0.5–2.5 Hz was most prominent during N3 and REM. However, during REM, a wider fronto-occipital region was affected.

Conclusions: Overall, results suggest the presence of local SWA power differences induced by an intervention period of only 7 days on HBF, a novel Earth-based analogue of microgravity. Further studies are required to investigate potential mechanisms underlying the observed SWA changes and their possible role in previously reported cognitive changes under microgravity conditions.

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P477 | Which patients have abnormal spindles and K complexes on routine PSGs?

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Objectives/Introduction: Neurological disorders, namely Parkinson's disease (PD), REM sleep behaviour disorder (RBD), dementia, psychiatric disorders, and stroke, may lead to changes in NREM sleep microstructure. Previous studies have mostly analysed subtle quantitative changes in sleep spindles and K-complexes morphology in each of these disorders. There are, however, PSGs where NREM sleep microstrutucture is visually altered. The clinical significance of this finding has not been systematically evaluated. Our aim was to characterize a group of patients with clear morphological changes in spindles and K-complexes according to demographic characteristics, neurological comorbidities and sleep macrostructure.

Methods: From 736 polysomnography's (PSG) performed in 2010–2017 in a sleep lab from a university hospital neurological department, we selected those with sleep spindles and K-complexes abnormalities either in quantity and/or morphology based on the visual analysis of the PSG by certified technicians and somnologists. We performed a descriptive analysis of this group, including sex, age, neurological disorders, other sleep disorders, and sleep macrostructure.

Results: We identified a total of 76 PSG with clear visually identified changes in sleep spindles and K-complexes. Twenty-one (28%) were women, and mean age was 62.1 ± 18.2 years. Mean BMI was 27.8 ± 4.8 kg/m^2. Mean sleep duration was 7 hr 07 ± 2 hr 03, wakefulness corresponded to 29% ± 17%. REM sleep was 6 ± 5% and Non-REM sleep corresponded to 65%±16%; with N1 24 ± 19%, N2 31 ± 19%, and N3 11 ± 11%. Neurological comorbidities were present in 55 patients (72%): 15 DP, 7 multi system atrophy, 5 progressive supranuclear palsy; 8 patients were diagnosed with dementia, 8 with epilepsy, and 3 with ischemic stroke; 9 patients had other neurological diagnoses (3 restless legs syndrome, 2 Guillain-Barré syndrome, 2 intracranial tumours, 1 vascular parkinsonism, 1 head trauma). RBD was diagnosed in 14 patients (18%).

Conclusions: Poorly formed sleep spindles and K-complexes occur mostly in patients with previous neurological disorders, mainly PD or atypical parkinsonism. Sleep in these patients is fragmented and superficial, which may be related to the possible sleep protecting functions of K complexes and spindles. These N2 changes may also lead to difficulties classifying sleep, reinforcing the need for video-PSG in patients with significant neurological comorbidities.

Disclosure: Nothing to disclose.

MEDICAL DISORDERS 1

P478 | Poor sleep quality in patients with type 2 diabetes in association with melatonin and other factors

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Objectives/Instruction: Of the present study was to evaluate the serum levels of melatonin in type-2 diabetic patients and to clarify whether there is an influence of adiposity and smoking.

Methods: 26 type-2 diabetic (T2D) patients were recruited in the pilot study and 12 healthy subjects (non-smokers) were selected as controls (C). The study groups were matched for age and sex. Melatonin was measured in saliva by ELISA. Statistical analyses were performed using SPSS Statistic software.

Results: Patients with T2D had significantly lower melatonin level than healthy control subjects ($p < 0.003$), besides T2D patients with adiposity (BMI > 30 kg/m^2) had significantly lower melatonin level than patients without adiposity ($p < 0.035$), as well as T2D smokers had significantly lower melatonin level than T2D non-smokers.

Conclusions: T2D patients are associated with decreased melatonin level in saliva. Adiposity and smoking have influence on the decrease of melatonin concentration of T2D patients.

Disclosure: Nothing to disclose.[1]

P480 | The comparison of dexmedetomidine and midazolam for sleep in critically ill patients

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Objectives/Instruction: Many critically ill patients treated in the intensive care unit (ICU) experience sleep disruption. For the sedation of critically ill patients, dexmedetomidine and midazolam are commonly used. This study was undertaken to compare dexmedetomidine and midazolam for sleep in critically ill patients.

Methods: This prospective study was conducted in medical ICU of a tertiary referral hospital. Polysomnography recording was performed over 24 hr to assess the quantity and quality of sleep in patients who sedated with dexmedetomidine and midazolam.

Results: Total 19 patients were enrolled. Even though Richmond Agitation-Sedation Scale was not different ($p = 0.099$), total sleep time was longer in midazolam group (418.0 [286.3] min) than dexmedetomidine group (210.1 [146.0] min, $p = 0.050$). Midazolam group showed longer sleep duration compared with dexmedetomidine group during stage 2 (194.3 [201.1] min vs. 48.3 [68.0] min, $p = 0.034$) and REM (28.0 [40.6] min vs. 1.3 [3.6] min, $p = 0.032$) sleep.

Conclusions: The duration of sleep in sedated critically ill patients was longer with midazolam than dexemedetomidine. Especially, midazolam group showed longer sleep in stage 2 and REM sleep.

Disclosure: Nothing to disclose.[2]

P482 | Hypopharyngeal surgery for OSAS – side effects

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Objectives/Instruction: Hypopharyngeal collapse during sleep prevails in as much as 70% of OSAS patients. The commonest interventions targeting hypopharyngeal aerodynamics are lingual tonsillectomy with tongue base(T.B) ablation and hyoid suspension(H.S) applied alone or as part of multilevel approach. These procedures might be associated with several side effects (SE) affecting long term quality of life. We hereby present the incidence of dysgeusia, hyposmia, oral sensation and dysphagia in our cohort.

Methods: This is a retrospective study. 41 patients that underwent H.S, T.B coblation ablation, T.B transoral robotic surgery (T.O.R.S), T.B channeling between 82,014–12,017 where identified. Patients were asked to complete the eat 10 questioner. They were further interrogated regarding changes of smell, taste and oral sensation. Scoring was 0–4 regarding disturbance severity. Patients were grouped in accordance to the surgical procedure performed. Significance of incidence or severity difference of SE were checked by chi square test.

Results: 27 patients completed the questioner. 20 reported at least one S.E. Mean eat 10 score was 3. S.E incidence ratio and mean eat10S.E severity were: 55 and 1.6 respectively for T.O.R.S patients, 57 and 6.28 for B.T coblation, 36 and 1.5 for H.S., 23 and 1.3 for B.T channeling and 36 and 2.5 for the combined group. Differences between groups were statistically insignificant. Difference between combined group and all other groups together was insignificant as well ($p = 0.75$).

Conclusions: The risk for persistent SE in patients undergoing hypopharyngeal surgery for O.S.A.S is high regardless of the procedure elected. Larger cohort is needed for SE intervention specific risk determination. Multistage approach should be considered.

Disclosure: None.[3]

P483 | Sleep in ATR-X

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Objectives/Instruction: X-linked alpha thalassemia mental retardation (ATR-X) syndrome is characterized by four main symptoms: severe mental retardation, alpha thalassaemia, facial dysmorphisms and genital abnormalities, occurring exclusively in males. Sleep disorders are commonly reported in clinic, but their frequency and nature have not been studied.

Aim: In this cross-sectional study we explored sleep rhythm, and the prevalence and treatment of sleep disorders in ATR-X syndrome.

Methods: All members of the Dutch and international ATR-X foundation were asked to participate in this study. If they were willing, parents received the sleep questionnaire of Simonds and Parraga and kept a graphical sleep diary for 2 weeks.

Results: Thirty-seven participants joined the study with mean age of 12.9 years (range 1.8–43.5 years). Twenty six out of 37 (70%) reported sleep problems (62% current, 8% in the past). The most frequent occurring sleep problems were difficulty falling asleep (41%) and maintaining sleep (51%). The sleep diary (N = 17) showed a total mean sleep time of 10.4 hr, total bed time of 12.3 hr (daytime naps included), sleep efficiency 85% and sleep onset of 0.96 hr. There was no decrease in sleep time or total bed time with increasing age. Individuals with sleep problems went to bed earlier (p = 0.03) and had a lower sleep efficiency ($p < 0.01$) than individuals without self-reported sleep problems. Parents mentioned gastro-intestinal problems, jerky movements and hyperactivity as possible sleep disturbers. Sixteen out of 37 participants (43%) used medication (predominantly melatonin N = 10) to improve sleep which gave improvement in only two (melatonin together with temazepam; alimimazin).

Conclusions: Seventy per cent of individuals with ATR-X syndrome experienced sleep problems, although total sleep time was normal in most patients. Physical discomfort and hyperactivity were mentioned by parents as a possible cause of sleep problems. However, long bedtimes might also have a negative influence on sleep efficiency. Sleep medication is usually not effective, urging the need for new treatment programs in these patients.

Disclosure: This research was funded with an unrestricted grant from the Dutch ATR-X syndrome Foundation.

P484 | Non-apnoea sleep disorder increases the risk of incident heart failure-a nationwide population-based cohort study

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Objectives/Instruction: Non-apnoea sleep disorder (NASD) increases the risk of cardiovascular events, such as hypertension and ischemic heart disease (IHD). Patients with heart failure (HF) are at higher risk for sleep disorder; however, there is no documentation on NASD's association with HF to date. Therefore, our study aimed to determine whether NASD increases the risk of incident HF.

Methods: Using the outpatient and inpatient data from Taiwan's Longitudinal Health Insurance Database, we conducted a nationwide cohort study of patients with a first-time diagnosis of NASD in the year 2000 and followed up the risk of incident heart failure until December 31, 2013. We calculated risks and incidence ratios of HF for patients with NASD compared with the general population. The cumulative incidence of NASD and the subsequent risk of HF are assessed by the Kaplan-Meier method and Cox regression using a matched comparison cohort of HF patients without NASD.

Results: The NASD cohort had an adjusted hazard ratio (HR) of incident HF 23.6% higher than that of the cohort without NASD (95% CI = 1.164–1.308; $p < 0.001$). In the NASD population, the mean interval to HF in males and females were 5.02 ± 3.65 years and 5.02 ± 3.70 years, respectively. The Kaplan-Meier analysis indicated that after the seventh year, the incidence of HF was higher in the NASD cohort than in the control cohort till the end of the follow up.

Conclusions: Our study demonstrates that NASD patients are at a higher risk of incident HF.

Disclosure: Nothing to disclose.

P485 | Opioid use in adults referred for sleep disorder assessment and associated long-term consequences: a population-based study

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Objectives/Instruction: Opioid use is associated with impaired breathing in sleep and impaired sleep architecture. Despite these risks, there are no large-scale population studies investigating the long-term consequences of this relationship. We conducted a population-based cohort study using provincial health administrative data in Ontario (Canada) to (i) investigate the prevalence of opioid use among adults who underwent an initial diagnostic overnight sleep study, and (ii) assess the relationship between opioid use, positive airway pressure (PAP) treatment, and long-term outcomes in this population.

Methods: We included all adults who underwent an initial diagnostic sleep study in Ontario between 2013 and 2016, and followed them until March 2017, excluding individuals who received palliative care or resided in a long-term care facility prior to the sleep study. Our exposure, opioid use at the date of the sleep study, was identified from the Narcotics Monitoring System. PAP therapy initiation was defined through the Ontario Assistive Devices Program database. Our composite outcome was time from sleep study to the first of emergency department visit, hospital admission, or all-cause death. We used Cox models to investigate the relationship between opioid exposure, PAP initiation and the outcome, controlling for income status, comorbidities, primary care exposure and use of controlled substances at baseline.

Results: A total of 267,461 adults (median age 51 years; 57% men), were included in our analyses of whom 12,205 (5%) were on opioids at the time of the sleep study. Over a median follow-up of 24.5 months, 103,398 (39%) initiated PAP and 140,080 (52%) developed a composite outcome. Controlling for confounders, opioid use was significantly associated with an increase hazard of the composite outcome (HR = 1.21, CI: 1.19–1.24), but not with PAP prescription (HR = 1.03, CI: 0.99–1.06). The results were driven by all-cause death: HR = 1.52, CI: 1.39–1.66.

Conclusions: In a large population-based study, we found that among adults referred for a sleep disorder assessment, opioid exposure was associated with a 21% increased hazard of hospital visits or death from any cause. These findings suggest the need for better management in these individuals and can be used to identify those at the most risk, ultimately improving clinical outcomes.

Disclosure: Bruyere Research Institute - Big Data Research Fund.

P486 | Analysis of tissue metalloproteinase inhibitor-1 gene polymorphism (C536T) in non-valvular atrial fibrillation patients with concomitant obstructive sleep apnea-hypopnea syndrome

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Objectives/Instruction: The events in obstructive sleep apnea/hypopnea (OSAHS) result in an arrhythmogenic structural substrate for atrial fibrillation (AF) characterized by atrial fibrosis formation. Both in AF patients and in subjects with OSAHS an altered expression of some matrix metalloproteases and their tissue inhibitors has been described, which may influence the extracellular matrix remodeling. Aim of the study was to explore if tissue metalloproteinase inhibitor-1 (TIMP-1) gene polymorphism (C536T) could be found in patients with non-valvular AF and co-existing OSAHS and be related to OSAHS severity and various stages of AF.

Methods: 78 patients with non-valvular AF (50 (64.1%) men) were recruited into this study (mean age 54.04 ± 8.15 years) and classified into one of 3 groups: paroxysmal, persistent and permanent AF. A 24-hr multifunctional study with cardiorespiratory monitoring was conducted in the study subjects and they were divided into 2 groups according to the presence of OSAHS. DNA was extracted from peripheral venous blood leukocytes by commercial kits. Genotyping of TIMP-1 (C536T) was carried out using real-time polymerase chain reaction method. All statistical analyses were performed using STATISTICA 10.0 (Start Soft Inc., USA)

Results: There were 55 (70.51%) confirmed OSAHS patients (34 (61.82%) men) among the study subjects. OSAHS group demonstrated AHI level of 25 (LQ14; UQ34) and non-OSAHS patients have AHI level of 4 (LQ2; UQ4) ($p < 0.001$). 32.73% patients had severe OSAHS, 41.82% patients had moderate OSAHS and 25.45% patients were with mild OSAHS. Patients with persistent/permanent AF had higher level of AHI than patients with paroxysmal AF (18 (LQ4; UQ30)/28.5 (LQ23.5; UQ35.5) vs. 9 (LQ4; UQ20, $p = 0.002$). Moderate/severe OSAH patients were more likely than mild OSAHS patients to have permanent AF (38.89%/17.39% vs. 0%, $p = 0.013$). The analysis of TIMP-1 (C536T) polymorphism revealed the following distribution of CC, CT, and TT genotypes between the study groups: in all subjects the frequency of CC genotype was 100%, CT genotype – 0%, TT genotype – 0%. The allele frequency of the C allele was 100%.

Conclusions: The results showed absence of association between TIMP-1(C536T) gene polymorphism and the stage of AF progression or presence of OSAHS in the study cohort.The prevalence of permanent AF rises with the disease severity of OSAHS and level of AHI.

Disclosure: Nothing to disclose.

P487 | Effects of sleep extension on glucose metabolism in chronically sleep-deprived individuals

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Objectives/Introduction: Sleep deprivation is common in general population and shown to be associated with increased insulin resistance which may pose the risk of diabetes development. This study investigated whether 2-week sleep extension in chronically sleep-deprived individuals would improve glucose metabolism.

Methods: A randomized-crossover trial was conducted in non-diabetic volunteers who reported habitual sleep time <6 hr/night during the week days. The participants were randomized to maintain their habitual sleep or extend their sleep time for 2 weeks (with a goal of 1 hr extension), then crossed over after a washout period. Sleep was monitored by actigraphy recordings. A 75-g oral glucose tolerance was performed at the end of each period with glucose and insulin levels, along with weight and caloric intake recordings. Mixed effect linear regression analysis adjusting for sequence and period effects was applied.

Results: Twenty-one subjects (19 females) with mean age of 33.1 ± 6.1 years completed the protocol. Mean sleep duration during habitual sleep was 318.7 ± 44.3 min. The average washout period was 21 ± 11 days. The participants extended their sleep by 36.0 ± 45.2 min. There were no significant effects of sleep extension on any metabolic parameters. Two additional per protocol analyses were performed. Seventeen participants did extend their sleep during the sleep extension period, with a mean sleep duration of 361 ± 42 min (average extension 51.2 ± 33.8 min). The analysis in this group did not reveal significant effects of sleep extension on metabolic parameters. The second per-protocol analysis included eight participants who could sleep more than six hours during sleep extension (mean sleep duration 396 ± 25 min, extended by 60.1 ± 28.5 min). The analysis revealed that sleep extension resulted in improved fasting insulin resistance (HOMA-IR) (adjusted mean difference −0.50 (95% CI −0.90, −0.11, p = 0.013)), increased early insulin response to glucose (insulinogenic index) (mean difference 0.39 (95% CI 0.15, 0.63, p = 0.001)), and improved β-cell function (disposition index) (mean difference 1.07 (95% CI 0.17, 1.97, p = 0.02)).

Conclusions: Sleep extension in chronically sleep-deprived individuals resulted in improved glucose metabolism but only among those who could sleep >6 hr/night. Our findings suggest that a critical amount of sleep is needed to benefit metabolic outcomes.

Disclosure: Nothing to disclose.

P488 | Respiratory events, heart rate and oxygen parameters in obstructive sleep apnea - chronic obstructive pulmonary disease patients

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Objectives/Instruction: It is expected that the patient having the overlap syndrome of obstructive sleep apnea (OSA)- chronic obstructive pulmonary disease (COPD) will show overall higher impact on different physiological parameters.

Methods: 1,865 consecutive patients from 2007 to 2017 from Timisoara Sleep Lad were analyzed: 1,536 (82.4%) in group OSA without COPD and 329 (17.6%) in group OSA -COPD. The groups were compared regarding central, mixed and obstructive apnea index, hypopnea index, apnea-hypopnea index (AHI), mean duration of central, mixed and obstructive apnea, mean duration of hypopnea and apnea, mean heart rate during sleep, mean blood oxygen saturation, lowest desaturation, desaturation index. The p-values under 0.05 are regarded as statistically significant.Descriptive data is reported as mean values and standard deviations (SD), medians, or percentages.The Student's t-test for independent samples was performed. Continuous variables were analyzed by the Mann-Whitney U test. For categorical variables, the chi-square test was performed.

Results: central apnea index 3.1 ± 5.4/hr vs. 3.3 ± 5.3/hr (p = 0.980), mixed apnea index 3.5 ± 5.9/hr vs. 3.7 ± 6.8/hr (p = 0.663), obstructive apnea index 24.6 ± 21.9/hr vs. 25.2 ± 20.1/hr (p = 0.157), hypopnea index 13.4 ± 9.3/hr vs. 15.7 ± 10.7/hr (p < 0.001), apnea hypopnea index 44.8 ± 24.8/hr vs. 47.3 ± 25.3/hr (p = 0.090), central apnea duration 17.3 ± 6.3 s vs. 16.7 ± 5.1 s (p = 0.211), mixed apnea duration 20.5 ± 7.1 s vs. 19.8 ± 6.3 s (p = 0.443), obstructive apnea duration 20.4 ± 5.5 s vs. 20.2 ± 5.3 s (p = 0.904), hypopnea duration 21.6 ± 3.8 s vs. 21.3 ± 3.7 s (p = 0.202), apnea duration 21.5 ± 4.7 s vs. 20.9 ± 4.1 s (p = 0.112), heart rate during sleep 68.0 ± 12.1 beats per min vs. 69.1 12.9 (p = 0.235), mean O2 saturation 92.4 ± 4.1% vs. 90.1 ± 5.7% (p < 0.001), lowest desaturation 77.0 ± 12.7% vs. 73.5 ± 14.3% (p < 0.001), desaturation index 30.5 ± 26.9/hr vs. 36.0 ± 27.5/hr (p < 0.001).

Conclusions: COPD makes OSA patients significantly more desaturated during sleep regarding mean O2 saturation, lowest desaturation, and desaturation index with no significantly differences regarding the type and duration of respiratory events and heart rate, with the exception of hypopnea index.

Disclosure: Nothing to disclose.

P489 | Anthropometric and comorbidity differences in patient with obstructive sleep apnea and chronic obstructive pulmonary disease

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Objectives/Instruction: In the overlap syndrome of obstructive sleep apnea (OSA) – chronic obstructive pulmonary disease (COPD) it is expected that the patients will show overall poorer results and a higher prevalence of health consequences.

Methods: 1865 consecutive patients from 2007 to 2017 from Timisoara Sleep Lab were analyzed with data regarding patients' history, gender, age, body mass index (BMI) kg/weight^2), apnea-hypopnea index (AHI), pack-years of smoking, Epworth sleepiness scale (ESS), comorbidities such as diabetes mellitus (DM), systemic hypertension (SHT), coronary artery disease (CAD), heart failure (HF), arrhythmias, stroke. Descriptive data is reported as mean values and standard deviations (SD), or percentages. The Student's *t*-test for independent samples was performed. Continuous variables were analyzed by the Mann-Whitney *U* test. For categorical variables, the chi-square test was performed.

Results: 1536 (82.4%) patients in group OSA without COPD vs. 329 (17.6%) patients in group OSA -COPD, 483 (31.4%) female vs. 53 (16.1%) ($p < 0.001$), 1053 (68.6%) male vs. 276 (83.9%) ($p < 0.001$), age 52.2 ± 12.2 years vs. 58.2 ± 9.0 years ($p < 0.001$), BMI 33.5 ± 6.6 kg/m^2 vs. 36.0 ± 6.9 kg/m^2 ($p < 0.001$), AHI 44.8 ± 24.8/hr vs. 47.3 ± 25.3/hr ($p = 0.090$), smoking 664 (44.1%) patients vs. 244(77.0%) ($p < 0.001$), pack-years 21.1 ± 14.1 vs. 32.3 ± 17.5 ($p < 0.001$), ESS 11.1 ± 5.2 vs. 12.2 ± 5.4 ($p < 0.001$), DM 99 (17.6%) vs. 45 (37.5%) ($p < 0.001$, SHT 1027 (67.6%) vs. 254 (77.4%)($p < 0.001$), CAD 438 (29.4%) vs. 153 (48.3%) ($p < 0.001$), HF 332 (22.4%) vs. 144 (45.1%) ($p < 0.001$), arrhythmias 348 (23.3%) vs. 93 (30.4%) ($p = 0.008$), stroke 62 (4.3%) vs. 17 (5.7%) ($p = 0.287$).

Conclusions: COPD -OSA is common. Patients are more males, heavier, older, sleepier, and more smokers. Cardiovascular comorbidities are significantly higher, with the exception of stroke. However, COPD does not seem to significantly affect apnea hypopnea index.

Disclosure: Nothing to disclose.

P490 | Sleep bruxism, low back pain and quality of life

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Objectives/Instruction: Sleep bruxism (SB) is a sleep-related movement disorder. The repercussions in the patients' quality of life (QoL) are scarcely studied. Chronic low back pain (LBP) is one of the main and most studied causes of chronic pain and dysfunctions in the QoL. Main: determine the patients' with the diagnosis of SB, QoL, comparing with the QoL of patients with LBP. Secondary: determine, in the group with SB, how the QoL of those with isolated SB and those with SB associated with migraine is.

Methods: Clinical, observational and transversal, non-randomized study performed at Centro Hospitalar e Universitário de Coimbra (CHUC) which included 38 patients, of both genders, in adulthood; 18 with SB and 20 with LBP. The instruments applied were surveys that assessed characteristics of pain, daytime sleepiness scale (Epworth), QoL survey (SF-36v2) and anxiety and depression scale (HADS). The statistical analysis was performed in SPSSv24 with standard $p < 0.05$ cutoff.

Results: The sample ($n = 38$) is mostly female and presents a high BMI. In both diseases the pain's intensity is similar. There is less inability ($p < 0.05$) in SB. The QoL is similar; except in physical performance ($p < 0.05$) that is lesser in LBP. HADS did not reveal significant differences between both. There is no relationship between Epworth scale and the diseases, presenting both low daytime sleepiness levels. Between isolated SB ($n = 7$) and SB associated with migraine ($n = 11$) the significant differences ($p < 0.05$) found in QoL are in bodily pain and social function. In HADS, SB associated with migraine presents more anxiety. HADS and SF-36v2 show good correlation between them ($p < 0.05$), regardless of the disease. Pain intensity relates to anxiety, bodily pain and social function ($p < 0.05$ and $p < 0.01$), and inability relates to bodily pain, role-physical and general health ($p < 0.05$ and $p > 0.01$), regardless of the disease.

Conclusions: Patients with LBP present worse physical performance and greater inability than BN, the remaining parameters of QoL present overlapping results. SB associated with migraine presents more bodily pain, worse social function, greater intensity and inability, and more anxiety than isolated, the remaining parameters present overlapping results.

Disclosure: Nothing to disclose.

P492 | The role of chronotype and sleep hygiene in the treatment of obesity

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Objectives/Introduction: Physiological changes related to reduced sleep quality/duration and circadian rhythmicity are risk factors for increased apetite, body weight, blood pressure and for reduced glucose tolerance and immune response. These and other factors contribute to the emergence of metabolic and cardiovascular disorders. Due to many contributing factors, there is a vast space for improvement, especially through chronotype identification, sleep hygiene adjustment and control of light environment. These interventions can be used to current obesity treatment methods and increase the effectiveness of programs aimed at reducing body weight values.

Methods: 92 women (18–50 years) in conservative obesity treatment (BMI > 25 kg/m^2) using 3-months actigraphy, sleep diaries, MEQ, MCTQ. Therefore the length and quality of sleep, the individual setting of circadian rhythms and the rate of social jet-lag were validated.

Results: There is a negative correlation between BMI and sleep duration (−1.2, $p = 0.026$), so we can say that women with higher BMI have a shorter sleep duration. The distribution of chronotypes in the set indicates the Gaussian distribution, as well as in the healthy population. Chronotype is closely related to individual rate of social jet-lag. We found a positive correlation between the BMI and the social jet-lag (0.03, $p = 0.03$), which suggests that women who have a higher BMI have a greater discontinuity between their internal biological clocks and the outside social time.

Conclusions: The results of the study show that BMI or body weight changes the quality and length of sleep. With increasing BMI, the amount of sleep decreases and the rate of social jet-lag rises. Perhaps because of the massive weight, the patient suffers from orthopedic and respiratory difficulties, which may wake them up and prolong sleep latency. If this scenario repeats, the sleep deficit grows and the freshness does not come. The disruption of the sleep-wake cycle can lead to extensive changes in the body, for example leading to a disruption of the metabolic system. Previous studies have shown that metabolic and circadian system interacts bilaterally and that short and poor sleep can contribute to weight gain and obesity. We consider to expand the obese population′s research and use the knowledge in clinical practice.

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P493 | Are subjective measurements of insomnia sufficient in chronic pain?

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Objectives/Introduction: Insomnia is prevalent among patients with chronic pain and may contribute to aggravation and persistence of pain. Among key features of insomnia are increased sleep onset latency, periods of wake after sleep onset and early morning awakening, which all contribute to reduced sleep efficiency (SE). In a clinical setting insomnia is often assessed by subjective measures such as the insomnia severity index (ISI). How well does ISI reflect SE as measured by polysomnography (PSG) and actigraphy in pain patients and healthy controls?

Methods: 56 patients with chronic musculoskeletal pain and 53 age and gender matched healthy controls participated. Symptoms of insomnia were measured by ISI. A cut off score of 15 was used to indicate clinical insomnia. SE was measured by one night of PSG and 7 days of actigraphy. Pain was assessed by Brief Pain Inventory (BPI), symptoms of anxiety and depression by Hopkins Symptoms Check List 25 (HSCL 25) and fatigue by Chalder fatigue scale. Group differences were analyzed by Students *t*-tests and Fisher`s exact test for continuous and dichotomous variables, respectively. Pearson correlation coefficients were estimated for associations between variables.

Results: Clinical insomnia (ISI > 15), was more prevalent among pain patients than controls (30.4% vs. 3.8%, $p < 0.001$). Actigraphy showed significantly lower SE among pain patients (M = 86.5, SD = 5.0) than controls (M = 89.2, SD = 4.1), $p = 0.002$. There was no significant difference in SE as measured by PSG. Among pain patients, the correlation between ISI score and SE (either actigraphy or PSG) was non-significant. However, ISI correlated significantly with BPI ($r = 0.37$, $p = 0.006$), HSCL ($r = 0.77$, $p < 0.001$) and Chalder fatigue ($r = 0.75$, $p < 0.001$).

Conclusions: Subjectively measured insomnia was more prevalent among patients with chronic pain compared to healthy controls, but did not reflect objectively measured indicators of insomnia. However, subjective insomnia was related with measures of pain, mental distress and fatigue. In comorbid insomnia and pain, assessment of depression, fatigue and objective measures of sleep may be warranted in order to address sleep disturbance adequately.

Disclosure: Nothing to disclose.

PSYCHIATRIC & BEHAVIOURAL DISORDERS 2

P494 | Insomnia disorder as a predictor of mental disorders and pain: a systematic review and meta analysis

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Objectives/Instruction: Previous research has identified insomnia as a predictor for the onset of major depression. The aim of this meta-analysis is to investigate whether insomnia also predicts the onset of other mental disorders and pain.

Methods: The databases PubMed, Medline, PsycInfo, and PsycArticles were searched for longitudinal studies investigating the predictive value of the presence of insomnia at baseline for the presence of psychopathology or pain at follow-up. Primary studies were eligible if they included insomnia diagnosed based on DSM criteria and no mental comorbidity/pain at baseline or a statistical control for baseline psychopathology/pain.

Results: Fourteen primary studies were included in the meta-analysis. Across all studies, the model found an odds ratio of 2.43 (confidence interval: 1.67–3.54), indicating that insomnia disorder is a significant predictor for later onset of psychopathology/pain. Subgroup analyses showed similar results, i.e. insomnia was identified as a predictor of depression, anxiety disorders, alcohol abuse, and pain. One study suggested that insomnia is also a predictor of psychotic disorders. The overall risk of bias in the primary studies was rated as moderate, whereby most problems arose from insufficient documentation of attrition and reasons for dropout.

Conclusions: This meta-analysis provides evidence that insomnia increases the risk for future onset of psychopathology and pain in general. A future research agenda should include more prospective studies evaluating insomnia diagnosis at baseline and long-term follow-up intervals assessing a wide range of mental disorders. In addition, prospective long-term interventional studies investigating the efficacy of insomnia treatment for the prevention of mental disorders and pain are called for.

Disclosure: Nothing to disclose.

P495 | Sleep in individuals at risk of bipolar disorder

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Objectives/Instruction: Individuals with hypomanic personality are extraverted, impulsive, energetic, overconfident, and intensely emotional. Beyond that, they are at an increased risk of bipolar disorder (BD, 'manic-depressive illness'). Given the pathogenic role of disturbed sleep in BD, we investigated whether sleep alterations may also be related to hypomanic personality.

Methods: Participants filled in the Hypomanic Personality Scale (HPS; N = 1,890) and either underwent a 7-day actigraphy assessment (n = 771) or completed the Pittsburgh Sleep Quality Index (PSQI; n = 1,766), or both. We analyzed whether the HPS total score and the three HPS facets 'hypomanic core', 'sociability', and 'ordinariness' (as derived from factor analyses) are associated with the fourteen objective and seven subjective sleep variables.

Results: In total, 40 out of 84 correlations were significant after multiple testing correction (False Discovery Rate <0.05). HPS was associated with shorter, less efficient and a particularly higher variability of objectively assessed sleep. Likewise, HPS was associated with the questionnaire data, i.e. with shorter and less efficient sleep, higher daytime sleepiness, and lower sleep quality. The most significant associations were obtained between the PSQI total score (indicator for poor subjective sleep quality) and HPS facet hypomanic core (rho = 0.158, p = 3E-11) as well as facet ordinariness (rho = −0.165, p = 3E-12).

Conclusions: The current study reveals compelling evidence for sleep alterations in individuals at risk of BD. Similar to relapse prevention strategies in BD, the modification of sleep habits might be a valuable approach to avert mood episodes in individuals with hypomanic personality.

Disclosure: Nothing to disclose.

P496 | Family irregularity disturbs the development of sleep in children

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Objectives/Instruction: Previous studies have shown that poor family environments are related to more sleep problems; however, little is known about how family irregularity in early life affects the development of sleep problems over childhood using objective sleep measures. The current study tests the hypothesis that early family irregularity contributes to the development of sleep problems.

Methods: This population-based study comprises 5,443 children from the Generation R Study. Family irregularity was measured with seven maternal reported questions on family routines when children were 2 and 4 years old. Mothers reported on sleep problems at child age 3, 6, and 10 years, children completed questionnaires at age 10. Additionally, we used tri-axial wrist accelerometers for five nights in 851 children (mean age 11.7 years) to assess sleep measures objectively.

Results: Family irregularity was associated with more mother-reported sleep problems at ages 3, 6, and 10 years (respectively, $\beta = 0.13$, 95%CI: 0.10–0.16, $p < 0.01$; $\beta = 0.11$, 95% CI: 0.08–0.14, $p < 0.01$; $\beta = 0.06$, 95% CI: 0.03–0.09, $p < 0.01$) and with child-reported sleep problems at 10 years ($\beta = 0.08$, 95% CI: 0.04–0.13, $p < 0.01$). Also, family irregularity predicted a later objective sleep onset and waking time at age 11 (respectively, $\beta = 0.11$, 95% CI: 0.04–0.17, $p < 0.01$; $\beta = 0\ .09$, 95% CI: 0.02–0.16, $p < 0.01$), but not sleep duration or efficiency. The association of family irregularity and multi-rated subjective sleep problems at age 10 years was mediated by mother-reported child psychopathology at age 6 years (*mother-reported sleep problems:* $\beta = 0.14$; 95% CI: 0.04–0.33 for [Ratio of indirect to direct effect 40%]; *child-reported sleep problems:* $\beta = 0.05$; 95% CI: 0.00–0.16 [Ratio of indirect to direct effect 13%]).

Conclusions: Our findings show that pre-school family irregularity is prospectively associated with more sleep problems during childhood, and with a later objective sleep onset and a later waking time. In part, these sleep problems were associated with family irregularity by way of child psychopathology. This study is unique in the examination of both subjective and objective sleep data in the context of family irregularity. These findings suggest that interventions improving pre-school family irregularity, which are targeted to reduce child psychopathology, may also impact the development of sleep problems beneficially.

Disclosure: The funders had no role in the study design, data collection, analysis, interpretation of the data, or writing of the report. F.C.V. is the contributing editor of the Achenbach System of Empirically Based Assessment, from which he receives remuneration. For the other authors, no competing financial interest were reported.

P497 | Sleep quality during pregnancy and at postpartum is associated with delusional ideation

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Objectives/Instruction: Delusional ideation (DI) is relatively prevalent in non-clinical populations, including pregnant women. DI may be a precursor of psychiatric conditions, such as depression, schizophrenia and postpartum psychosis. Disordered sleep during pregnancy and in the postpartum is well-documented, and includes insomnia, fragmented sleep, daytime fatigue, sleep apnea and periodic limb movement. Poor sleep during pregnancy has been associated with a number of adverse outcomes including mood disorders and postpartum psychosis. Thus, both disordered sleep and DI may be related to postpartum psychosis and to development of psychopathology. The present study investigated the relationship between sleep quality and DI during pregnancy and in the postpartum.

Methods: A community sample of 300 women pregnant expecting a singleton birth (mean age = 31.92 ± 4.55 y.o.) participated in a longitudinal study of perinatal mental health in Montreal, Canada. Participants were assessed during the third trimester of pregnancy (32–34 weeks gestation, PN, $N = 300$) and at 2 months postpartum (PP, $N = 287$). Sleep quality was measured by the Sleep Symptom Checklist (SSC) self-report questionnaire, and DI was measured by a total score on the Peters Delusional Ideation scale (PDI). Four sleep scores were calculated: SSC total score and three subscales: insomnia, daytime symptoms, and sleep disorders.

Results: Stepwise regressions were performed with SSC subscales as predictors and PDI scores at PN and at PP as outcome. PDI at PN was positively associated with daytime symptoms ($F(1, 246) = 21.779$, $p < 0.001$, adjusted $R^2 = 0.081$); and at PP, PDI score was positively associated with the severity of scores on insomnia and sleep disorder subscales ($F(2, 269) = 17.921$, $p < 0.001$, adjusted $R^2 = 0.111$). Total SSC score at PN predicted PDI symptoms at PP ($F(3, 259) = 9.234$, $p < 0.001$, adjusted $R^2 = 0.086$)

Conclusions: Severity of delusional ideation was associated with sleep disturbances in women both during pregnancy and in the postpartum. Different aspects of disordered sleep predicted DI during pregnancy and at postpartum. These differences may reflect specific qualities of sleep disorders and of sleep-associated distress at each time point. These results suggest that sleep quality may exacerbate

delusional ideation during pregnancy and in the postpartum, which, in turn may contribute to increased risk of psychopathology.

Disclosure: Nothing to disclose.

P498 | Bi-directional relationship between sleep and psychiatry illness

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Objectives/Instruction: In recent years evidence of a two-way relationship between sleep and psychiatric illness emerges, in contrast to the idea that sleep disorders are only symptoms of mental illness. It is known today that sleep disturbances represent an independent risk factor for mental illness. Sleep functions can influence the course and outcome of psychiatric illness.

Objective: Summarize the relationship between sleep disorders and psychiatry illness, with focus on bipolar disorder.

Methods: A systematic literature review was performed. We used standard search strategies involving the querying of two online databases (MEDLINE® and EMBASE), between January 2014 to September 2017, for English language articles using the key words: sleep and mental health; sleep and bipolar disorder. Data from citations included in the articles of the initial research were also used, if these were shown as a good value for the explanation of the problematic in question. We selected 25 studies from 59 articles.

Results: Sleep disorders are highly prevalent among individuals with bipolar disorder. There appears to be a certain genetic predisposition to sleep problems with a dysregulation of their circadian rhythm, which leads some authors to consider that sleep disorders may be an early marker for this condition. Sleep disorders occur at all stages of the disease. Most of the sleep architecture findings are concentrated in the REM sleep phase, with a decreased latency and increased REM density. In several publications it is suggested that sleep disorders are associated with the worst course of the disease, and may induce acute phases in bipolar disorder.

Conclusions: Sleep disturbances are very common and often the first or the main complaint underlying psychiatric conditions. However, the reverse is also common, with a gap in the diagnosis and appreciation of the risks of psychiatric illness in people with sleep disorders. Evidence that sleep disturbances are associated with an increased risk of developing psychiatric illness has existed since the 1980s. It is necessary to sensitize the population and physicians who diagnose and treat sleep issues for effective intervention in the management of these health patients.

Disclosure: Nothing to disclose.

P499 | Which daytime impairments are specific to insomnia and which overlap with depression: a case-control study

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Objectives/Instruction: It is often difficult to determine to what extent the daytime symptoms are specific to insomnia or suggestive of another condition (i.e., depression), a confusion that may hinder optimal care. This study aims to describe insomnia-related daytime symptoms and examine their overlap with depression-related symptoms.

Methods: Data were derived from a population-based epidemiological study in Canada (Quebec, 2008). Participants were selected based on the presence of insomnia syndrome and significant depressive symptoms. They were categorized into four groups: Pure Insomnia, Pure Depression, Comorbid Insomnia and Depression, and Neither insomnia nor depression, which were matched on age and gender. Analyses of covariance (ANCOVAs), adjusting for nighttime insomnia symptoms, were conducted to compare the four groups on the following variables: Multidimensional Fatigue Inventory (MFI), Epworth Sleepiness Scale (ESS), State-Trait Anxiety Inventory – Trait (STAI-Trait), Extended Insomnia Severity Index (ISI-daytime symptoms), and Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS).

Results: A total of 228 participants were selected. The ANCOVAs revealed a significant group effect for all targeted symptoms (all ps $<$ 0.001). Post hoc tests further showed that when compared to control (Neither group), the three other groups had higher scores on most of the variables except for the ESS and DBAS. The Insomnia group presented more severe ISI daytime symptoms (on energy, $p < 0.001$ and on interpersonal relationship, $p < 0.05$) than the Depression group. Further, there were no added effects from depression on any of ISI daytime items, as indicated by the absence of significant differences on those items between the Insomnia and Comorbid groups. However, the STAI-Trait scores ($p < 0.001$) were higher in the Depression than in the Insomnia group, while the MFI scores were comparable between the two groups. The Comorbid group reported higher STAI-trait and MFI scores relative to the Insomnia and Depression groups ($p < 0.05$).

Conclusions: The findings indicate that daytime impairments related to decreased energy and interpersonal relationship, as measured by the ISI, are specific to Insomnia while daytime symptoms of anxiety and fatigue appeared to exist in both Insomnia and Depression. Specific attention should be devoted to those daytime dysfunctions when treating insomnia and comorbid conditions.

Disclosure: XWJ, HI, JS, ML, and CMM do not have any conflict of interest to disclose. This study was supported by a Canadian Institutes of Health Research grant (42504).

P500 | Impact of sleep restriction on mood and emotion regulation in adolescents with attention-deficit/hyperactivity disorder

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Objectives/Instruction: Adolescents with attention-deficit/hyperactivity disorder (ADHD) frequently experience emotion dysregulation and co-occurring internalizing symptoms (anxiety/depression). This study used an experimental sleep restriction/extension protocol to examine whether shortened sleep duration is causally linked to affect, emotion dysregulation, and internalizing symptoms in adolescents diagnosed with ADHD.

Methods: Forty-eight adolescents with ADHD (ages 14–17 years; 75% male) successfully completed a 3-week summer sleep manipulation protocol using a cross-over experimental design. The protocol included a phase stabilization week, followed in counterbalanced order by a sleep restriction week and a sleep extension week. Throughout the protocol, adolescents and parents completed a brief measure of negative and positive affect. At the end of each week, parents and adolescents completed measures of positive and negative affect, emotion regulation, and internalizing symptoms.

Results: Compared to the restricted sleep week, parents reported more positive affect ($p = 0.001$, $d = 0.52$), less negative affect ($p = 0.02$, $d = 0.35$), less emotion dysregulation ($p < 0.001$, $d = 0.56$), and fewer depressive symptoms ($p < 0.001$, $d = 0.82$) during the extended sleep week. Effects were not found for adolescent-reported internalizing symptoms, emotion regulation, or mood with the exceptions of significantly greater depressed mood on one measure of internalizing difficulties ($p < 0.001$, $d = 0.33$) and marginally less positive affect reported during the restricted sleep week compared to the extended sleep week ($p = 0.09$, $d = 0.25$).

Conclusions: This study provides the first evidence that sleep duration causally contributes to mood difficulties and internalizing symptoms in adolescents with ADHD, though effects were clearer parent report than adolescent self report measures. This study provides initial evidence that sleep contributes to emotion difficulties in adolescents with ADHD, though more studies are needed to understand specificity of effects and reasons for apparent informant differences.

Disclosure: Nothing to disclose.

P501 | Therapeutic auditory stimulation during sleep in depression: preliminary findings

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Objectives/Introduction: A previous study of audio stimuli during sleep in depression found that decreased slow-wave sleep correlated with depression improvement the next morning (Landsness et al., 2011). However, the goal of the stimulation may be not deprivation but rather improvement of slow-wave sleep.

Methods: Seven patients with melancholic depression underwent three polysomnographic trials - one adaptation and two experimental ("active" and "placebo", counter-balanced). EEG electrodes were positioned at Fz-Cz (bipolar derivation). Auditory paired (with interval of 1 s) 50-ms signals were automatically presented via miniaturised headphones. The stimuli onset was anchored to the moment when the program detected a decline of EEG waves below an amplitude threshold, with the elapsed time 0.5 s to fall at peak to increase amplitude of brain electrical oscillations (closed-loop in-phase stimulation as per Ngo et al., 2013). For the "placebo" night, the elapsed time for the stimuli varied randomly from 0 to 1 s. The 30-s epochs with stimuli were preceded and followed by 30-s epochs without stimulation, and these 1.5-min cycles were presented throughout the stage N2/N3 sleep. The number of cycles taken in the analysis was such that the cycles with in-phase and non-in-phase stimuli were matched by number of stimuli presented. Patients scored their depression and sleep quality by the abbreviated Hamilton scale HDRS-7-SR (before and after sleep) and by the Leeds Sleep Evaluation Questionnaire (LSEQ, in the morning), respectively.

Results: Compared to the pre- and post-stimuli epochs, acoustic stimuli significantly increased EEG power density in the frequency bands 0.5–2.5 Hz (delta waves), 16–25 Hz and decreased at 12.5–14.5 Hz. However, there was no difference in this effect between in-phase and non-in-phase stimulation. Greater overnight power density was associated with the greater decrease of HDRS-7-SR score ($N = 14$, $p < 0.02$) and better score on the wakening subscale of LSEQ.

Conclusions: Acoustic stimuli during sleep in depressed patients presented in a closed-loop fashion increase EEG delta sleep power density. Higher power density was associated with improve of depression state in the morning. Continuation of the study with proper placebo is warranted to prove or disprove the practical utility of the method.

Disclosure: Funding: The Russian Foundation for Basic Research grant #15-04-09349 (2015-2017).

P502 | The effect of sleep deprivation, daily life stress and happiness on academic performance in Korean adolescent students

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Objectives/Introduction: Sleep deprived on weekdays compared with weekends in adolescents have been shown to be associated with a wide variety of adverse effects on their lives, for example, academic performance. However, few epidemiological studies have specifically investigated this phenomenon. The present study examined the concurrent associations between sleep deprivation in weekdays, academic performance and other mental health factor in Korean adolescent students.

Methods: Analyses are based on data from the 2013–2016 Korean Youth Risk Behavior Web-based Survey (KYRBWS-V). The survey used a cross-sectional, national and representative sample consisting of 204,033 students (grades 7–12) who were selected using a stratified, clustered, multistage sampling method. Participants who reported "feeling depressed" were excluded. Multiple regression analysis was conducted to test the associations between academic performance, sleep deprivation (weekday and weekend sleep time difference), daily life stress, and feeling of happiness. Then the hypothetical path model was analyzed by path analysis.

Results: Greater daily life stress and more sleep deprivation in weekdays were correlated with better academic performance and less feeling of happiness degree were correlated with poor academic performance. Happiness, and sleep deprivation were potential influencing factors for academic performance ($p < 0.05$). In the path analysis, significant the factors influencing academic performance were sleep deprivation, happiness, stress, and fatigue recovery degree ($p < 0.05$). Sleep deprivation and happiness showed direct effects on academic performance in adolescents, while daily life stress showed indirect effects on academic performance in adolescents. Sleep deprivation was found to mediate the relationship between happiness and academic performance.

Conclusions: The findings of the study reveal that sleep deprivation, happiness, daily life stress can predict adolescents′ school performance. Our analyses of the relevant data from the KYRBWS-V suggested that the results will influence on future education strategies in school and on potential factors contributing to academic achievement.

Disclosure: Nothing to disclose.

P503 | Digital media use before bedtime and sleep quality among Finnish adolescents

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Objectives/Introduction: Use of digital media before bedtime, especially with portable devices like smartphones, has a potential to disturb sleep. In the current study we investigated sleep quality and usage of various forms of digital media with different devices before bedtime among Finnish adolescents. Our aim was to explore how adolescents used digital media before bedtime and did heavy usage negatively affect sleep.

Methods: The sample consist of 2,967 Finnish upper secondary education students (52.1% girl, 46.4% boy and 1.5% other). Majority of the participants (86.2%) were 16 years old. Use of digital media before bedtime was investigated with a question "How often have you done following things during the last hour before going to sleep?" with 12 different categories of digital media use with various devices to choose from (such as "Used social media on mobile phone"). Sleep related questions included self-assessment of subjective sleep satisfaction, sleep duration during weekdays and weekends, insomnia symptoms, daytime tiredness and short Morningness-Eveningness questionnaire (MEQ).

Results: 96.2% of participants reported to use digital media every night during the last hour before falling asleep. Since almost all participants used digital media every night, it was not possible to compare light and heavy users in this population. However, 8.9% of the participants self-assessed that use of digital media disturbs their sleep every night and 41.3% reported digital media to disturb their sleep at least once a week. Participants who reported that digital media disturbs their sleep were more often evening chorotypes, had shorter sleep duration, more social jet lag and more daytime tiredness than participants who did not feel that digital media disturbed sleep ($p < 0.001$ for all).

Conclusions: Use of digital media before bedtime every night is the norm among 16-year-old Finnish students. This leads to a lack of variance in the data, making it challenging to study possible negative impact of digital media usage to sleep. Regardless, there is a clear association between self-reports of digital media disturbing sleep and low sleep quality. In this population, everyone is using smart devices before bedtime but this only leads to sleep problems among minority of users.

Disclosure: Nothing to disclose.

P504 | Daylight exposure, depression and sleep in adolescents

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Objectives/Introduction: Sleep complaints and lowered mood states are frequently reported among in adolescence, especially during the dark season of the year. Autumn (Sep-Nov) in Sweden provides 14% of global yearly radiation, in winter 5%, markedly less than in spring (38%) and summer (43%). The aim of this study was to explore associations between daylight exposure, depressive symptoms, sleep and physical activity in adolescents during Scandinavian dark winter periods.

Methods: Data from 1,242 high school students (15–20 years; 52% boys) were obtained through a questionnaire on demographics (height, weight, age and gender), estimated hours of time spent outdoors in daylight, sleep problems, night-time technology use and physical activity. Indices were built for hours of daylight exposure (combined school days and weekends), depression (HAM-D6, 6-items), sleep disturbances (Karolinska Sleep Questionnaire, KSQ - 4-items), nighttime technology use (3-items) and excessive sleepiness (Epworth Sleepiness Scale, ESS). Depression was predicted using linear and logistic regression analysis. Symptom of depression was defined by cut-off score >22 (18% of sample) on the HAM-D6. Students lived in the Stockholm area at latitude 59.3°N.

Results: Linear regression showed that symptoms of depression was predicted by hours of daylight exposure ($p < 0.000$), sleep disturbances (KSQ, $p < 0.000$), physical exercise ($p < 0.000$), night-time technology use ($p < 0.000$) and excessive sleepiness (ESS, $p < 0.000$) but not age. Logistic regression predictors for symptoms of depression was gender (female), hours of daylight exposure (low), physical activity (low) and sleep disturbances (high). Social jetlag showed an association with depression ($p = 0.001$) and with sleep length ($p < 0.000$).

Conclusions: The study demonstrated that both daylight exposure and disturbed sleep was associated with symptoms of depression. It remains to be determined how much outdoor daylight exposure should be recommended to prevent health problems in adolescence.

Disclosure: Nothing to disclose.

P505 | Auditory closed-loop stimulation of the sleep slow oscillations in patients with schizophrenia

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Objectives/Introduction: Slow oscillations hallmark the electroencephalogram during slow-wave sleep and are critical to memory consolidation. In a recent study it was shown, that auditory stimulation in phase with the ongoing rhythmic occurrence of slow oscillation up states enhances the slow oscillation rhythm and the consolidation of declarative memory (Ngo et al., Neuron 78, 2013). Deficits in memory performance are among the most severe neuropsychological impairments in schizophrenia and contribute to poor functional outcome. Treatment options to improve these memory deficits are highly needed.

Methods: In the present study 20 patients with schizophrenia were included with a mean age of 41 years (range from 23 to 53 years). All patients were on stable antipsychotic medication. We conducted a randomized experimental design with repeated measures. An adaptation night preceded each of the two experimental sessions, the stimulation and shame condition in the sleep lab. Auditory closed-loop stimulation was applied in accordance to Ngo et al., 2013. To test declarative memory we used a verbal learning test of 15 words. Learning was conducted at 9 pm prior to polysomnography and recall at 7:30 am on the morning thereafter.

Results: After stimulation memory performance was higher as after sham stimulation, but this difference was not significant. Patients recalled 12.9 ± 1.9 words after stimulation and 12.1 ± 2.7 words after sham stimulation ($p > 0.1$; paired t-test).

Conclusions: Our results are promising, but further research is needed to improve sleep-related memory processes and thereby functional outcome in patients with schizophrenia.

Disclosure: Nothing to disclose.

P506 | High risk of OSA increases affect dysregulation among patients with schizophrenia spectrum disorder: an effect mitigated by the presence of a concurrent substance use disorder

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Objectives/Introduction: It is well-known that obstructive sleep apnea (OSA) leads to multiple adverse outcomes, including affect dysregulation. Existing literature demonstrates high comorbidity

between: 1) OSA and schizophrenia-spectrum disorders (SSD); and 2) SSD and substance use disorder (SUD). However, no studies have compared the impact of OSA on affect regulation in patients with SSD versus patients with SSD+SUD, so we compared both subgroups on different subjective measures of affect regulation. We hypothesized that:

(1) higher OSA risk would correlate with higher impulsivity among patients with SSD+SUD only, due to the additional complexity of concurrent disorders and because patients with SUD typically tend to display poorer impulse control; and

(2) for both groups, higher risk of OSA would correlate with all other measures of affect regulation.

Methods: Ten SSD and 31 SSD+SUD patients completed the Sleep Disorders Questionnaire 2-Sleep Apnea subscale to estimate the risk of OSA, and the Pittsburgh Sleep Quality Inventory (PSQI). Self-report measures were administered to examine different aspects of affect regulation: the Depression Anxiety and Stress Scale (DASS), the Difficulties in Emotion Regulation Scale (DERS), the Barratt Impulsiveness Scale (BIS) and the Buss-Perry Aggression Questionnaire (BPAQ).

Results: Among patients with SSD+SUD, higher risk of OSA was correlated with poorer impulse control (BIS, $r = 0.46$, $p = 0.006$) and poorer quality of sleep (PSQI, $r = 0.31$, $p = 0.047$). Among patients with SSD, higher risk of OSA was linked with poorer emotional regulation (DERS, $r = 0.58$, $p = 0.040$). For both subgroups, higher risk of OSA was associated with lower mood (SSD: DASS, $r = 0.87$, $p = 0.001$; SSD+SUD: DASS, $r = 0.36$, $p = 0.028$).

Conclusions: As predicted, higher risk of OSA was correlated with poorer impulse control among patients with SSD+SUD only. Higher risk of OSA was correlated with poorer emotion regulation among patients with SSD only. For both groups, higher risk of OSA was correlated with lower mood. No correlation was found between higher risk of OSA and aggression. These findings present novel insights into the potentially differential impacts of OSA on affect regulation, which appears to vary depending on the clinical picture. Using polysomnography to confirm the presence of OSA will help improve our understanding of the present findings.

Disclosure: Nothing to disclose.

P507 | Severity of paranoid thoughts in a non-clinical sample moderates the relationship between previous night sleep and next-day paranoia: a prospective study using experience sampling methodology

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Objectives/Introduction: Sleep disturbances such as insomnia and nightmares have been shown to be linked to the increased severity of paranoia in healthy and clinical samples. However, it is not clear whether increased severity of paranoid moderates an elevated vulnerability to the effects of sleep disturbance. Therefore, objective and subjective measurements of sleep were assessed in a low and high non-clinical paranoia group, and both were assessed on daily paranoia, mood and mood regulation in an experience sampling methodology design (ESM). The study was designed to understand whether nightly measured sleep predicted next day paranoia across a single week, and to test potential mediators of this relationship using a prospective ESM design.

Methods: Two groups were recruited based on a sample from a previous study (Barton et al., in submission) to form a lower quartile ($n = 24$) and upper quartile ($n = 21$) paranoia group. Both were screened for clinical diagnoses and sleep disorders other than insomnia. All participants completed baseline questionnaires and were then provided with a Pro Diary actigraphy watch which allowed for the integrated day by day collection of paranoia, mood, mood regulation and putative cognitive mediators. All participants completed entries via the watch 5 times a day over 7 days and the data was analysed using multi-level modelling.

Results: Previous night objective ($p < 0.001$) and subjective ($p = 0.004$) total sleep time was associated with increased next day paranoia scores in the whole sample ($n = 45$). No other sleep variables were associated with next day mean paranoia scores ($p > 0.05$). In the moderation analysis, it was shown that the association between total sleep time and paranoia was stronger in the high compared to low trait paranoia group ($p = 0.018$). It was shown that negative affect, threat anticipation and dissociation mediated 49, 37, and 42% of the association between previous night total sleep time and next day paranoia respectively.

Conclusions: Previous night total sleep is associated with next day paranoia and this is moderated by severity of paranoid thoughts. Mediation analysis suggested that negative affect, threat anticipation and dissociation were important mediators.

Disclosure: Nothing to disclose.

P508 | Daily activity levels, sleep quality and chronotypes in the early phase of psychosis

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Objectives/Introduction: Recent evidence suggest that sleep and circadian disturbances may play a role in the early stages of the psychosis and be related to symptoms severity. In order to assess sleep and circadian impairments in a cohort of early psychosis (EP) patients

treated in the TIPP program (Lausanne University Hospital, Switzerland), we evaluated sleep quality and chronotype and we measured the daily activity levels in EP and in healthy control (CTL) subjects. We also tested correlations between these data and clinical evaluation.

Methods: Study included 18 EP and 9 CTL subjects (mean age ± SD: 26 ± 3.8 years; 2 females). Sleep quality and chronotype were determined using the "Pittsburg Sleep Quality Index" (PSQI) and the "Morningness-Eveningness Questionnaire" (MEQ) respectively. In addition, subjects wore an actigraphic wrist over 21 days. Activity levels were calculated from activity counts recorded during 1 min epochs by a GeneActiv "Original" tri-axis accelerometer and divided in "Sedentary/Light Activity" (SLA) or "Moderate/Vigourous Activity" (MVA). Following elimination of days with incomplete recording, data were separated in "Week Days" (WD) and "Week-End Days" (WED). Statistical comparison of PSQI, MEQ and activity in both groups were performed using a Mann-Whitney test. Correlations of sleep/circadian parameters with scores from clinical symptoms scales (MADRS, PANSS, SOFAS, GAF) and medication (CPZ equivalent) were evaluated using a nonparametric Spearman correlation test.

Results: The EP subjects displayed a higher PSQI global score ($p < 0.005$) than CTL subjects. Among the PSQI components, the sleep latency score was the most increased. In EP group, PSQI was positively correlated ($r = 0.536$; $p = 0.0392$) with mean MADRS score. Chronotype between both groups was not different. Due to a significant decrease in SLA ($p < 0.05$), total activity during WD was lower in EP subjects ($p = 0.0027$). No difference was observed for WED.

Conclusions: The EP subjects reported a poorer subjective sleep quality that, in line with other studies, is mainly due to an increase in sleep latency. In EP, PSQI was positively correlated with MADRS scores suggesting that depressed patients have poorer sleep quality. The decrease in activity during WD is likely to be related to the limited access of EP subjects to social synchronizers rather than to medication.

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P509 | Sleep as a moderator of the relationship between child maltreatment and romantic relationship patterns

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Objectives/Introduction: Previous research shows that adverse childhood experiences (ACEs) can lead to a worse sleep quality and have an impact on social behavior and relationships. This study aims to examine the role of sleep on the association between ACEs and romantic relationship quality. Additionally, the relationship between ACEs and romantic relationship patterns (RRQ) and nightmares is investigated.

Methods: A sample of 377 participants aged 18–53 years was examined. A self-assessment questionnaire survey was conducted to interview the participants about their ACEs, romantic relationship patterns (quality, history, orientation) as well as about their sleep patterns (quality, nightmares).

Results: Sleep quality was found to be a significant mediator of the relationship between child maltreatment and RRQ ($\beta = -0.362$, 95% CI [−0.630, −0.134]). Neither a general history of ACEs ($p = 0.480$) nor single types of ACEs ($p = 0.080 - p = 0.998$) predict short-term romantic relationship orientation. Overall childhood maltreatment (CM) ($p \leq 0.000$), history of sexual abuse ($p = 0.010$), separation of parents ($p = 0.003$), violence against the mother ($p = 0.026$), substance abuse of a household member ($p = 0.005$), and psychic disorder of a household member ($p = 0.000$) predict more romantic relationships in the participants' histories. A heightened nightmare frequency is predicted by emotional neglect ($p = 0.044$) and substance abuse of a household member ($p = 0.046$). More nightmare daytime effects were as well predicted by overall CM ($p \leq 0.000$).

Conclusions: This study underlines the influence of childhood experiences on the adult life. As sleep was found to moderate the relationship between ACEs and RRQ, therapeutic treatments for childhood maltreated individuals should take sleep quality improvement as an important goal into consideration.

Disclosure: Nothing to disclose.

PAEDIATRICS 1

P512 | Association between REM sleep EEG connectivity and daytime core symptoms in children with Autism Spectrum Disorder

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Objectives/Instruction: The Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by atypical connectivity between brain regions. We have previously found a lower intrahemispheric EEG coherence within the right frontal area in adults with ASD during REM sleep.We verified whether frontal REM sleep connectivity was also atypical in ASD children and if it was associated with daytime functioning.

Methods: The sleep of 11 children with ASD (10.5 ± 1.2 years) and 13 typically developing (TD) children (10.2 ± 2.0 years) was recorded for 2 consecutive nights with a full EEG montage; EEG data from night 2 was used. Participants with a full-scale IQ below 80 or taking medication were excluded. Parents filled the Autism

Diagnostic Interview-Revised (ADI-R). EEG coherence values for Delta, Theta, Alpha, Sigma and Beta frequency bands were calculated for intrahemispheric frontal pairs of electrodes on artifact-free samplesof REM sleep. Group differences on EEG coherence were assessed with repeated-measured ANOVA on each electrode pair for all frequency bands. The associations between ADI-R subscales scores and EEG coherence was tested with Pearson's r.

Results: Compared to TD children, ASD children displayed significantly greater coherence values between frontal intrahemispheric pairs of electrodes: FP1-F7 ($F(3;54) = 9.2$, $p < 0.001$), FP1-F3 ($F(4;80) = 5.7$, $p < 0.001$), F3-F7 ($F(4,84) = 8.6$, $p < 0.001$), FP2-F8 ($F(2;30) = 5.5$, $p < 0.05$), FP2-F4 ($F(3;59) = 4.5$, $p < 0.01$), and F4-F8 ($F(2;45) = 4.6$, $p < 0.05$). The social ADI-R subscale score was positively correlated with frontal left hemisphere (FP1-F3) sigma coherence in ASD children ($r = 0.74$, $p = 0.02$).

Conclusions: Opposite frontal EEG coherence values in ASD children and adults suggest an atypical developmental pattern of brain organization in ASD. The positive correlation between left frontal coherence and social deficits on the ADI-R points toward a common neuronal substrate.

Disclosure: Nothing to disclose.

P513 | The relationship between sleep and temperament in early childhood

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Objectives/Introduction: Sleep patterns and temperament in the first year of life are closely related, and have important developmental implications (Ednick et al., 2009). However, despite the growing understanding of the role of sleep in preschool children's development, scarce research has been conducted in earlier ages, i.e. important developmental periods. Temperament is conceptualized as a construct with two systems: reactivity and regulation. Nevertheless, many studies have been focused on reactivity as a key component of temperament, whereas less research has been conducted on regulation (de Marcas et al., 2015). We aimed to examine the relationship between sleep and temperament during infancy.

Methods: This study was derived from the FinnBrain Birth Cohort Study. The variables of interest were sleep and temperament at 6 and 12 months. A total of 1,990 subjects at 6 months, and 1,684 at 12 months had data available for the analyses. Sleep functioning was assessed using the Brief Infant Sleep Questionnaire (BISQ) and temperament with the Infant Behavior Questionnaire-Revised (IBQ-R). The association between several sleep variables (short sleep, delayed circadian rhythm, night-time awakenings, late settling-time, and sleep difficulties) and the three IBQ-R dimensions (Surgency-SUR, Negative Affectivity-NEG and Regulation-REG) was studied.

Results: Sleep difficulties at 6 months were negatively associated with SUR ($p = 0.003$), while other sleep variables were unrelated. Regarding NEG, we obtained significant positive associations at both 6 and 12 months, with short sleep ($p < 0.001$; $p < 0.001$), frequent night-time awakenings ($p < 0.001$; $p < 0.001$), late settling-time ($p < 0.001$; $p < 0.001$), and sleep difficulties ($p < 0.001$; $p < 0.001$). Sleep quality problems were also negatively related to REG at both time-points: short sleep ($p = 0.065$; $p = 0.010$), late settling-time ($p = 0.010$; $p = 0.014$), sleep difficulties ($p < 0.001$; $p = 0.004$); and frequent night-time awakenings, only at 6 months ($p < 0.001$).

Conclusions: Sleep characteristics, such as short sleep, nigh-time awakenings, late settling-time and sleep difficulties are positively associated with Negative Affectivity and negatively with Regulation among infants. The interrelations of child emotional reactivity and self-regulation and sleep require further attention. Follow-up is needed to understand the potential bidirectional contributions between sleep and temperament and also to identify possibilities for tailored interventions for pediatric sleep problems.

Disclosure: Nothing to disclose.

P514 | A full sleep assessment in children with attention deficit hyperactivity disorders (ADHD)

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Objectives/Instruction: We present the results of a prospective case-control sleep study in children with attention deficit hyperactivity disorder (ADHD), aimed to identify one of the following 5 sleep phenotypes: (1)narcolepsy-like; (2) sleep onset insomnia (SOI); (3)obstructive sleep apnea syndrome (OSA); (4) periodic limb movements (PLMs); and (5) sleep epilepsy, and to explore differences in sleep slow wave activity (SWA) distribution and sources, as compared to normal controls, by high density electroencephalography (HD-EEG).

Methods: Thirty consecutive outpatients with ADHD (9 females, mean age 10.1 ± 2.1 years), were recruited, and underwent the full sleep assessment. Twenty five controls, sex- and age-matched control subjects (12 females, mean age 10.34 ± 1.54) only underwent the PSG-HD EEG. The scalp topography, the SWA sources' distribution were calculated in children with ADHD and compared to normal controls. In addition, the differences of SWA, comparing the first and last part of the night, were calculated.

Results: The narcoleptic-like phenotype was found in 4 children, SOI in 5 children, OSA in 7 children, PLMs in 8 children, while sleep epilepsy in 5. All patients slept less 9 hr at actigrapy, confirmed by PSG, and had a higher apnea hypopnea index than controls. At scalp

topography, both groups showed a similar distribution of SWA, but in ADHD subjects, the focus of SWA was over centro-parietal regions, whereas in control subjects it was prominent over frontal regions ($p < 0.05$). The statistical non parametric comparison of localized sources showed a greater delta power over the posterior cingulates in ADHD group compared to controls ($p < 0.05$). The overnight physiological decrease in SWA, diffused over the whole scalp, was more evident in control subjects. To account for this discrepancy between groups, late sleep from early sleep delta power values were subtracted and the obtained distributions compared. A significant increase of delta power was found over central regions in ADHD ($p < 0.05$).

Conclusions: The study confirms the relevant association between ADHD and defined sleep disorders, inducing a chronic sleep deprivation. The HD-EEG analysis confirms a maturation delay of SWA, which may also reflect a state of sleep deprivation, and a reduced downscaling process.

Disclosure: Nothing to disclose.

P515 | Clinical and patient global impression in a study of sodium oxybate in children and adolescents with narcolepsy with cataplexy

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Objectives/Instruction: Clinical and Patient Global Impression of Change (CGIc, PGIc, respectively) for cataplexy severity and narcolepsy overall were assessed as secondary/exploratory endpoints in a study of sodium oxybate (SXB) in paediatric patients with narcolepsy with cataplexy.

Methods: Children and adolescents (7–17 years) diagnosed with narcolepsy with cataplexy either on SXB treatment or SXB-naïve were enrolled. SXB-naïve participants were titrated to a stable dose (SD) of SXB and those on SXB remained on their current SD. After the SD period, participants were randomised to continue SXB (SD) or receive placebo in a 2-week, double-blind withdrawal period (DB). CGIc for cataplexy severity and narcolepsy overall, and PGIc for narcolepsy overall were assessed at the end of the DB period with respect to the end of the SD period. Responses (+3 [Very Much Improved] to −3 [Very Much Worse]) were compared between placebo and SXB groups using the Cochran-Mantel-Haenszel row mean difference test. Treatment emergent adverse events (TEAEs) were also assessed.

Results: Sixty-three participants were randomised (7–11 years: 41%; female: 44%; SXB naïve: 62%). Prior to receiving any treatment, the mean CGI scores for cataplexy and narcolepsy overall indicated markedly ill disease severity. Compared to subjects randomised to SXB, the placebo group demonstrated lower mean (standard deviation [SD]) CGIc and PGIc scores with a greater percentage of patients being "much worse" and "very much worse," regardless of age group or SXB entry status: CGIc cataplexy severity, placebo −1.5 (1.2) vs. SXB −0.4 (1.1)* and 65.6% vs. 17.2%; CGIc narcolepsy overall, placebo −1.4 (1.1) vs. SXB −0.4 (1.0)* and 59.4% vs. 10.3%*; PGIc narcolepsy overall, placebo −1.3 (1.0) vs. SXB 0.0 (1.3)* and 48.3% vs. 16.7%. In the safety population, the most frequently reported TEAEs (>5%) included enuresis, nausea, vomiting, headache, and weight decrease. (*$p < 0.001$).

Conclusions: In participants on SD SXB, randomisation to placebo resulted in significant worsening of cataplexy and narcolepsy symptom severity as rated by clinicians and participants, supporting the efficacy of SXB on cataplexy and overall narcolepsy symptoms in paediatric patients with narcolepsy with cataplexy. Safety and tolerability were consistent with previous studies in adult and paediatric populations.

Disclosure: C Ruoff has served as an advisory board member and unpaid consultant for Jazz Pharmaceuticals. N Simakajornboon is involved in Jazz Pharmaceuticals investigator initiated research, "A Multicenter Retrospective and Prospective Follow-up Study of Early Onset Childhood Narcolepsy: Recent Cases and Post Infection." F Hassan has received research funding from Jazz Pharmaceuticals and has participated on a scientific advisory board for Spinraza (Biogen). M Chen has nothing to disclose. T Swick is an employee of Neurology and Sleep Medicine Consultants; has received consultancy fees and/or honoraria from Jazz Pharmaceuticals, Vanda Pharmaceuticals, XenoPort Pharmaceuticals, UCB Pharma, Merck Pharma, Aerial BioPharma, Flamel/Avadel has received research funding from Jazz Pharmaceuticals, Aerial BioPharma, LLC, GSK Pharmaceuticals, Otsuka Pharmaceuticals, Teva Pharmaceuticals, Vanda Pharmaceuticals; and Flamel/Avadel and is a speakers' bureau member for Jazz Pharmaceuticals. J Black is a part-time employee of Jazz Pharmaceuticals and shareholder of Jazz Pharmaceuticals plc. YG Wang and R Parvataneni are, full-time employees of Jazz Pharmaceuticals, who, in the course of this employment, have received stock options exercisable for, and other stock awards of, ordinary shares of Jazz Pharmaceuticals, plc. G Plazzi has received consultancy fees from UCB, Jazz Pharmaceuticals, and Bioprojet.

P516 | The impact of experimental sleep restriction on adolescent mood

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Objectives/Instruction: Adolescence is a critical developmental period when the onset of mood disorders is prevalent. Limited

studies have examined the relationship between sleep duration and mood experimentally using chronic sleep restriction paradigms that are consistent with adolescents' normative sleep. Further, studies tend to measure positive or negative mood rather than discrete mood states. The present study examines the relationship between sleep duration and mood states in adolescents using a dose-response study including measures of sadness, anger, depressed mood, confusion and happiness.

Methods: Thirty-four adolescents (20 male), aged 15–17 years spent ten days and nine nights in a temperature- and light-controlled sleep laboratory. In between two baseline nights and two recovery nights with 10 hr time in bed (TIB) per night, participants experienced either severe (5 hr TIB, $N = 12$), or moderate (7.5 hr TIB, $N = 10$) sleep restriction for five consecutive nights, while the control group ($N = 12$) had 10 hr TIB each night. Mood was measured every three hours during wake using unipolar visual analogue scales measuring mood states of "sad", "depressed", "angry", "confused", "happy."

Results: Linear mixed models analyses revealed that participants in the 5 hr group, but not the 7.5 or 10 hr groups, reported being significantly more sad ($F(4,1314) = .57$, $p < 0.001$), depressed ($F(4,1314) = 7.48$, $p < 0.001$), and angry ($F(4,1314) = 3.00$, $p = 0.018$) during sleep restriction than at baseline and significantly less happy ($F(4,1314) = 12.72$, $p < 0.001$). The effect of sleep restricted to 5 hr on confusion varied according to sex ($F(4,1313) = 7.01$, $p < 0.001$), with males reporting increased confusion from baseline to sleep restriction, while females did not. Two nights of recovery sleep was not sufficient to recover from increased negative mood states for the 5 hr group, although recovery occurred for happiness.

Conclusions: Given the prevalence of insufficient sleep and the prevalence of mood disorders and dysregulation across adolescence, these findings highlight the importance of sufficient sleep to help mitigate these risks.

Disclosure: Nothing to disclose.

P517 | The predictive value of polysomnography combined with quality of life for treatment decision of children with habitual snoring related to adenotonsillar hypertrophy

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Objectives/Instruction: Both surgical treatment and non-surgical treatment are suggested by clinicians for children with habitual snoring related to adenotonsillar hypertrophy; However, how should the decision be made remains unclear. The objective of this study was to investigate potential predictors for the treatment decision, i.e. surgical treatment vs wait and see in children with habitual snoring related to adenoidal and/or tonsillar hypertrophy.

Methods: Children with complaints of snoring and/or apnea associated with adenotonsillar hypertrophy who received polysomnography (PSG) monitoring at our Hospital were recruited. After at least 6 months, the subjects were followed up and grouped according to whether or not they had received adenoidectomy and/or tonsillectomy (AT) execution. The heights, weights, as well as quality of life (assessed using the OSA-18 quality of life questionnaire) and baseline PSG of the subjects were recorded and compared. Two logistic regressions were performed to reveal the factors influencing decision-making on conducting AT.

Results: A total of 509 children were finally included (345 males and 164 females). Among these children, 287 eventually received AT. Significant differences in age, scores for item 1 and 5 of the OSA-18, apnea-hypopnea index, obstructive apnea index, obstructive apnea-hypopnea index (OAHI), and Lowest arterial oxygen saturation ($p < 0.05$) were observed between groups. By multivariate logistic regression, the factors that influenced the surgical decision were identified as follows: age <7 years ($p = 0.008$: odds ratio [OR] = 1.667, 95% confidence interval [CI]: 1.140–2.438), score for item 5 of OSA-18 > 4 points ($p = 0.042$: OR = 1.489, 95% CI: 1.014–2.212) and OAHI > 1/hr ($p = 0.044$: OR = 1.579, 95% CI: 1.013–2.463).

Conclusions: School age children aged <7 years, with OAHI > 1/hr and mouth breathing scored >4 points were more likely to receive AT during the disease process and thus require increased attention.

Disclosure: The research was supported by National Key Research & Development Program of China (2017YFC0112500) and Beijing Municipal Administration of Hospitals' Mission Plan (SML20150201).

P518 | Adenotonsillectomy improved quality of life better versus nonsurgical management for children with controversial diagnoses of obstructive sleep apnea: a prospective cohort study

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Objectives/Introduction: To investigate the effect of adenotonsillectomy versus nonsurgical management on quality of life (QoL) in children with controversial obstructive sleep apnea (OSA) diagnoses by American Thoracic Society (ATS) and International Classification of Sleep Disorders (ICSD-3).

Methods: Children complaining of snoring who received PSG monitoring in Capital Medical University Beijing Tongren Hospital were recruited. Subjects with controversial OSA diagnoses according to ATS and ICSD-3 were enrolled and assigned to 2 groups: Group 1, adenotonsillectomy (adenoidectomy with or without tonsillectomy); Group 2, nonsurgical management. Gender, age, height, weight and BMI were matched and baseline QoL was recorded. After at least

6 months, subjects were followed up by phone and final QoL was obtained.

Results: A total of 63 subjects were finally included. 39 of them received adenotonsillectomy and 24 received nonsurgical management. Baseline characteristics, PSG parameters and OSA-18 showed no difference between groups. And both groups had improved QoL at follow-up: sleep disturbance (group 1: weighted mean difference (WMD) [95% confidence interval CI], −7.97 [−9.09, −6.86]; group 2: −3.92 [−4.97, −2.86]), physical symptoms (group 1: −7.9 [−8.92, −6.87]; group 2: −4.08 [−5.3, −2.86]), emotional distress (group 1: −1.95 [−2.86, −1.04]; group 2: −1.38 [−2.7, −0.05]), daytime function (group 1: −2.28 [−3.09, −1.47]; group 2: −2.63 [−3.75, −1.5]), caregiver concerns (group 1: −12.36 [−14.2, −10.52]; group 2: −5.38 [−7.55, −3.2]), and total score (group 1: −32.46 [−36.53, −28.39]; group 2: −17.38 [−22.04, −12.71]). However, the improvement was significantly greater in group 1 than that in group 2 in the domains sleep disturbance, physical symptoms, caregiver concerns and total score ($p < 0.05$).

Conclusions: Adenotonsillectomy can improve caregiver-reported QoL better versus nonsurgical management for children with controversial OSA diagnoses.

Disclosure: This research was supported by National Key Research & Development Program of China (2017YFC0112500) and Beijing Municipal Administration of Hospitals' Mission Plan (SML20150201).

P519 | Sleep onset latency and psychologic problems in Siberian adolescents: the school-based study

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Objectives/Instruction: The Strengths and Difficulties Questionnaire (SDQ) was developed by R. Goodman [J Child Psychol Psychiatry. 1997 Jul;38(5):581–6] as a brief psychopathological screening tool that has been recommended for the detection and classification of psychosocial problems in adolescents. Data regarding the SDQ assessment in adolescents with sleep disturbances are limited. To evaluate the association of sleep onset latency with psychologic problems according to Strengths and Difficulties Questionnaire in Siberian adolescents.

Methods: 481 urban Siberian (Krasnoyarsk) adolescents (aged 12–18; boys/girl ratio 213/268) were tested with self-report version of SDQ questionnaire and sleep characteristics. Adolescents were asked "During the past month, how long (in minutes) has it usually taken you to fall asleep each night?" to estimate sleep onset latency. Bedtime and wake-up time on school days were assessed with the question: "At what times (hours: minutes) do you usually go to bed and wake up on school days?" Data are shown as median (25–75% quartiles). Kruskal-Wallis test was used.

Results: Significant positive associations were detected between sleep onset latency and SDQ total difficulties score with more remarkable progressive increasing in adolescents with emotional problems. Sleep onset latency were 16.5 (15.5–17.6) min in group with emotional symptoms score = 0–3 ($n = 314$), 21.3 (16.3–26.3) min in group with emotional symptoms score = 4 ($n = 114$), and 24.2 (20.9–27.4) min in group with emotional symptoms score = 4 ($n = 53$), Kruskal-Wallis test $p = 0.022$.

Conclusions: Sleep onset latency increasing may be used as a surrogate marker of psychosocial problems in adolescents, especially those with emotional problems.

Disclosure: Nothing to disclose.

P520 | Sleep spindles features in obesity obstructive sleep apnea adolescents

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Objectives/Instruction: Sleep spindles (SS) are the EEG-hallmarks of stage 2 non-rapid eye movement sleep. SS may indicate on disturbed sleep. Limited studies have examined the SS patterns in obstructive sleep apnea (OSA), and no studies have evaluated those in obesity adolescents with OSA. The aim of this study was to evaluate SS characteristics in obesity adolescents according to absence or presence of OSA.

Methods: We examined 30 male obesity adolescents (mean age 16.5 ± 0.3 years). Obesity was diagnostic if body mass index Z-score (BMI Z-score) >2 for age and sex. Polysomnography (PSG) was performed applying system GRASS-TELEFACTOR Twin PSG (USA). All patients were divided into 2 groups in accordance with the PSG results (18 obesity OSA patients - the 1st group, 12 obesity non-OSA patients - the 2-nd group). Adolescents were included in the 1-th group if apnea/hypopnea index ≥1.4 episodes in hour. SS were scored visually from C4-A1 EEG derivation after PSG analysis. SS were defined as a waveform with frequency between 11.0–15.9 Hz, at least 0.5 s in length. All differences were considered significant at $p < 0.05$ (Mann-Whitney test).

Results: The Mann-Whitney test showed that number of sleep spindle density was significantly higher in obesity OSA adolescents than in obesity non-OSA group (767 ± 235 n versus 275 ± 82 n, $p < 0.0001$, and 4.3 ± 1.5 n/30 s epoch versus 1.2 ± 0.3 n/30 s epoch, $p < 0.0001$, respectively). However, maximum spindle amplitude and spindle frequency were significantly lower in the 1st group than in the 2nd group (20.8 ± 0.3 μV versus 28.2 ± 0.4 μV, $p < 0.0001$, and 11.7 ± 0.6 Hz versus 13.5 ± 0.4, $p = 0.008$

respectively). There was no significant change in spindle duration between the three groups.

Conclusions: SS characteristics related to OSA presence in obesity adolescents. We suggested that, the slow and low amplitude spindles in the OSA group might indicate long hyperpolarization rebound sequences with low hyperpolarization level, possibly indicating altered neural mechanisms in the structures regulating spindle activity in OSA. While the increased spindle number and spindle density in obesity OSA adolescents might were the EEG responses to multiple brief occlusions in impaired sleep, an adaptive response to hypoxia.

Disclosure: Nothing to disclose.

P521 | The relationship between sleep habits and positive and negative emotions in infants and toddlers: a preliminary study

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Objectives/Introduction: Sleep is fundamental for emotional development especially in early infancy. Children with sleep disturbance tend to have problems in self-regulation, and specifically in managing their emotions. This study aimed to investigate the relationship between sleep habits and emotions in nursery setting using an ecological momentary assessment.

Methods: Preliminary data on 24 children (12 F, 12 M) aged 6–35 months (17.8 ± 9.6) were obtained. Sleep habits and emotion were monitored by educators during nursery times through a sleep and emotion diary (based on Positive and Negative Affect Scale for Children questionnaire) for 10 days. Sociodemographic, family organization, nighttime sleep habits at home and emotional and behavioural assessment questionnaire were administered to children families and educators.

Results: Based on questionnaires, we divided children in 2 groups: children without sleep problems (N = 13) and children with sleep problems (N = 11). Daily sleep time of children without sleep problems was significantly higher compared to children with sleep problem during both the first ($F_{(1,22)}$ = 6.29, p = 0.02) and the second week ($F_{(1,22)}$ = 7.61, p = 0.01). A significant correlation between daily sleep time during the first week and positive emotions in general (r = 0.47, p = 0.02), happiness (r = 0.63, p = 0.01), cheerfulness (r = 0.76, $p < 0.01$), dynamism (r = 0.78, $p < 0.01$), joy (r = 0.70, $p < 0.01$), was found. Daily sleep time during the second week resulted moderately correlated with energy (r = 0.45, p = 0.03) cheerfulness (r = 0.43, p = 0.03), dynamism (r = 0.43, p = 0.04), fear (r = −0.41, p = 0.04), loneliness (r = −0.41, p = 0.05).

Conclusions: Preliminary analyses indicated that good sleep seems to be associated with high positive emotions, but not necessarily with low negative emotions. Future studies conducted in larger samples are warranted to replicate these results.

Disclosure: Nothing to disclose.

P522 | Polysomnographic study in primary-school children with Attention Deficit Hyperactivity Disorder

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Objectives/Introduction: 10% of children with Attention Deficit Hyperactivity Disorder (ADHD) present persistent sleep disorders. Sleep has a role in cerebral plasticity. Poor sleep may worsen the attentional dysfunction in ADHD. Comorbidity diagnosis (ADHD + sleep disorder) is complex. This retrospective study investigates subjective and objective sleep quality in a group of 22 ADHD children.

Methods: Aged from 6 to 10 years (mean age 7.5), 18 boys and 4 girls, they were referred to our Sleep Unit for poor sleep and poor attention. They had not yet a conclusive diagnosis of ADHD and they were all stimulant drug-naïve. They underwent a sleep-expert interview and one-night PSG. After PSG, diagnosis of ADHD was made by an expert in this field: clinical features of all children met the DSM-V diagnostic criteria for ADHD (14 combined and 8 inattentive presentation). A neurocognitive evaluation (Kitap battery) confirmed attention deficit.

Results: The children's families reported: snoring (77%), tiredness (68%), insomnia (41%) and parasomnia (41%). No one complained about clear Restless Legs Syndrome, but 14% reported "restless sleep". 86% complained about at least two sleep symptoms. 50% of families considered sleep problems more important than attention deficit and consulted first for sleep problems. PSG showed a mean sleep latency of 21 min ± 22; a mean sleep efficiency of 89% ± 8 and total sleep time of 553 min ± 61. 23% of children had a bad night at Sleep Unit with sleep latency >30 min or sleep efficiency <80%, with total sleep time <420 min. PSG showed periodic limb movement disorder during wakefulness in 23% of children and an Apnea-Hypopnea Index (AHI) between 3–4.9/hr in 36%. No one had a AHI ≥ 5/hR. Parasomnia episodes were not recorded.

Conclusions: The present results show that 50% of school-aged drug-naïve ADHD children arriving at our sleep consultation had a priority complaint of poor sleep rather than attention. PSG showed comorbid sleep disorders: parasomnia in 41%, mild OSAS in 36%, restless legs syndrome in 23%, insomnia in 23%. These results

reinforce the idea that ADHD children complaining about sleep disorders may consult first sleep-expert. They should undergo a cognitive and PSG analysis.

Disclosure: Nothing to disclose.

P523 | Night-to-night sleep variability and objective short sleep duration are associated with impaired sympathetic-parasympathetic balance in adolescents

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Objectives/Introduction: Impaired sympathetic-parasympathetic balance, as measured by heart rate variability (HRV), has been associated with increased risk of cardiovascular morbidity. Inadequate sleep has been shown to contribute to impaired HRV, however, it is not clear what sleep problems are independently associated with impaired HRV in adolescents, a population in which insomnia symptoms, short sleep duration and night-to-night sleep variability are highly prevalent. We examined whether polysomnography (PSG) and actigraphy (ACT) measured sleep duration and its night-to-night variability were independently associated with worse HRV indices, as measured by 24-hr EKG, in adolescents.

Methods: We examined this question in the Penn State Child Cohort, a randomly-selected sample of 421 adolescents (12–23 years). All subjects underwent 9-hr, in-lab PSG, wore an ACT monitor in the non-dominant wrist for 7 days, and an ambulatory EKG for 24 hr. Mixed-effect regression models predicting HRV indices included PSG sleep duration and ACT sleep duration and its variability (standard deviation) adjusted for each other as well as for sex, race, age, body mass index, insomnia symptoms, and apnoea/hypopnoea index.

Results: Shorter PSG sleep duration and higher ACT sleep variability were independently associated with worse HRV indices [e.g., SDNN: 2.05 ± 0.70, $p < 0.01$ and −4.50 ± 1.14, $p < 0.01$ and Log-HF: 0.10 ± 0.03, $p < 0.01$ and −0.10 ± 0.05, $p = 0.05$, respectively], while ACT sleep duration was not [e.g., SDNN: −0.57 ± 0.84, $p = 0.49$ and Log-HF: −0.06 ± 0.04, $p = 0.12$, $p = 0.37$, respectively].

Conclusions: Short PSG sleep duration and high ACT sleep variability are independently associated with impaired sympathetic-parasympathetic balance, which indicates that these two objective measures may help identify distinct sleep phenotypes associated with increased cardiovascular risk in adolescence.

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P524 | Self-assessed sleep quality and it influencing factors in Latvian adolescents

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Objectives/Introduction: Good sleep quality (SQ) is important for physical and mental health of the individual, and is a positive indicator of well-being. However, in adolescents SQ decreases noticeably due to different reasons. The objective of the study was to analyse the SQ and it influencing factors in Latvian adolescents.

Methods: Prospective study was performed at different schools in Latvia including adolescents attending 7th–12th grade. Adolescents were asked to assess their sleep quality and adequacy and to mention reasons of bad SQ and inadequate sleep amount using a questionnaire. Sleep hygiene index (SHI; range 14–65) was calculated. Statistical analysis: ANOVA, Chi-squared test.

Results: Final sample consisted of 973 respondents (female/male ratio: 571/402) aged 12 – 19 years (mean – 15.4 ± 1.7; median – 15). In total, 21% (197/956) of adolescents assessed their SQ as bad, 55% (526/955) reported they have inadequate sleep amount. However significantly more girls assessed their SQ as bad compared to boys (65% (128/571) vs. 35% (69/402) ($p = 0.04$)). In the total patient sample the mean SHI score was 32.9 ± 6.0; range: 14–53. Higher SHI was among adolescents, who assessed their SQ as bad compared to individuals with good SQ (mean values: 36,048 ± 5,603 vs. 32,113 ± 5,832 ($p < 0.001$)), and among adolsecents, who reported inadequate sleep amount compared to adolescents with enough sleep (34,221 ± 6,061 vs. 31,335 ± 5,566 respectively ($p < 0.001$)), moreover girls had higher SHI than boys (33,731 ± 6,171 vs. 31,750 ± 5,662 ($p < 0.001$)). In both sexes SQ decreased with age: in 13-years-olds 45.8%, in 18-years-olds 57% reported inadequate sleep amount ($p = 0.03$) and 14% in 13-years-olds, 21% in 18-years-olds reported sleeping not well ($p = 0.02$). Reasons for bad SQ were mentioned by 26%(259/571) girls, 17% (169/402) boys: significantly more often girls compared to boys mentioned: homework (19%(49/259) vs. 13%(22/402) ($p = 0.002$)); not having a time for sleep (52% (134/259) *vs* 21%(85/402) ($p = 0.001$)), emotional conditions (32% (83/259) *vs* 14%(57/402) ($p = 0.03$)) as causes for inadequate sleep amount.

Conclusions: Self-assessed SQ in Latvian adolescents decreases with age. Females have worse SQ due to load of school homework, emotional conditions and not having enough time for sleeping. Reasons for differnce in SQ between sexes should be studied more detailed taking into accout psychological factors.

Disclosure: Nothing to disclose.

P525 | Infants′ sleep development during the 1 year after birth under nocturnal co-sleep conditions

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Objectives/Introduction: The 10% birth rate of preterm infant in Japan is increasing. This study examined preterm infants′ sleep development under nocturnal co-sleeping conditions. We examine quiet sleep, active sleep, and wakefulness during their first 1 year.

Methods: Subjects were 4 first-born preterm-infant without complications with a gestation period greater than or equal to 32 weeks, and had been admitted to the neonatal intensive care unit. The caregivers gave verbal and signed informed consent before participating in the study. Videosomnographic recordings were made on 2 consecutive nights, and Actigraphic recordings were made using Actiwatch® (Respironics, Inc.) for 5 consecutive days, at home under co-sleep conditions, at 4-weeks, 7-weeks, 12-weeks, and 25 weeks. The sleep parameters were analyzed by video data, and the circadian rhythm of rest-activity for the mothers and the infants was examined by autocorrelograms for 5 continuous days during each week. (Nishihara, et al., 2002).

Results: Quiet sleep increased 7% at 4 weeks and 20–30% in 25 weeks. Active sleep decreased 0–3% in 25 weeks. By 25 weeks the longest sleep period was 400–500 min. Nocturnal waking decreased during the same period. Typical self-soothing behavior was observed. Actiwatch data of each infant during the four observation periods was calculated. The autocorrelation function indicated a 24-hr amplitude peak at 12 and 25 weeks ($p < 0.001$).

Conclusions: We observed the transitioning of preterm infants nocturnal sleep over 25 weeks. Quiet sleep was increasing and active sleep was decreasing, and self-soothing occurred early similarly to term infants. Development of circadian rhythm was delayed compared to term birth infants, however, if calculated from the time of fertilization the timing was similar.

Disclosure: Nothing to disclose.

P526 | The association of sleep disturbances and gastroesophageal reflux in adolescents

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Objectives/Instruction: Many clinical studies have shown a relationship between gastroesophageal reflux disease (GERD) and sleep disturbances in adult patients. Data about this relation in children and adolescents are limited, especially in studies based on the school samples.

Objective: To evaluate the association of sleep disturbances and gastroesophageal reflux in urban Siberian adolescents.

Methods: 465 urban Siberian (Krasnoyarsk) adolescents aged 12–18 were asked for belching and/or heartburn presence in the past month and screened with the Russian version of Gastroesophageal Reflux Disease Questionnaire (GerdQ). The sum of the scores for the six GerdQ questions ranged from 0 to 18 and was defined as the GerdQ score, with a score ≥ eight indicative of high probability for GERD. Additionally, adolescents were tested for sleep quality with Pittsburgh Sleep Quality Index (PSQI), nine questions from section #5. Answers were pointed from "0" ("not during the past month") to "3" ("three or more times a week"). "Sleep disturbance score" was calculated as the sum of points for all nine questions. Data are shown as median (25–75% quartiles). Kruskal-Wallis test was used.

Results: Progressive positive associations were detected between "Sleep disturbance score" and selected adolescents groups with an increase in the level of upper GI motility disturbance: no belching and/or heartburn presence group (n = 330) – 4.87 (4.66–5.09), belching and/or heartburn complaints but no GERD group (n = 110) – 6.24 (5.88–6.59) and GERD high probability group (n = 25) – 7.95 (6.89–9.02), Kruskal-Wallis test $p < 0.001$).

Conclusions: In this school-based sample of urban adolescents we observed a strong association between GERD and sleep disturbances, that may reflect the effect of nighttime symptoms on sleep quality. On the other hand, sleep disorders may be caused by anxiety and depression associated with GERD.

Disclosure: Nothing to disclose.

MEDICAL DISORDERS 2

P527 | A simple measurement of cardiac output using blood circulating time can faithfully reflect changes in cardiac condition in patients with sleep apnea and cardiac diseases

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Objectives/Introduction: Patients with cardiac diseases are highly comorbid with sleep disordered breathing (SDB). We previously reported that the lung-to-finger circulating time (LFCT) calculated automatically from polygraph data of cardiac patients with SDB could indicate cardiac output (CO). In this study, we tried to access the ability of this method to indicate the changes in CO and SDB parameters as well through the treatment.

Methods: We enrolled 84 patients and finally 69 patients completed SDB study before and after treatment (median age 77 years,

36 men). We divided them into heart failure group (HF: n = 43) and non-HF group (NHF: n = 26). SDB indexes were evaluated using a portable polygraph (SAS-2100) and LFCTs were calculated using custom made algorithm.

Results: Overall prevalence of SDB (respiratory disturbance index (RDI) > 15/hr) before treatment was 66.6%. RDI significantly improved through treatment from 25.3 ± 18.2 to 18.7 ± 14.0/hr ($p < 0.01$). Mean SpO_2 and minimum SpO_2 values also improved from 93.8 ± 2.8 to 95.2 ± 2.2% ($p < 0.05$) and 80.5 ± 9.4 to 84.1 ± 8.3% ($p < 0.01$), respectively. In HF group, ejection fractions of left ventricle was significantly lower than non-HF group (51.9 ± 18.7 and 63.5 ± 12.4%, $p < 0.01$) and B-type natriuretic peptide was higher in HF group than non-HF group (558.6 ± 477.2 and 159.4 ± 164.2%, $p < 0.01$). RDI improved significantly only in HF group from 29.0 ± 17.9 to 19.9 ± 14.9/hr ($p < 0.01$) in HF group and 19.2 ± 17.3 to 16.7 ± 12.5/hr (p = 0.2) in non-HF group. CO measured by LFCT were significantly improved only in HF group from 26.5 ± 7.2 to 24.8 ± 6.8 L/min (p = 0.03), whereas no significant change in non-HF group 20.5 ± 6.0 to 22.3 ± 6.2 L/min (p = 0.07).

Conclusions: LFCT measurement using the data of polygraph could simply evaluate the changes in CO along with the changes in usual SDB parameters. This method could be useful tool for screening and management of cardiac patients with SDB.

Disclosure: The resource of the study was funded by Teijin Pharma Ltd.

P528 | Assessment of sleep quality in patients with Idiopathic pulmonary fibrosis

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Objectives/Introduction: Idiopathic Pulmonary Fibrosis (IPF) is a progressive and ultimately lethal pulmonary disease of unknown pathogenesis which can be also associated with sleep disturbances. Aim of the study was to explore possible associations between sleep quality and

- **a)** pulmonary function tests (PFTs),
- **b)** health related quality of life (QoL),
- **c)** physical activity,
- **d)** anxiety,
- **e)** depression,
- **f)** daytime sleepiness in a line of consecutive patients with IPF.

Methods: Included were 39 newly-diagnosed patients, who underwent PFTs and completed the following questionnaires: Pittsburgh Sleep Quality Index (PSQI), Saint George Respiratory Questionnaire (SGRQ), International Physical Activity Questionnaire (IPAQ), Zung Self-Rating Anxiety Scale (SAS), Zung Self-Rating Depression Scale (SDS) and Epworth Sleepiness Scale (ESS).

Results: Mean age of IPF patients was 69.6 ± 6.2 years, the majority (n = 36, 92.3%) were males. Their mean BMI was 28.2 ± 3 kg/m^2 while the total SGRQ score was 41 ± 22.1 (symptoms score and activity score were respectively 41.4 ± 21.7 and 62.6 ± 29.6). Eleven patients (30.6%) had a PSQI ≥ 5, indicative of poor sleep quality. Compared with those with good sleep quality (PSQI < 5) they did not differ in terms of age (69.79 ± 6.9 vs. 69.57 ± 5.1 years, p = 0.921) or BMI (27.82 ± 3.2 vs. 28.36 ± 2.78 kg/m^2, p = 0.613). No difference was found in scores of total SGRQ (47.06 ± 19.95 vs. 48.16 ± 22.92, p = 0.886), IPAQ (404.25 ± 711.63 vs. 497.84 ± 624.19, p = 0.691), SDS (43.57 ± 5.4 vs. 41.78 ± 8.82, p = 0.485) and ESS (5.36 ± 3.73 vs. 6 ± 5.42, p = 0.705). Likewise, PFTs revealed no difference. A significant difference was only observed in SAS score (34.79 ± 4.87 vs. 40.16 ± 7.81, p = 0.021).

Conclusions: Poor sleep quality can be detected in IPF patients, which is not associated with lung function, physical activity or overall health related QoL, a fact that highlights the need of use of specific questionnaires.

Disclosure: Nothing to disclose.

P529 | Nearly 1 in 5 patients with stroke could have undiagnosed OSA that could impact their recovery

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Objectives/Introduction: Obstructive sleep apnoea (OSA) is associated with increased cardiovascular morbidity and mortality. Previous work shows strong association between OSA and stroke. AF is associated with OSA as well as being a causal factor in stroke. OSA could potentially decline the recovery phase in Stroke and cause AF recurrence. Prediction tools assessing OSA risk are not routinely utilised in stroke patients. We reviewed the potential incidence of OSA in stroke patients, investigated the proportion with AF and their length of inpatient stay (LOS).

Methods: 295 consecutive patients presenting to acute stroke services were reviewed. 113 patients excluded due to stroke-mimics or data discrepancies. Study period from November 2015 to January 2017. Pre-stroke symptoms and co-morbidities reviewed and patients were assessed for risk of OSA using STOP BANG score (SBS) questionnaire within 30 days of presentation .In non-communicative patients, questionnaires were given to relatives.

Results: 182 patients' data analysed. 98 females (53.84%) and 84 (46.15%) male patients. Median patient age was 77 years, with range of 28 to 96 years. 13 patients (7.14%) patients died during in-patient stay, with 92.85% (169 patients) surviving to discharge. Of 182

patients, 31 patients (17.03%) had high SBS (≥5). 78 (42.85%) had intermediate SBS (3–4) and 65 (35.71%) had low SBS (0–2). In patients with high SBS, 16.2% (5 patients) had AF; with intermediate SBS, 24% (19 patients) had AF and in patients with low SBS, 21% (14 patients) had AF. Mean LOS in patients with high SBS was 43.3 days. In intermediate SBS, mean LOS was 52.9 days and in low SBS was 30.72 days. Mortality during in-patient stay in high SBS was 1 (7.69%), intermediate SBS was 7 (53.84%) and in low SBS patients was 5 (38.46%)

Conclusions: Stroke patients with intermediate-high SBS (>3) have greater incidence of AF, longer LOS and worse survival compared to low SBS. We recommend early recognition of potential OSA by utilising SBS and performing sleep studies in patients with intermediate-high SBS. Identifying and treating OSA could impact recovery from stroke and hence LOS.

Disclosure: Nothing to disclose.

P530 | Sleep during naturally occurring acute respiratory infections (ARIs)

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Objectives/Introduction: There is strong experimental support for infections to increase the drive for sleep in animals, and it is widely believed that more sleep is part of an adaptive immune response. The objective was to determine how people sleep while suffering from an acute respiratory infection (ARI) in normal daily life.

Methods: We recruited 100 people, of which 30 became acutely sick in a ARI during the study period, and measured their sleep, both objectively (actigraphy) and subjectively (diary ratings), sickness symptoms and body temperature for one week when sick, and again 4 weeks later when healthy.

Results: During the ARI, people spent objectively longer time in bed, but they also had longer wake bouts and less total sleep time ($p < 0.05$). During the week with ARI, people also experienced more difficulties falling asleep, more restless sleep, and more shallow sleep ($p < 0.05$), although they did not report sleep to be less sufficient. Most sleep disturbances occurred at the beginning of the week with ARI, when symptoms were strong, and showed signs of recovery thereafter (as indicated by interactions between condition and day with sickness for 9 out of the 10 outcomes, $p < 0.05$). The degree of symptoms was related to worse sleep quality and more restless sleep ($p < 0.05$), but not to any of the objective sleep outcomes or the other subjective sleep variables. Having a higher body temperature was related to less actual sleep ($p < 0.05$), but not to any of the other outcomes.

Conclusions: This study, carried out in people's own homes, shows that having an acute respiratory infection is related to a longer sleep duration but also more disturbed sleep, both objectively and subjectively, rendering people sleep less and worse than normal. To understand whether the sleep alterations seen during infections are adaptive and whether sleep could be used as a means to facilitate recovery there is a need for future larger studies that classify the exact pathogen type, and also manipulate sleep duration.

Disclosure: Nothing to disclose.

P531 | Obstructive sleep apnea (OSA) and rhinitis: literature review and personal experience

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Objectives/Introduction: Sleep disordered breathing (SDB) have been reported to be associated with rhinitis as a potential etiologic factor. Even if the consequences of nasal obstruction on sleep quality have been well demonstrated, the relationship between the two disorders remains controversial.

Methods: We performed an analysis of medical literature performing a systematic review with the purpose to highlight fundamental aspects of OSA and rhinitis.

Results: The mechanism of OSA is still not well understood. Subjects with chronic nasal obstruction reported significantly higher ESS (Epworth Sleepiness Scale). The high nasal resistance leads to a more negative intraluminal pressure in the lower airways that may promote partial or intermittent collapse of the pharynx, increasing the risk of OSA. The link between OSA and rhinitis has been discussed in the literature.

Conclusions: Multilevel anatomic obstruction is often present in snoring and OSA. As the nose is the first anatomical boundary of the upper airway nasal obstruction may contribute to SDB. The role of nasal obstruction in OSA remains controversial: there isn't a linear correlation between the degree of nasal obstruction and the severity of SDB. Rhinitis is a risk factor for OSA. Decreasing nasal congestion with nasal steroids may improve sleep, daytime fatigue, and the quality of life of patients with rhinitis. Many pathophysiological mechanisms can potentially explain the role of nasal pathology in SDB: the Starling resistor model, the unstable oral airway, the nasal ventilatory reflex and the role of nitric oxide. Physicians should always be aware of the high risk of sleep disorders in patients with rhinitis.

Disclosure: Nothing to disclose.

P532 | Agreement study of general sleep quality within infertile couples

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Objectives/Introduction: Sleep hygiene and sleep related disorders are emerging field in the field of infertility. Limited evidence is available regarding sleep quality and its related problems among infertile couples. This study aimed to assess sleep quality among infertile couples and estimate agreement of sleep quality between couples.

Methods: This was a cross-sectional study. A total of 153 infertile couples (306 participants) referred to Royan Institute for Reproductive Biomedicine were recruited in the study. Participants completed an informed consent form, a demographic characteristics 'questionnaire and Pittsburgh sleep Quality Index (PSQI). PSQI score >5 was defined as bad sleeper.

Results: The Mean age and mean work experience of the participants were 37 ± 9.3 and 10 ± 8.6 years, respectively. Fifty-six (29.2%) of participants were fixed day shift workers, 111 (57.8%) were swing shift workers (7 days/7 nights), 6 (3.1%) were fixed night shift workers and 19 (9.9%) were standby shift workers. Mean PSQI score of all workers was 6.73 ± 3.61. In 69% of subjects, total score of PSQI was ≥5. Night shift workers had greater score of PSQI than other three groups of shift workers.

Conclusions: Current findings indicated significant agreement between sleep quality of infertile couples. Further investigation of common risk factors for poor sleep quality among infertile couples and early therapeutic interventions are recommended.

Disclosure: Nothing to disclose.

P534 | Self-reported insomnia and subclinical carotid atherosclerosis: is there a relation?

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Objectives/Introduction: Based on the recent studies, insomnia is assumed to be an additional cardiovascular (CV) risk factor, however, its association with arterial atherosclerotic damage is unclear. We assessed the relation between self-reported insomnia and asymptomatic atherosclerosis evaluated by carotid intima-media thickness (IMT).

Methods: In this analysis, we included 861 (321 males, 37%; mean age 44.9 ± 11.9 years old) out of 1,600 participants of the St Petersburg population-based sample (within the epidemiological study ESSE-RF) without previously known CV events. All subjects underwent a structured interview (lifestyle, medical history, complaints), blood pressure (BP) and total cholesterol (TChol) level assessment. Insomnia was evaluated based on the answers "≥3 times per week" to at least one of the questions: "How often did you have difficulties in falling asleep for longer than 30 min after going to bed in the last month?", "How often did you have difficulties in falling asleep after midnight awakening in the last month?". We also asked about snoring (yes/no). Subclinical atherosclerosis was assessed by carotid IMT (ultrasound device «My Sono U6», Samsung, Korea) qualified as following: normal ≤0.9 mm, abnormal >0.9 mm. We applied parametric statistics (t-Student, chi-square tests, two-sided criteria), Spearman correlation analysis.

Results: At least one insomnia complaint was reported by 176 subjects (20%), while 65 participants (8%) reported both difficulties in falling asleep and midnight awakenings. IMT thickening was found in 122 subjects (14.2%). IMT values were greater in subjects with insomnia complaints (0.71 ± 0.16 vs. 0.76 ± 0.18 in insomniacs vs. non-insomniacs $p < 0.001$), in particular, in those with frequent nocturnal awakenings ($p = 0.004$) but not in subjects complaining of sleep onset difficulties ($p = 0.06$). Only subjects with nocturnal prolonged awakenings showed higher prevalence of increased IMT (chi-square 5.3, $p = 0.025$) compared to those with difficulties falling asleep ($p = 0.20$). Correlation analysis demonstrated a weak association between mean IMT and insomnia complaints ($\rho = 0.14$, $p < 0.001$), mean IMT and snoring ($\rho = 0.21$, $p < 0.001$). However, they were no longer significant after adjustment for age, BP and TChol.

Conclusions: Our results from the epidemiology cohort confirm an association between insomnia complaints and subclinical carotid atherosclerosis, although it appears to be weak compared to the common CV risk factors.

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P535 | Sleep/wake cycle patterns in adolescence relate to alterations in cardiovascular and metabolic health in early adulthood

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Objectives/Introduction: Sleep/wake cycle patterns (SWP) are relevant to healthy functioning of cardiovascular and metabolic systems. Adolescent lifestyles are characterized by disrupted SWP that interfere with several processes. The objective of this study was to assess whether SWP in adolescence (17-year-olds) might influence cardiovascular and metabolic variables 5 y later (22-year-olds).

Methods: Participants were part of an infancy cohort and follow-up study. Motor activity was recorded for 1 week using actigraphs (Actiwatch-16/64) worn on the nondominant wrist, yielding SWP through an automated method (Actiware®). SWP for the diurnal period included: wake-up time, daytime sleep amount (DSA) and number of naps. SWP for the nocturnal period included: sleep onset time, nighttime waking amount (NWA) and number of episodes (WEN). Nutritional and cardiovascular variables of interest were body mass index, waist circumference, systemic blood pressure (BP), and plasma glucose, cholesterol and triglycerides. We used linear regression and univariate GLM for data analysis. Statistical models included sex as a covariate.

Results: Participants (n = 402) were 50.2% male with mean ages of 17.5 ± 0.3 and 22.5 ± 0.4 years at the two assessments. Results showed that NWA ($F = 1.82$, $p < 0.01$) and nocturnal WEN ($F = 1.47$, $p < 0.04$) at 17 were positively related to BP at 22 years. WEN at 17 years was also positively associated with plasma cholesterol at 22 years ($\beta = 0.099$, $p < 0.05$). DSA at 17 years was related to plasma cholesterol ($F = 1.43$, $p < 0.01$) and triglycerides concentrations ($F = 1.79$, $p < 0.01$) at 22 years.

Conclusions: Fragmented nighttime sleep in adolescence appears to influence cardiovascular and metabolic variables in early adulthood, including higher systemic BP and increased plasma triglycerides and cholesterol concentrations. These results support the hypothesis that SWP in adolescence influence the functioning of cardiovascular and metabolic systems in young adulthood.

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Disclosure: Nothing to disclose.

P536 | Examining the relationship between sleep disturbance and daytime variables in psoriasis using actigraphy and experience sampling methodology

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Objectives/Introduction: Psoriasis, an inflammatory skin condition, is associated with sleep disturbance but few studies have examined sleep and its relationship to daytime variables prospectively. We examined whether

(1) psoriasis symptoms, night-time arousal and low mood predicted subsequent objective and/or subjective sleep; and

(2) whether objective and subjective sleep predicted next-day psoriasis symptoms and day-time functioning.

Methods: Momentary assessments of psoriasis symptoms, mood and daytime functioning were completed at five pseudo-random intervals daily for 15 days using time-stamped digital diary entry. Objective sleep was estimated using actigraphy while subjective reports of sleep and night-time arousal were assessed upon waking each morning. Multi-level models were computed to test relationships.

Results: Nineteen individuals (Female: 11 [59.7%], median age: 39 years) with psoriasis reporting poor sleep quality were recruited for a prospective experience sampling study. Increased night-time arousal was associated with poorer subjective sleep ($p < 0.05$). Neither subjective nor objective sleep parameters were associated with day-time psoriasis symptoms in bi-directional analyses. However, both objective and subjective sleep predicted impairments in next-day fatigue (Objective and subjective total sleep time [TST], subjective sleep quality), sleepiness (Subjective TST, sleep efficiency and sleep quality) and concentration (Sleep quality) ($p < 0.05$).

Conclusions: We showed night-time arousal predicted subjective sleep parameters in people with psoriasis, and that sleep was a predictor of next-day functioning. Current sleep treatments that target cognitive factors and arousal (e.g., cognitive behavioural therapy) should be trialled in psoriasis.

Disclosure: Nothing to disclose.

P537 | Cardiorespiratory effects of indoor air quality during sleep

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Objectives/Introduction: The impact of environmental pollution in health is globally documented, with long and short-term effects related to higher rates in mortality and morbidity, namely cardiovascular and respiratory causes. The present study aims to assess IAQ and evaluate the existence of correlations between cardiorespiratory outcomes during the sleep.

Methods: A total of nine men following specific inclusion criteria (age between 25 and 40 years old, healthy individuals, non-smoking, without children below 5 years and without sleeping problems), whose households are within Grande Lisbon area, were recruited. An untended polyssomnography (PSG) was performed during 2 weeknights in a row. The second night PSG′s results were used in order to minimize the first night effect. IAQ monitoring was based on a comprehensive multi-pollutant assessment where physical (temperature and relative humidity) and chemical (carbon dioxide, carbon monoxide, formaldehyde, volatile organic compounds, particulate matter – PM_{10} and $PM_{2.5}$) were assessed through real time instruments.

Results: The mean age was 31.9 ± 5.80 years. The results related to the heart rate (HR) showed that the standard deviation from the mean value increased in those participants that were exposed to higher levels of PM10 (r_s = 0.583; p = 0.099) and PM2.5 (r_s = 0.600; p = 0.088). During REM sleep, the HR acceleration and deceleration index increased with higher CO concentrations (r = 0.643; p = 0.085 and r = 0.627; p = 0.096). During the NREM sleep, a decrease in the pulse transit time was related to higher concentrations of CO_2 (r_s = –0.650; p = 0.058). The respiratory rate was lower in those subjects that were exposed to higher levels of relative humidity, in both NREM (r_s = –0.678; $p < 0.05$) and REM (r_s = –0.816; $p < 0.05$) sleep. In opposition, during the REM sleep the respiratory rate increased when the temperature was higher (r_s = 0.680; p = 0.093).

Conclusions: In this study, the increase in some parameters of indoor air quality (PM, CO and CO2) and thermal comfort was associated to mild, but rather significant, changes on cardiovascular and respiratory indicators of autonomic response meaning sympathetic activation thus making plausible to hypothesise a conection between disturbed air quality and cardiovascular risk.

Disclosure: Nothing to disclose.

P538 | Increased risk of sleep disorder in burn patients: a nationwide, population-based cohort study

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Objectives/Introduction: Burn is a major event which can cause physical and psychological impairments for those affected. Previous studies indicated that sleep disturbance was a major problem after burn. However, the literature was limited. There were no study identified the risk and types of sleep disorder in burn patients. The goal of this study was using a population-based case-control study to assess the risk of sleep disorder among burn patients.

Methods: We used data from Taiwan's National Health Insurance Research Dataset to investigate the risk of having sleep disorder in burn patient from 2000-2013 which is a valid representative sample of the total population in Taiwan. The case group was diagnosed as burn (ICD-9 CM: N-code 940-949 and E-code 890-899) prior to the index date. The control group was diagnosed without burn in study period, and then we took 4 times matched by index year, gender and age. The tracking continued until December 31, 2013. The event of tracking definite is the occurrence of sleep disorder (ICD-9-CM 307.4, 780.5×). Cox proportional hazard regression analysis was used to evaluate the effects of burn injury on the risk of sleep disorder.

Results: There were 10,653 individuals diagnosed as burn. The results showed burn injury significantly increased the risk of total sleep disorder (adjusted HR = 1.36; 95% CI, 1.048–2.864, p = 0.044), insomnia (adjusted HR = 1.41; 95% CI, 1.083–2.960, p = 0.036), sleep disturbance (adjusted HR = 2.40; 95% CI, 1.840–5.029, p = 0.005) and sleep apnea (adjusted HR = 1.38; 95% CI, 1.063–2.906, p = 0.029). In the subgroups stratified analysis, comparing to without burn patients, the risk of sleep disorder was increased in burn patients aged 13–18 (5.45-fold, 95% CI, 4.109–11.450, $p < 0.001$) and with monthly income less than18,000 NTD(2.13-fold, 95% CI, 1.641–4.484, p = 0.001). Cox regression analysis showed that the risk of sleep disorder was increased to 3.211-fold (95% CI, 1.390–7.419, p = 0.006) in burn patients with mental disorders.

Conclusions: Among burn population, cases with mental disorders carried a higher risk of developing sleep disorder.

Disclosure: Nothing to disclose.

P539 | Self-reported and actigraphic sleep quality in female patients with fibromyalgia and healthy controls

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Objectives/Introduction: Sleep disturbances are a relevant and frequent feature (74–90%) in Fibromyalgia (FM) (Bigatti et al., 2008; Choy, 2015). Sleep quality in FM patients is commonly assessed through self-reports (SR), however studies with actigraphy (AG) gave unclear results (Diaz-Piedra et al. 2015) and found that the agreements between AG and SR sleep latencies and Total Sleep Time (TST) were poor, with high discrepancies associated to high FM impact scores (Segura-Jiménez et al., 2015). We compared the SR and AG sleep quality measures of FM patients with those of age-matched healthy controls (HC); and examined the concordance between subjective and objective (AG) measures of sleep in both groups.

Methods: Patients were recruited at the FM unit of the university hospital. After a medical visit, physicians invited female outpatients who fulfilled both ACR/EULAR 1990 and 2010 diagnostic criteria to participate in the study. HC were enrolled in the Sapienza university community. All participants wore a wrist actigraph (AMI Motionlogger Watch) and completed a sleep diary for seven consecutive days. When returning the actigraph, they completed questionnaires measuring sleep quality (Sleep Disorder Questionnaire), fatigue severity (Checklist Individual Strength), and fibromyalgia impact (FIQ).

Results: 30 FM patients and 23 HC were included for data analysis. The sleep questionnaire showed poorer sleep quality in several variables considered in FM patients compared to HC (all $p < 0.001$). FM patients and HC did not differ in any of the actigraphy measures of sleep efficiency or continuity (e.g. Sleep Efficiency $p = 0.40$, WASO $p = 0.45$, Sleep Fragmentation Index $p = 0.75$). The inter-method agreement for TST and Sleep Efficiency was low in FM patients, while it was good for TST among HC. Hierarchical regressions considering fatigue severity and sleep measures showed that fatigue gave a unique significant contribution to the FM impact.

Conclusions: Although FM patients and HC have similar objective AG sleep patterns, the subjective experience of sleep quantity and quality is poorer among FM patients, suggesting that they might underestimate TST. These findings support the view that fatigue is a crucial feature and the importance of assessing both objective and subjective measures of sleep quality in FM patients.

Disclosure: None to declare.

P540 | Independent association between severe obstructive sleep apnea and liver stiffness

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Objectives/Introduction: The goal of this study was to assess the relationship between the severity of obstructive sleep apnoea (OSA) and liver stiffness measurement (LSM) by transient elastography, an accurate method for evaluation of NAFLD severity in patients investigated for suspected OSA.

Methods: One hundred forty-seven patients assessed by overnight polysomnography for clinical suspicion of OSA were included in the study. LSM was performed using FibroScan®. Significant liver disease and advanced liver fibrosis were defined as LSM≥7.3 kPa and LSM ≥ 9.6 kPa, respectively.

Results: Twenty-three of the 147 patients included were secondarily excluded because of unreliable LSM. OSA was confirmed in all patients, including 34 (27.4%) patients with mild OSA, 38 (30.6%) with moderate OSA and 52 (42.0%) with severe OSA. LSM values ranged between 7.3 and <9.6 kPa in 18 (14.5%) patients and ≥9.6 kPa in 15 (12.1%) patients. A dose-response relationship was observed between OSA severity and LSM values ($p = 0.004$). After adjustment for age, gender, MS and insulin resistance, severe OSA was associated with an increased risk of LSM ≥ 7.3 kPa (odds ratios [95% confidence interval]): 7.17 [2.51–20.50]) and LSM ≥ 9.6 kPa (4.73 [1.25–17.88]).

Conclusions: Severe OSA is independently associated with increased liver stiffness, which may predispose OSA patients to a higher risk of significant liver disease.

Disclosure: Nothing to disclose.

P541 | The impact of obesity on morning headaches in OSAS patients

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Objectives/Introduction: According to international data, 45% of patients with Obstructive sleep apnea syndrome (OSAS) present obesity and 20% present morning headache (MH). Also, it is known that the prevalence of headaches episodes is higher in overweight patients then in those with normal weight. The goal of our study is to evaluate the relationship between weight and MH in OSAS patients.

Methods: The study sample included 18 patients (12 women, mean age – 60.84 ± 7.5 years) diagnosed with OSAS (mean AHI – 37.36 ± 33.09) through ambulatory cardiorespiratory monitoring during sleep. MH was established according to ICHD-3 beta criteria. For all patients was calculated BMI (=weight [kg]/height[m]^2).

Results: MH was present in 12 of OSAS patients (66.7%) (8 women, mean age – 60.62 ± 6.5 years; mean AHI – 28.3 ± 33.38) and 6 patients (33.3%) were without MH (4 women, mean age – 61.25 ± 10.34 years; mean AHI – 31.1 ± 14.6). The OSAS patients with MH presented an higher BMI (mean BIM = 33.58 ± 9.78) then patients without MH (mean BMI = 30.86 ± 5.47). 50% (BMI > 30) of OSAS patients with MH, were obese, while only 33.3% of OSAS patients without MH.

Conclusions: MH occurs more frequently in OSAS patients with higher BMI. We can suppose that a higher BMI represents a risk factor for MH in OSAS patients.

Disclosure: Nothing to disclose.

P542 | The antihypertensive effect of continuous positive airway pressure therapy for patients with obstructive sleep apnea and resistant hypertension: telephone survey

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Objectives/Introduction: Obstructive sleep apnea (OSA) is associated with drug- resistant hypertension (RH). Our aim was to see weather continuous positive airway pressure (CPAP) therapy effected RH treatment.

Methods: This study was comprised of a retrospective chart review and a telephone survey. This was a pilot study. Medical records were reviewed of all patients, who underwent diagnostic polisomnografy for OSA at Pulmonology department of Lithuanian University of Health Sciences Hospital in 2015. Study subjects were patients with RH and moderate or severe OSA (apnea- hypopnea index (AHI) > 15 per hr).

Results: A total of 28 patients met the criteria and agreed to complete brief telephone survey regarding RH treatment. All patients with moderate/severe OSA and RH were using CPAP therapy more than 5 hr during night for about 1 year. The antihypertensive drug regimen was unaltered in 9 patients (32.1%), modified in 19 patients (67.9%) by either dose reduction (n = 8) or by discontinuing 1 antihypertensive drug (n = 11). The survey showed that patients whose antihypertensive treatment was modified by discontinuing 1 drug, had higher AHI compared with patients whose treatment was unchanged or was reduced the drug dose (p = 0.013).

Conclusions: According to this telephone survey CPAP therapy was associated with better blood pressure control for the patients with moderate/severe OMA and RH that let to reduce the number or the dose of antihypertensive drugs.

Disclosure: The authors declared no conflict of interest.

PSYCHIATRIC & BEHAVIORAL DISORDERS 3

P543 | The influence of anticipatory stress on sleep - preliminary results from an experience sampling method study

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Objectives/Introduction: In research about non-normative sleep behaviour, the various effects of sleep deprivation and sleep disturbances on affect have been focused on. However, comparatively little research on how stress immediately influences sleep quality has been conducted. In this study, the direct influence of evening anticipatory stress for the next day on the subjective appraisal of sleep quality the next morning was examined using data from Experience Sampling Method (ESM). To further differentiate the results, the moderating effect of state emotion regulation on the effect of proximate stressors on sleep quality is analysed.

Methods: In a quasi-experimental longitudinal design, clinical and healthy control participants completed questionnaires 6 times a day over 1 week, using the Experience Sampling Method (ESM) paradigm. In addition, they filled out a questionnaire battery at baseline, including the Insomnia Severity Index and questionnaires regarding emotion regulation. The hypotheses were tested on a day-to-day level, using evening and morning ESM data, as well as baseline data.

Results: 284 participants with Major Depressive Disorder (n = 118), Social Anxiety Disorder (n = 47), and healthy controls (n = 119) were included in the study. The mean age was 31.75 years (SD = 11.52) and 189 (66.55%) were female. 93.16% of the prompts in the morning or evening have been completed (n = 3,704 prompts). Anticipatory stress correlated negatively with subjective sleep quality (r = −0.228, $p < 0.001$). Groups differed both in sleep quality ratings ($F(1,1823) = 152.2$, $p < 0.001$) and anticipatory stress appraisals ($F(1,1807) = 59.03$, $p < 0.001$). A time-dependent multi-level model using appraisal of sleep, emotion regulation, anticipatory stress, and the baseline scores of insomnia and emotion regulation will be analysed. Differences in emotion regulation as a moderator of anticipated stress and its impact on sleep quality will be examined.

Conclusions: This study shows how anticipatory stress can have an immediate effect on subsequent sleep and how the ability to regulate emotions can moderate this effect. The findings implicate a susceptible process in nocturne events and can be utilized for the development of improved treatment for populations suffering from insomnia or sleep disturbances. As the study shows results from both psychiatric patients and healthy controls, generalizability vs. specificity will be directly tested.

Disclosure: Nothing to disclose.

P544 | Misperception of sleep patterns and memory experience gap among patients with major depressive disorders, and social anxiety, and healthy controls

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Objectives/Introduction: While it is a very common finding that patients with clinical symptoms of insomnia present with normal objective measures of sleep continuity, the psychological factors contributing to this misperception of sleep are rather unclear. Here we compared subjective, objective and retrospective sleep quality ratings among patients with major depressive disorders (MDD), social anxiety (SAD) and healthy controls (HC). We hypothesized that, compared to controls, patients will show (1) stronger misperception of sleep (difference between objective sleep continuity measures and subjective sleep evaluation immediately after sleep) and (2) a larger memory experience gap (MeG, i.e. disagreement between the insomnia rating of the previous week, compared to the promptly subjective and objective assessments).

Methods: Age and gender matched groups of 56 patients with MDD, 14 patients with SAD and 58 HC took part in the present study. Sleep was assessed by actimetry over seven consecutive nights. Subjective sleep was assessed (1) each morning immediately after awakening with the question "How do you rate your sleep quality" on a metric scale from 0 (best sleep quality) to 100 (worst sleep quality), and (2) retrospectively, after the week of actimetry, with the Insomnia Severity Index (ISI; with higher scores indicating worse sleep quality) referring to overall sleep quality of the past seven nights.

Results: Neither retrospective sleep assessment nor immediate sleep morning assessment correlated with objective sleep measurements in any of the three groups (p's > 0.15), except for a positive correlation with SOL in SAD subjects (r = 0.59, $p < 0.05$). By trend of significance ($p < 0.10$), retrospective ISI ratings of MDD subjects were worse and ISI ratings of SAD patients better than immediate sleep morning ratings, while there was no MeG in healthy controls.

Conclusions: The results of our study confirm previous observations of misperception of sleep, even when sleep evaluation was performed immediately in the morning. In addition, in patients with depression or anxiety, retrospective sleep assessments by questionnaires may be confounded by a MeG.

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P545 | Poor sleep quality and depressive symptoms in young adults

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Objectives/Introduction: The association between poor sleep and affective disorders is well established, but it remains unknown which specific sleep dimensions are associated with depressive symptoms. We characterized sleep quality and estimated the association between dimensions of poor sleep quality and depressive symptoms in a sample of 21-year-old young adults.

Methods: A cross-sectional study was conducted comprising 1459 21-year old participants (52% women) from the EPITeen Cohort, Porto, Portugal. The Pittsburgh Sleep Quality Index was used to assess sleep quality. Besides an overall score (>5: poor quality; ≤5: good quality), this scale measures sleep quality along 7 dimensions: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction (higher scores, worse sleep quality). The Portuguese version of the Beck Depression Inventory-II was applied to assess the severity of depressive symptoms (scores>13 meaning presence of

depressive symptoms). Odds ratios (OR) and 95% confidence intervals (95% CI) between sleep quality (global and for each dimension) and depressive symptoms were computed using logistic regression models, adjusting for sex, education, body mass index and smoking status.

Results: At 21 years of age, 30.0% of young adults presented poor sleep quality, being higher among women (33.2 vs. 26.6%, $p = 0.006$). Moreover, 15.6% presented depressive symptoms, being higher among women (20.1% vs. 10.8%, $p < 0.001$). Poor sleep quality was associated with a higher prevalence of depressive symptoms (adjusted OR = 4.66, 95% CI: 3.43–6.33). Considering each sleep dimension separately, stronger associations were observed for sleep disturbance (adjusted OR = 9.08, 95% CI: 3.70–22.27), daytime dysfunction (adjusted OR = 8.04, 95% CI: 5.28–12.23) and subjective sleep quality (adjusted OR = 8.84, 95% CI: 4.80–16.24).

Conclusions: Overall, poor sleep quality is associated with increased frequency of depressive symptoms among young adults, but special attention should be paid to the presence of sleep disturbance, daytime dysfunction and subject's opinion regarding their sleep quality. Future longitudinal studies should better clarify this association, in order to assess the relevance of considering different dimensions of sleep quality when delineating strategies to prevent depression in this specific population.

Disclosure: Nothing to disclose.

P546 | Sleep-related heart rate changes in people with depression: potential for a novel multi-systemic biomarker

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Objectives/Introduction: Depression is associated with decreased heart rate variability (HRV) during sleep, which reflects abnormal autonomic regulation of the sinoatrial node, but this has not been assessed across the entire sleep period. While studies investigating depression biomarkers in sleep physiology have focused on electroencephalographic features, heart rate abnormalities may provide new information about the sleep signature of depression. The current study investigated changes in heart rate across sleep in people with depression, and assessed the validity of a classification algorithm using sleep-derived heart rate patterns to identify depression status.

Methods: A retrospective database containing sleep electroencephalograms and electrocardiograms was used to derive heart rate and HRV in the very low frequency (VLF), low frequency (LF), and high frequency (HF) ranges. These parameters were compared across sleep stages in 279 individuals with depression (69% female, 46 ± 17 years old) and 374 healthy controls (55% female, 40 ± 19 years old). This dataset was integrated in a larger sample of 1193 recordings to train a heart rate profiling algorithm developed by a biomedical company to discriminate between individuals with depression and healthy controls. This algorithm was then tested in a distinct sample of 174 individuals: 87 with depression (59% female, 44 ± 11 years) and 87 healthy controls (55% female, 43 ± 11 years).

Results: The depression group had significantly higher heart rate and lower VLF, LF, HF HRV than the controls ($n = 543$, all $p < 0.050$). A significant interaction between depression status and sleep stages [$n = 543$, $F(3, 1617) = 6.0$, $p < 0.001$] indicated that, for VLF, this group difference was at least 2.8 times more pronounced during stage 1 sleep than in other sleep stages. The algorithm had an overall classification accuracy of 79.0% [$n = 174$, sensitivity: 82.8%, 95% CI(0.73–0.89), specificity: 77.0%, 95% CI (0.67–0.85)].

Conclusions: These findings confirm that depression is characterized by elevated heart rate and low HRV during sleep, a phenomenon suggestive of autonomic deregulation. For VLF, this was especially marked during "light" sleep. The accuracy by which the algorithm was able to detect depression suggests it may be a promising biomarker of depression and highlights the extent to which autonomic dysfunctions may relate to sleep abnormalities in people with depression.

Disclosure: This study is part of a wider investigator-led project based on a retrospective polysomnographic database at the Royal Ottawa Mental Health Centre (ROMHC). Medibio Limited, a medical technology company, has led the heart rate algorithm development and provided partial funding for the salaries of research assistants working on collating diagnostic information from ROMHC medical records. The senior author did not receive a salary from Medibio.

P547 | Sleep architecture in adolescents hospitalized during a suicidal crisis

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Objectives/Introduction: Adolescence is a sensitive period for the emergence of both sleep and mood problems, two major risk factors for suicidality. While the effects of depression on sleep are less consistent in adolescents than in adults, some studies suggested

that young people with depression have poor sleep consolidation, shortened REM latency, and abnormal amounts of N3 sleep. Yet, very little is known about sleep in depressed adolescents undergoing acute suicidal crisis.

Methods: This study included 17 adolescents (15.0 ± 1.2 years old, 82% females) with major depression admitted to a pedopsychiatric unit for acute risk of suicide who endorsed significant suicidal ideation and behaviors (Suicide Behaviors Questionnaire-Revised ≥7). Sixteen of them were taking antidepressants. None was taking benzodiazepines, sedatives or hypnotics. An sample of 18 non-depressed adolescents was retrospectively collated from another database (15.0 ± 1.1 years old, 83% females). Across both groups, none of the participants had a history of sleep disorder or significant medical condition. All participants underwent a polysomnography adaptation night before the polysomnography recording used for analyses.

Results: On average, compared to the control group, suicidal adolescents took 46 min longer to fall asleep (n = 35, Z = −4.5, $p < 0.001$) and 70 min longer to reach REM sleep (n = 35, Z = −3.2, p = 0.001). Suicidal adolescents also had a slightly but significantly higher percentage of N1 sleep than the control group (3.5% versus 2.0%; n = 35, t(33) = −2.6, p = 0.020). A significant interaction indicated that group differences in N3 changed across the progression of the sleep episode (n = 35, F(2,66) = 3.4, p = 0.041): in the first two thirds of the night, the two groups had similar N3 percentage ($p \geq 0.411$), but in the last third of the night, the suicidal group had significantly lower N3 percentage than the control group (p = 0.008).

Conclusions: Significant sleep abnormalities were observed during a suicidal crisis in a sample of mostly medicated depressed adolescents. This included sleep and REM sleep initiation difficulties and shallower sleep especially at the end of the night. Future studies should decipher the relative effects of depression, suicidality and medication on sleep. These findings stress the need to address sleep disturbances in the management of suicidality in adolescents.

Disclosure: Nothing to disclose.

P548 | Effect of continuous positive airway pressure on neuropsychiatric characteristics of adherent and non-adherent OSA patients

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Objectives/Introduction: Cognitive dysfunction and higher degree of anxiety and depressive symptoms are the main neuropsychiatric OSA consequences. The aim of this study was to characterize the neuropsychiatric clinical picture of OSA patients and to determine the CPAP effect on adherent and non-adherent patient to neuropsychiatric functioning after 3 months of CPAP usage.

Methods: 126 OSA patients were involved into the study, 43 of them were indicated to CPAP treatment and were retested by neuropsychological test battery. The following tests were performed: Montreal Cognitive Assessment (MoCA) for the evaluation of cognitive impairment, Beck Depression Inventory (BDI-II) and the State-Trait Anxiety Inventory (STAI) together with the Epworth Sleepiness Scale (ESS) for the evaluation of neuropsychiatric symptoms and a person's general level of daytime sleepiness.

Results: OSA patients with the CPAP showed significantly less daytime sleepiness, anxiety and depressive symptoms (all $p < 0.001$) and no cognitive dysfunction (p = 0.213) after 3 months of CPAP usage than before the treatment start. The study found significant difference between adherent and non-adherent retested OSA patients in CPAP effect regarding the psychomotor speed (p = 0.012).

Conclusions: 3-months CPAP treatment have significant effect on affectivity and on excessive daytime sleepiness in OSA patients. Adherent patients had faster psychomotor speed in MoCA test than less adherent patients.

Disclosure: Nothing to disclose.

P549 | Investigation of sleep structure with polysomnograhy in the patients with first episode psychosis

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Objectives/Introduction: Sleep researches allow the structure of sleep to be analyzed at macro and micro levels of sleep changes. These researches reveal a different perspective on the understanding of the pathophysiology of schizophrenia. Sleep disturbance in schizophrenic individuals is common among healthy individuals. These disturbances usually occur before the symptoms of the disease and are considered as an important risk factor. In this study, sleep architecture of drug-naive non-affective first episode psychosis patients and healthy controls was investigated, and the relationship between the sleep structure and clinical features of the patients during the active psychotic period and after the active psychotic period was investigated.

Methods: Twenty-one non-affective drug-naive first-episode psychotic patients and 11 of these patients that had been followed for at least 6 months (with one psychotic episode) and 18 healthy volunteers matched for age and education. Two consecutive night polysomnography (PSG) studies were conducted in all sample. Positive and Negative Syndrome Scale (PANSS) was administered during the onset of the psychotic episode and ongoing. Sleep consistency and sleep structure variables were compared between patients and healthy groups. Correlation analyzes were performed between patients′ sleep continuity and changes in sleep structure and their clinical characteristics.

Results: Compared to healthy controls, there was an increase in sleep latency and a decrease in sleep efficacy in patients with non-affective first-episode psychosis. Patients showed a significant decrease in slow wave sleep ($p < 0.001$). In the 6th month follow-up of the patients after active psychotic episodes, the variables related to sleep continuity and sleep structure were not different from healthy controls. There was a positive correlation between PANSS positive subscale scores and sleep latency in first-episode psychosis patients, and a negative correlation between PANSS negative subscale scores and slow-wave sleep.

Conclusions: The findings indicate that the decrease in slow-wave sleep in patients with non-affective drug-naive first-episode psychotic patients is significant. The fact that reduced slow wave sleep is associated with negative symptoms in first-episode psychosis patients and that sleep structure returns to normal after a psychotic episode suggests that it may be related to underlying physiopathology of the disease.

Disclosure: Nothing to disclose.

P550 | Traumatic experiences influence later sleep and stress perception in vulnerable individuals

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Objectives/Introduction: Sleep problems are not only key symptoms of many mental and physical health conditions, but can also influence the development of psychopathology, such as depression and posttraumatic stress disorder (PTSD). Here we investigate sleep as an outcome as well as a potential mechanism influencing the relationship between exposure to traumatic experiences during child- and adulthood and later perceived anxiety, stress and intrusion development.

Methods: We examined a sample of 50 medical students prior to and during their first internship representing a well described real-world stressor. Data on sleep and heartrate were continuously collected over a time frame of 12 weeks non-invasively by a wrist-worn activity monitor. Prior to starting the internship, i.e., at baseline participants reported early critical life events and traumatic experiences. At mid- internship, and after the internship, participants filled in a questionnaire battery on stress, sleep and intrusive memories about stressful incidents during the internship.

Results: Half of the examined population has been exposed to trauma during child- and adulthood. An independent T-Test showed a significant better subjective sleep quality for individuals who have not been exposed to trauma before the start of the internship ($T(48) = 2.25$, $p = 0.029$). Linear regression analyses revealed that perceived stress after 3 months in the hospital predicted wake after sleep onset time ($F(1,23) = 6.89$, $p = 0.015$, $R^2 = 0.48$) in both groups.

Conclusions: Trauma during child- and adulthood may affect sleep quality years later and may also change stress perception and intrusive memory formation during a prolonged phase of acute stress exposure.

Disclosure: Nothing to disclose.

P551 | Sleep spindles and depressive symptoms in post-traumatic stress disorder

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Objectives/Introduction: Post-Traumatic Stress Disorder (PTSD) is characterized by recurring intrusive memories of past traumas. Sleep disturbances are also very common. In healthy people, increased intrusive memories after seeing traumatic stimuli have been associated with lower sleep spindle density. However, surprisingly little is known about spindles in people with PTSD. Depression, which commonly co-occurs with PTSD, has been linked to reduced spindles. This study evaluated spindles occurrence and morphometry in people with PTSD and their possible association with depressive symptoms. We hypothesized that spindles density would be low in individuals with PTSD and that this would be worse in those with more severe depressive symptoms.

Methods: Polysomnographic data was retrospectively collated for 60 individuals referred to a sleep clinic: 32 people diagnosed with PTSD (47.1 ± 9.9 years old, 13% females) and 28 people without any documented history of mental disorders (46.4 ± 9.6 years old, 14% females). Twenty-seven participants from the PTSD group were taking psychotropic medication. Depressive symptoms were assessed using the Beck Depression Inventory (BDI-II). Fast (13.5–16 Hz) and slow (11–13.5 Hz) spindle detection was conducted on C3 during NREM2 and NREM3 sleep.

Results: Spindle density did not significantly differ between the two groups. Compared to the control group, people with PTSD had significantly lower slow spindle amplitudes during NREM2 ($n = 60$, $Z = -2.2$, $p = 0.026$), with a similar trend for fast spindles ($n = 60$, $Z = -1.8$, $p = 0.071$). NREM3 fast spindles had a significantly faster frequency in the PTSD group than in the control group ($n = 53$, $Z = -2.3$, $p = 0.019$). Within the PTSD group, depressive symptoms were negatively correlated with the frequency of slow spindles during NREM3 ($n = 27$, $r = -0.44$, $p = 0.021$).

Conclusions: Significant morphometric abnormalities were observed in people with PTSD and sleep complaints. This seems to

be influenced by the severity of comorbid depressive symptoms. Given the importance of spindles for sleep maintenance, these abnormalities could possibly play a role in poor sleep quality, increased awakenings and atypical sleep architecture in PTSD. Further work is required to assess the potential effects of psychotropic medication on sleep spindles to better decipher the effects of PTSD pathophysiology and related pharmacological manipulations on spindle generation.

Disclosure: Nothing to disclose.

P552 | Social rhythms and the sleep-wake cycle in young people with depression

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Objectives/Introduction: Depression in youth is often accompanied by sleep and circadian rhythms disruptions, which are partly regulated by our daily behaviors and social rhythms. It has previously been proposed that irregular social rhythms could generate or worsen a depressive episode. Accordingly, some previous studies showed unstable social rhythms in people with bipolar disorder or unipolar depression, but this was mostly studied in middle aged and older adults. The purpose of this study was to characterize social rhythms in adolescents and young adults with depression and to determine how social rhythms relate to age, sleep and depressive symptoms.

Methods: The Social Rhythm Metric (SRM-5), a validated diary documenting the timing of daily behaviors and social activities, was completed during 14 days by 51 participants with unipolar depression (22.1 ± 0.8 years old; 27.5% males) and 50 healthy controls (24.5 ± 0.4 years old; 41.2% males). In the depression group, the sleep-wake cycle was monitored with actigraphy during the period when the SRM-5 was completed, and the severity of depressive symptoms was assessed using the Hamilton Depression Rating Scale.

Results: After controlling for age, sex, and occupational status, participants with depression had significantly less regular social rhythms than controls (n = 101, $F(1)$ = 8.8, p = 0.004). Within the depression group, younger age correlated with more unstable social rhythms (n = 51, r = 0.31, p = 0.026). Also, irregular social rhythms correlated with later sleep onset times (n = 50, r = −0.33, p = 0.021), as well as with a greater variability in the timing of sleep onset (r = −0.40 p = 0.004), sleep offset (n = 50, r = −0.45 p = 0.001), and total time spent in bed (n = 50, r = −0.28, p = 0.047). In contrast, social rhythms were not significantly correlated with the severity of depressive symptoms.

Conclusions: These results suggest that youth with depression have irregular social rhythms, and that this may be independent from the degree of depressive symptoms severity. Irregular social rhythms were found to be most pronounced in those with younger age, as well as in those with more delayed and unstable sleep schedules. Considering the promising outcomes of psychotherapies directly targeting social rhythms in adolescents with bipolar disorders, further work should determine whether this may also be a useful clinical tool for young people with unipolar depression.

Disclosure: Nothing to disclose.

P553 | Temperament, character and personality in patients with panic disorder and sleep disorder: personality and sleep

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Objectives/Introduction: This study is aimed at assessing temperament, character and personality features in patients with Panic Disorder and Sleep Disorder (group PS) compared with those without sleep disorder (group P).

Methods: Personality measurements were taken using the Structured Interview for DSM-IV Personality Disorders (SIDP-IV) and the Temperament and Character Inventory (TCI). Fourty-seven patients (male = 29, female = 18) with a DSM-IV diagnosis of PS with (n° 39, 83%) or without (n° 8, 17%) sleep disorder were enrolled in the study. Axis I diagnoses were made using the SCID-IV. A sample of 45 age-matched (mean age = PS: 34.8 ± 9.1, P: 32.6 ± 8.8, n.s.).

Results: Patients (PS) showed a greater prevalence of Personality Disorders (PD) than group P (PS: 38.6% vs. P: 5.4%; $p < 0.001$), particularly Cluster B (PS: 19.0% vs. P: 2.1%; $p < 0.005$) and Cluster C PD (PS: 22.4% vs. P: 4.3%; $p < 0.005$). Regarding TCI dimensions, patients showed higher *Harm Avoidance* (PS 21.6 ± 6.8 vs. P 17.7 ± 6.6; $p \leq 0.001$), and lower scores in the trhee character dimensions: *Self Directedness* (PS 25.5 ± 7.1 vs. P 30.3 ± 6.1; $p \leq 0.001$), *Cooperativeness* (PS 27.3 ± 5.6 vs. P 31.3 ± 5.1; $p \leq 0.001$), *Self Trascendence* (PS 12.4 ± 5.9 vs. P 20.7 ± 4.7; $p \leq 0.001$).

Conclusions: The study confirms that patients with Panic Disorder associated sleep disorder have a greater prevalence of DSM-IV Axis-II PD, particularly those of the Cluster B and C, that probably arose from abnormalities in both temperament (HA) and character (SD, C, ST) dimensions in panic disorder with sleep disorder.

Disclosure: Nothing to disclose.

P554 | Quality of sleep, anxiety and depression among medical students during exams period: a cross sectional study

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Objectives/Introduction: The impairment of sleep quality is a frequent problem among students. This is particularly true for medical students, especially during exams. The objectives of our work were to assess the quality of sleep of medical students during exams period and to study the impact of anxiety and depression levels on sleep.

Methods: We carried out a cross-sectional study among 184 students of Sfax Medical School in Tunisia during the period of final exams of the academic year 2015/2016. Each participant filled in the following questionnaires: Pittsburg Sleep Quality Index (PSQI) and Hospital Anxiety and Depression Scale (HAD).

Results: The average age of students was 21.4 years. Among the participants, 71.7% (N = 123) were women. Fifty nine students had a common housing among whom 37 shared their bedrooms with others. Coffee and hypnotic drugs were consumed by 152 (82.6%) and 40 (21.7%) students respectively. The mean PSQI score was 8.2. Among the participants, 80.4% (N = 148) had a poor quality of sleep. As for anxiety and depression, the mean scores were 10.1 and 8.5 respectively. Anxiety and depression levels were abnormal in 47.8% (N = 88) and 31.5% (N = 58) of the cases respectively. The PSQI score was significantly higher for women than for men (p = 0.02) and for those who shared their bedrooms (p = 0.03). Students who consumed coffee and hypnotic drugs had a significantly poorer quality of sleep (p = 0.02 in both cases). Women had a significantly higher level of anxiety (p = 0.01). The PSQI score was correlated to anxiety and depression scores (r = 0.4 and $p < 0.01$ in both cases).

Conclusions: Our study showed that medical students struggle with sleep problems and emotional distress during exams period. A specific training on stress management, such as mindfulness based stress reduction, could be added to the academic program. It is likely to improve the quality of sleep and relieve the emotional distress of these students.

Disclosure: Nothing to disclose.

P555 | The influence of depressive symptoms and physical illness on sleep disturbance in elderly people

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Objectives/Introduction: This study was conducted to collect basic data for the elderly mental health by identifying the influence of depressive symptoms and physical illness on sleep disturbance.

Methods: Among 1,535 Medicaid people at least 60 years of age residing in Chungju, 1,262 people were examined. We investigated the general characteristics of the patients and the history of physical illness. Also we did screening test for depression and sleep quality. Data analysis was done by t-test, Pearson's correlation, step by step regression analysis with SPSS/PC WIN 19 version.

Results: Among the 1,262 survey personnel, 520 (41%) people had depressive symptoms and 718 (57%) people had sleep disturbance. Also, 140 (11%) people had been diagnosed as stroke, 712 (56%) people had hypertension, and 279 (22%) people had diabetes mellitus. There was no significant difference in physical illness, age, height, weight between the sleep disorder group and the normal group, but in the sleep disorder group, the depression symptom was significantly larger ($p < 0.001$) and also in female group than male group respectively (p = 0.006). It was found that there was a static correlation between depression symptoms and the quality of sleep (correlation coefficient of Pearson 0.360). Among stroke, hypertension, diabetes and other physical disorders, stroke and diabetes did not significantly correlate with sleep quality. However, hypertension was found that it had static relationship with sleep quality (Pearson's correlation coefficient 0.057). As a result of carrying out the stepwise regression analysis to investigate the description amount of the change, statistically significant results were not found for other causes such as stroke and diabetes. Depression symptoms and high blood pressure showed the greatest explanation (13.2%).

Conclusions: The study showed that depressive symptoms are significant associated with sleep quality in elderly over 60 years old. So we suggest that elderly people with sleep disturbance need care for depression and hypertension.

Disclosure: Nothing to disclose.

P556 | The relationship between obstructive sleep apnea and depression

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Objectives/Introduction: Obstructive sleep apnea (OSA) patients may exhibit symptoms that overlap with depression, such as sleep problems, fatigue, difficulty concentrating, and irritability.

Methods: Eighty-eight patients who suffered from OSA were divided into mild, moderate, and severe according to the Apnea-Hypopnea Index (AHI) and lowest oxygen saturation at night. The Zung Self-rating Depression Scale (SDS) was used to assess depressive symptoms and severity in all subjects. The standard score was determined by multiplying the SDS score by 1.25. A standard score ≥50 indicated depression compared the morbidity of depression across the three OSA subgroups and investigated the relationship between OSA and depression.

Results: The prevalence of depression was significantly increased in the OSA group (47.7%). The incidence of depression in the mild, moderate, and severe OSA groups was 11.9%, 38.1%, and 50.0%, respectively ($p < 0.05$). In the 42 patients who presented with comorbid OSA and depression, increased SDS scores were associated with an increased body mass index (BMI), AHI, and SaO2 min at night. The prevalence of depression increased with OSA severity. In patients with comorbid OSA and depression, depression severity was positively correlated with the BMI, AHI, and ESS and negatively correlated with the SaO2 min at night.

Conclusions: The current findings indicate that clinicians who treat patients with OSA should be aware of the potential occurrence of depression and should routinely assess depression in this patient population. The central nervous system may be involved in the pathogenesis of OSA in patients with depression and should be further investigated to identify novel treatments.

Disclosure: Nothing to disclose.

P557 | Social responsiveness in pediatric narcolepsy patients

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Objectives/Introduction: This study aims to explore the impairments in social functioning in pediatric narcolepsy patients compared to healthy children.

Methods: The parents of 53 pediatric narcolepsy patients and 64 age- and sex matched healthy children completed the Social Responsiveness Scale (SRS) and the Child Behavior Checklist (CBCL).

Results: Pediatric narcolepsy patients scored significantly higher on both the total score of the SRS (median = 56, IQR = 23.5), compared to the healthy control group (median = 44.5 IQR = 8.5, U = 797.0, $p < 0.000$). Twenty four out of 53 (45.3%) narcolepsy patients reported at least mild to moderate difficulties in social functioning compared to seven out of 64 (10.9%) healthy controls ($\chi^2 = 17.165$, $p =< 0.000$). Eleven narcolepsy patients (20.8%) and only one healthy control (1.6%) had T-scores above 76 ($\chi^2 = 11.602$, $p = 0.001$), which is considered severe and strongly associated with a clinical diagnosis of an autism spectrum disorder. Pediatric narcolepsy patients also scored higher on the sum of the CBCL subscales Withdrawn/ depressed, Social problems and thought problems (further referred to as CBCL WST) (median = 183, IQR = 30.5) compared to the healthy controls (median = 155 IQR = 13 U = 500.0, $p < 0.000$). CBCL WST is presumed to be indicative of autism spectrum problems. There was a high correlation ($r = 0.745$, $p < 0.000$) between the SRS score and the combined CBCL scale. Within the patient group, girls reported significantly more often mild to moderate difficulties in social functioning on the SRS (77.8%) compared to boys (28.6%, $\chi^2 = 17.560$, $p < 0.000$).

Conclusions: Problems in social responsiveness are common in children with narcolepsy, especially in girls. There should be more attention for screening for of these symptoms in pediatric narcolepsy patients. Instead of a using a dedicated screening tool such as the SRS, assessing the described subscales of the more commonly used CBCL can also provide a valid reason to consider further psychiatric evaluation.

Disclosure: Nothing to disclose.

P558 | A novel home video behaviour analysis algorithm to diagnose childhood chronic insomnia

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Objectives/Introduction: Chronic insomnia (CI) is the most common sleep disorder in childhood, categorised as limit setting or sleep onset association type. In both, parent-child interaction is significant in the development and persistence of the problem. CI is currently diagnosed by clinical interview with the parent, however parental recall of their own behaviour may be inaccurate. Objective observation may aid diagnosis and treatment. We aimed to trial home video technology in childhood brain tumour survivors who have a high prevalence of CI. Specifically, we aimed to develop a novel scoring algorithm of behavioural observations for future clinical applications.

Methods: Participants were recruited from neuro-oncology clinics at Southampton Children's Hospital, UK. Inclusion criteria were: aged 3–12 years, completed brain tumour treatment at least 6 months previously, and at risk of CI according to a screening questionnaire (Sleep Disturbance Scale for Children: Disorders of Initiating and Maintaining Sleep subscale). Families completed a home video sleep study using an infra-red camera with actigraphy (SOMNOmedics),

followed by a clinical sleep history taken from the parent (audio recorded to allow peer review). Video analysis was undertaken using BORIS v6.1, a software programme designed by researchers at University of Turin for animal behaviour observation. An analysis algorithm was designed and iteratively developed which categorised behaviours into the following domains: sleep schedule, bedtime routine, lights out, night wakings, parent and child speech and behaviour (sleep promoting and sleep inhibiting). These domains could both be visually plotted and quantitatively computed (e.g. total and mean duration of activities) to aid interpretation by the clinician.

Results: Five children have been recruited. Inter-rater reliability for scoring of sleep-related behaviours will be presented. Preliminary video analysis has indicated that parents of childhood brain tumour survivors commonly demonstrate overly soothing behaviour at bedtime and night wakings (e.g. co-sleeping and extended close physical contact), which is likely to contribute to CI in the child.

Conclusions: Video behavioural analysis has the potential to be a useful tool in aiding diagnosis of CI and, particularly with the further development of our scoring algorithm, could be used to give parents specific feedback regarding their overnight interactions.

Disclosure: Nothing to disclose.

PAEDIATRICS 2

P559 | Sleep and daytime functioning in children with autism

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Objectives/Introduction: Autism spectrum disorder (ASD) is a neurodevelopmental condition associated with a high prevalence of sleep disturbances. It is well established that sleep problems affect several aspects of cognition and has also been shown to predict internalizing/externalizing behavioural problems. Previous studies suggest that the relationship between sleep problems and daytime behaviour may be correlated with the manifestations of autism. Our aims were to investigate

(1) the association between sleep problems and degree of ASD severity and how this relates to daytime behaviour in children with ASD, and

(2) how sleep disturbances relate to prosocial behavior.

Methods: We conducted a cross-sectional study where parents reported their children's sleep problems (Children's Sleep Habits Questionnaire), symptoms of ASD (Autism Quotient-Children's Version) and daily behaviour problems (Strengths and difficulties questionnaire). We here report interim analysis of the first 39 children with Autism (4–11 years old) in this ongoing study, the majority boys (85%). Data were analysed using multiple regression models.

Results: Sleep problems were associated with more problems with daytime behaviour (p = 0.001). Higher severity of ASD was related to more problems with daytime behaviour, (p = 0.04). When adjusting for the effect of sleep problems, the significant association between severity of ASD and daytime behavior disappeared (p = 0.35). The positive relationship between sleep problems and behavioural problems remained significant (p = 0.004) after adjusting for the severity of autism. Additionally, sleep problems were related to less prosocial behaviour, (p = 0.002) but the association between degree of autism and prosocial behaviour was not significant.

Conclusions: Our interim results support a relationship between sleep problems and impaired daytime behavior in children with ASD. We also observe a significant association between the severity of autism and daytime behavioural problems, but this relationship was no longer significant after adjusting for sleep problems. This indicates that daytime functioning may be more related to sleep disturbances rather than severity of ASD. Further research should examine causality by determining whether improvement in sleep leads to improvements in daytime functioning.

Disclosure: The study has been supported by a grant from Wolff Memory fund. None of the authors have a conflict of interest.

P560 | Weekday-weekend sleep variations in young children and the associated family factors

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Objectives/Introduction: The great weekday-weekend variations in sleep schedules have been reported to be associated with chronic sleep loss and increased health risk. However, this variation is less understood in young population. The aim of this study was to investigate the weekday-weekend sleep variations in young children, as well as to identify the associated family risk factors.

Methods: Children participating in a longitudinal obesity prevention project in Stockholm was used. In total, 137 children aged 2 years were included and were classified into three groups based on two family risk factors, parental low education and unhealthy weight:

(1) "high risk" (parents with both low education and obesity),

(2) "medium risk" (parents with either low education or obesity),

(3) "low risk" (parents with neither low education nor obesity).Children's sleep was assessed using wrist-worn accelerometer for 7 days. The analysis of variance for repeated measures was adopted to examine the weekday and weekend sleep among groups. Further, the weekday-weekend

variations among groups were explored with adjustment for confounders.

Results: There were 27 children in the high risk group, 79 in the medium risk group and 31 in the low risk group. There was no difference in the average sleep patterns across the week among groups. Children showed later sleep onset ($p < 0.001$), later sleep offset ($p < 0.001$), delayed midpoint of sleep ($p < 0.001$) and longer sleep duration ($p = 0.01$) on weekends than weekdays. Children in the high risk group showed more delayed sleep during weekends than children in both low and medium risk groups, with later sleep offset ($p = 0.005$) and midpoint of sleep ($p = 0.03$). After adjustment for confounders, the group differences in weekday-weekend sleep variations can only be detected between the low and high risk groups, with more delayed sleep offset ($p = 0.02$) and midpoint of sleep ($p = 0.04$) on weekends in children in the high risk group than children in the low risk group.

Conclusions: The weekday-weekend sleep variations can be identified in children at aged 2 years. Compared to children of parents with high education and normal weight, children of parents with low education and unhealthy weight had greater delayed sleep timing on weekends.

Disclosure: Nothing to disclose.

P561 | Sleep duration and socio-economic status in pediatric population: a systematic review of the literature

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Objectives/Introduction: Insufficient sleep is a primary public health problem. Low sleep quantity in pediatric population is associated with weight gain and obesity, cognitive impairment, low academic performance and behavioral disorders. Some research have observed that socioeconomic status (SES) and neighborhoods characteristics could be predictors of sleep disparities in pediatric population.

Methods: This systematic review have been realized according to the PRISMA statement. A bibliography search in the main database (PubMed, Web of Science, Scopus, PsycInfo, Cochrane Library), without publication time limits, was realized. All the articles published in English focusing on the association between sleep duration and SES in pediatric population were included.

Results: From 106 articles analyzed, 25 studies investigated the association between sleep duration and SES. Most of the articles selected employed a cross-sectional methodology and only 2 publication were longitudinal studies. In 7 (28%) pre-adolescent and 5 (20%) adolescent sample were involved. Only 2 studies (%) focused on sleep duration in infant from 0 to 3 years old. In the majority of the studies low SES was associated with short sleep duration, while in 2 (8%) studies the association was inverse. Only in 7 (28%) studies no relation between sleep quantity and SES was obtained.

Conclusions: The results obtained indicate that inadequate sleep duration positively correlate with low SES. Prevention of chronic diseases of the child and the adult cannot ignore the promotion of the correct lifestyles and sleep hygiene from the pediatric age, particularly involving parents with low SES.

Disclosure: Nothing to disclose.

P562 | Treatment of symtoms of depression with light goggles in adolescents

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Objectives/Introduction: Sleep complaints and lowered mood states are frequently reported in adolescence, November was marked as the worst month for mood and fatigue in a previous questionnaire study. The aim of this study was to treat depressive symptoms by use of light goggles during the Scandinavian dark winter period.

Methods: In an intervention study, high school students (15–20 years; 52% boys) answered a question on willingness to try light goggles (Luminette®) in the morning to improve health. For 2 weeks 60 invited students with moderate or high depression scores on the depression scale (HAD-D6) wore glasses during 20 min in the morning before going to school and at weekends. Subjects were randomized to either a white light condition (≈1,000 lux) or red light condition. Subjects were questioned before and after treatment and a repeated mixed model analysis was performed using condition (before/after) and light (white/red) as factors.

Results: Compliance to treatment was very good according to daily logs. In total 50 students fulfilled the protocol. Effects of white and red light did not yield significant differences. General improvement on the depression scale (HAD-D6) was 26% ($p < 0.001$), 7.3% on the Epworth Sleepiness Scale ($p < 0.006$), insomnia index 16% (Karolinska Sleep Questionnaire, $p < 0.013$) and increased morningness (Diurnal Type Scale) 5.5%. After treatment 42% of the students would recommend use of light goggles to peers and 37% would partly do so, 2% disagreed with goggle use. The lack of difference between white and red diods might be explained by placebo induced effects or by the strength of direct lighting effects on pathways signaling to mood regulating brain areas.

Conclusions: The study demonstrated that at a season were very little daylight is obtained traveling to school, use of goggles reduces

symptoms of depression and has mild positive effects on insomnia symptoms, daytime sleepiness and promotes morningness.

Disclosure: Nothing to disclose.

P563 | When the children don't sleep: the impact on paternal mental health

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Objectives/Introduction: While a considerable amount of research has been conducted investigating the relationship between children's poor sleep and maternal mental health and general well-being (Lam, Hiscock & Wake, 2003 and others), studies exploring this link in fathers are limited.The aim of this study was to address the scarcity of existing research in this area by investigating the association between children's sleep quality and several paternal mental health outcomes, such as stress, anxiety and depression.

Methods: Using a cross sectional design we have recruited 308 dyads of fathers and children (mean age 39.51 ± 6.41 and 7 ± 2.1 respectively) that responded to a number of measures for sleep (child), anxiety, depression, stress and involvement in childcare.

Results: Highly significant associations were found between measures of paternal mental health and sleep in children, which measured with the Children's Sleep Habits Questionnaire (Owens et al, 2000). More specifically, paternal stress ($r = 0.243$, $p < 0.001$; Perceived Stress Scale), depression ($r = 0.219$, $p < 0.001$; Patient Health Questionnaire Depression Scale), anxiety ($r = 0.220$, $p < 0.001$; State-Trait Anxiety Inventory) were found to be significantly associated with child's sleep as reported by the fathers. No significant associations with parental involvement were found (Paternal Involvement in Child Care Index) despite that 87.8% of the fathers were living in the same household as the children.

Conclusions: This study adds to the existing literature that children's sleep difficulties have an impact on paternal mental health with higher instances of stress, anxiety and depression without the mediation of parental involvement.

Disclosure: Nothing to disclose.

P564 | Moderate impact of prone positioning in Robin infants: a polysomnography study

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Objectives/Introduction: Obstructive sleep apnea syndrome (OSA) is very frequent in infants with Pierre Robin Sequence (PRS). Its management is not consensual but the prone positioning (PP) is commonly recommended. However, its effect has never been studied by polysomnography (PSG). The aim of the study was to evaluate the impact of the PP on sleep and breathing outcome measures.

Methods: This retrospective study was conducted between 2015 and 2017 in a tertiary care hospital. For each incidental PRS infant, a nocturnal PSG with pulse oximetry and transcutaneous carbon dioxide was performed in the supine position (SP) and in the PP. Sleep and breath outcomes measures, expressed as median [Q1–Q3], were compared between SP and PP.

Results: PSG outcomes of 18 PRS infants, aged of 61 ± 50 days at evaluation, were analyzed. Among the 18 infants, 11 had clinical manifestations of OSA. All had OSA diagnosed on PSG. In the PP, 13 infants among 18 had a better night quality than in the SP with a significantly higher sleep efficiency (83 [69–90] vs. 70 [55–77], $p = 0.04$). In PP, there was a trend towards a lower obstructive apnea hypopnea index in rapid eye movement stage (50 [28–82] vs. 61 [40–103], $p = 0.05$). The PP was sufficient alone to decrease OSA index below 10 events/hr in 3 infants; otherwise a respiratory support was required for 13. The SP was maintained for 2 infants.

Conclusions: In PRS infants, PP improves sleep quality but was found to be frequently insufficient to correct OSAS. We recommend a nocturnal sleep and breathing study to be systematically performed in those babies

Disclosure: Nothing to disclose.

P565 | Sleep habits in a western Mediterranean population from 0 to 30 months: a cohort study

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Objectives/Introduction: There are few studies on sleep habits and sleep quality in paediatric population in our sociodemographic environment (Island of Mallorca), despite the fact that sleep disorders have a high prevalence in childhood. The objective of this study was to describe the patterns and sleep habits of children from 0 to 30 months of age and the factors that modify them.

Methods: Descriptive, observational and cross-sectional study. The parents were asked to fill a survey that included the Brief Infant Sleep Questionnaire (BISQ) as well as other sociodemographic variables, medical history, physical examination and sleep habits of their child.

Results: 200 children (97 males) were studied. Total sleep hours decreased from 14.07 ± 2.58 in children under 6 months of age to 11.73 ± 1.26 at 24–30 months after birth ($p < 0.05$), mainly by decreasing daytime sleep from 4.46 ± 2.02 to 1.82 ± 1.26 ($p < 0.05$) hours. In addition, the number of awakenings decreased

progressively with age from 1.90 ± 1.22 to 0.69 ± 0.97 ($p < 0.05$) per night. Aged mothers, low socioeconomic status, breastfeeding, bed-sharing, and supine positioning have been associated with increased sleep fragmentation. However, using pacifier and sleeping outside the parents′ room reduced the number of awakenings.

Conclusions: It is confirmed that in the Western Mediterranean environment, children population from 0 to 30 months of age presents important sleep disturbances, reason why the health professionals must know this situation to advise families properly.

Disclosure: Nothing to disclose.

P567 | The role of polysomnography in respiratory management of obstructive sleep apnea in infants with Pierre Robin sequence: essential or not?

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Objectives/Introduction: Currently, polysomnography (PSG) is the gold standard for the diagnosis of obstructive sleep apnea syndrome (OSAS), but its access is still difficult. A polygraphy (PG) combined with oximetry and transcutaneous PCO2 (TcPCO2) allows the diagnosis of OSAS. Until this day, the management of infants with Pierre Robin Sequence (PRS) and OSAS is not standardized. The aim of this study is to compare the OSAS therapeutic decision in infants with PRS depending on PSG versus PG combined to oximetry and TcPCO2.

Methods: This study was conducted in infants with PRS in the sleep unit of the pediatric university hospital of Lyon, France, from 2015 to 2017. A nocturnal PSG with measurement of gas exchange was performed for each infant during their routine follow-up. Each anonymized PSG were analyzed by a single reviewer. After suppression of sleep data, 1 month after, anonymized raw data were analyzed by the same single reviewer in order to obtain only PG data. The first OSAS therapeutic option selected with PSG by 3 pediatricians was notified. The new OSAS therapeutic option selected with PG by the same 3 pediatricians was notified. Respiratory index [obstructive apnea index (OAI), obstructive hypopnea index (OHI), obstructive apnea hypopnea index (OAHI)] were compared between PSG and PG. Data were presented as median and interquartile range 25% and interquartile range 75% [Q1–Q3].

Results: PSG was performed in 20 infants at a median of 43 [24.5–113.5] days. 15 patients had isolated PRS, 5 patients had associated or syndromic PRS. All patients had confirmed OSAS with PSG. Therapeutic option selected after PG combined to oximetry and TcPCO2 and compared to decision after PSG recording was identical for 18 infants and different for 2 infants. No significant difference was observed between OAHI measured by PG and PSG (23 [16.3–43.5]/hr, vs. 29 [13.3–48]/hr, $p = 0.458$). OHI was under-estimated in PG versus PSG (2 [0–3]/hr vs. 8.5 [5.3–25]/hr, $p < 0.0001$).

Conclusions: An overnight PG recording in a sleep unit, combined to oximetry and TcPCO2, lead to select the adequate therapeutic option to treat OSAS in PRS infants in the 8 first months of life.

Disclosure: Nothing to disclose.

P568 | Psychological factors of sleep disorders in school-age children: the role of parent′s subjective sleep problems and dysfunctional beliefs about their child′s sleep

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Objectives/Introduction: Sleep disorders are a sensitive criterion of adaptation problems in children and adults, and they are associated with various psychological factors such as beliefs about sleep. Since the impact of sleep problems in children is more expressed than in adults, it is important to explore ways to treat and prevent them. One of these targets are parents' unrealistic and dysfunctional beliefs. The aim of the study is to reveal a relationship between the parental sleep and beliefs about their own sleep and their children's sleep.

Methods: 100 children ages 5–13 (45 females, mean age 8.21 ± 2.13 years) and their parents (100 females, ages 26–56 years) participated in the study. Children were interviewed about their sleep quality using Sleep Self-Report (SSR; Owens et al., 2000) while their parents complete Insomnia Severity Index (ISI, Morin, 1993), Dysfunctional Beliefs About Sleep Scale (DBAS; Morin, 1993), Dysfunctional Beliefs About Children's Sleep Scale (DBACS; Ng et. al. 2012), Children's Sleep Habits Questionnaire (CSHQ; Owens et. al. 2000).

Results: The parental appraisal of quality of the child′s sleep correlated with the children's assessment of their own sleep ($r = 0.53$, $p < 0.05$), as well as with parental complaints about their own sleep ($r = 0.36$, $p < 0.05$) and their dysfunctional beliefs about their sleep ($r = 0.36$, $p < 0.1$) and sleep of their children ($r = 0.36$, $p < 0.05$). After adjusting for parent′s dysfunctional beliefs about their own sleep parent′s subjective sleep problems and dysfunctional beliefs about children's sleep were independent significant predictors of children's subjective sleep quality (R-square change 22.8%, beta = 0.36 and 0.37, $p < 0.001$).

Conclusions: Both parental sleep disorders and parental dysfunctional beliefs predicts poorer subjective sleep in children thus supporting the hypothesis that sleep regulation is developing in the parent-child interaction.

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Disclosure: Nothing to disclose.

P569 | Cataplexy and sleep disorders in Niemann-Pick type C disease – a case study

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Objectives/Introduction: Niemann-Pick disease type C (NP-C) is a rare and progressive autosomal recessive lysosomal lipid storage disorder leading to disabling neurological manifestation and premature death. One of its characteristic symptoms is cataplexy that is found in 5–30% of the NP-C patient. However, sleep disturbances are described only exceptionally. Children with type 1 narcolepsy at disease onset often display complex abnormal motor behaviours that do not meet the classical definition of cataplexy. However in pediatric NP-C patients no such »unconscious« active motor behaviours were discribed. We present a child with juvenile form of NP-C in whom dyskinetic-dystonic movements and stereotypies were observed intermingled with cataplectic attack.

Methods: 13-years-old boy that was diagnosed with NP-C at the age of 7 years by molecular genetic testing of *NPC1* gene. He was put on miglustat treatment and fluoxetine was introduced. Video recording of paroxysmal events was followed with nocturnal polysomnography recording (PSG) and 3-day videoEEGtelemetry.

Results: On video recording clear gelastic cataplectic attacks with loss of facial and neck tone were recorded. Other type of paroxysmal events included atonic head drops followed by with asymmetric tonic posturing and unilateral dystonia/dyskinesia with grabbing hand automatisms, sometimes followed by left hand nose wipping. PSG revealed distrupted sleep with sleep efficiency of 54% and sleep onset REM despite fluoxetine treatment. Altered sleep patters included sudden increases in muscle tone during slow wave sleep, atypical K-complexes and spindle activity and increased amount of REM sleep (39% of TST). EEG recording showed no epileptiform discharges, however long-term video-EEG during the latter paroxysm disclosed attenuation of the activity over left frontal leads and vertex, followed by spread over left hemisphere and rhythmic sharp theta activity over left frontocentral leads, suggesting epileptic seizures.

Conclusions: Classical cataplexy, typically provoked with strong emotions, is a characteristic symptom of Niemann-Pick disease type C that can be accompanied also by important sleep disruption. In case of associated complex movement disorder that often co-occur in pediatric narcolepsy with cataplexy extensive neurophysiological evaluation should be performed to exclude epileptic events and guide pharmacological treatment in NP-C.

Disclosure: Nothing to disclose.

P570 | Effect of parental group sleep education in young children with Down syndrome: the REST-Ed study

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Objectives/Introduction: Children with Down syndrome (DS) experience a higher incidence of sleep problems than their typically-developing peers. Untreated, this can lead to sleepiness, behavioural/emotional problems, cognitive impairment and reduced quality of life. Children's sleep problems affect parental wellbeing, and parents caring for a child with a developmental disability may also experience poor sleep. This study (ISRCTN no. TBC) aims to evaluate the effect of a sleep education package on the sleep and quality of life of young children (aged 6 months–5 years) with DS and their parents/carers living in Scotland.

Methods: Families with children aged 6 months-5 years with DS will be identified anonymously on behalf of the investigators by a national charity, Down's Syndrome Scotland. The package, based on an intervention evaluated by Stores and Stores in 2004, includes a short film, colour booklet and instructional talk, delivered in a small group setting. Effectiveness of the intervention will be evaluated using a randomised, parallel groups design, with a 12 m post-intervention follow-up period. All study participants will be screened for sleep-disordered breathing (SDB) using home-based level III cardio-respiratory polygraphy; children with significant SDB are ineligible and will be signposted for clinical assessment and treatment locally. The remaining children will be randomised by balanced-block to receive either the intervention or a control group session on a topic unrelated to sleep. Subjective and objective measures will be made at baseline and at 1 m, 3 m, 6 m and 12 m follow-up visits. Subjective sleepiness, behaviour and quality of life of children and parents/carers will be assessed using standardised questionnaires, including Epworth Sleepiness Scale, Infant and Toddler Quality of Life scale, Child Behavior Checklist, and General Health Questionnaire. Objective sleep quality/duration will be assessed using actigraphy. Standard statistical analyses will be undertaken, with significance set at $p < 0.05$.

Results: Recruitment will commence upon receipt of ethical approval, with a minimum sample size of 50 participants (25 per group). Preliminary study results will be available for presentation by the time of the conference.

Conclusions: If effective, this early sleep education intervention package may reduce the incidence of sleep problems in young children with DS, improving quality of life for the children and their parents.

Disclosure: Nothing to disclose.

P571 | Temperament and sleep in children: investigation of the direction of the association

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Objectives/Introduction: Although many are interested in the nature and direction of the link between sleep and temperament, they are still unclear (Sorondo and Reeb-Sutherland, 2015). The aim of this study was to investigate the reciprocal relationship between sleep and temperament in children.

Methods: The study was conducted with 82 children studied longitudinally. At age 2 and 3, children's sleep was assessed using actigraphs and temperament was assessed using the Toddler Behavior Assessment Questionnaire (Goldsmith, 1996).

Results: The results indicated that sleep at 2 years was associated with prone to anger dimension of the 3-year temperament, while the 2-year social fear dimension was associated with sleep at 3 years. Finally, the level of activity (3rd dimension of temperament) and sleep were not associated at any measurement time.

Conclusions: These results suggest that the direction of the relationship between sleep and temperament varies with the observed dimension of the temperament.

Disclosure: Nothing to disclose.

P573 | Relationship between sleep and health-related factor in adolescents

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Objectives/Introduction: Insufficient sleep among adolescents is common and has adverse health and behavior consequences. The purpose of this study is to determine whether physical activity, afterschool behavior, and nutrition are associated with sleep.

Methods: A total of 1,864 students, 8 middle schools (7–9th grade) were recruited. All students conducted self-reported questionnaires assessing regarding usual sleep/wake patterns over the previous 2 weeks, daytime function, physical activity, afterschool behavior and dietary factor. Students were divided by gender.

Results: A total of 1,634 students (53.3% male, mean age 13.36 ± 1.03) completed the survey. For both gender, the shorter sleep duration on school days (SD), the later bedtime was found to be on both school days and weekends. Shorter sleeper also reported more daytime sleepiness. Among boy, SD was positively associated with frequency and duration of both moderate and vigorous physical activity, but not significant. For both gender, SD was negatively associated with weekly internet use, but not significant. There are no association between SD and dietary factor.

Conclusions: These findings suggest that sleep duration of adolescent is positively related to physical activity, especially in boys. Sufficient sleep is recommended to adolescent for health benefits, yet more research is needed to understand if sufficient sleep should be recommended for improving health-related factor.

Disclosure: Nothing to disclose.

P574 | Our experience in treatment sleep apnea in children

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Objectives/Introduction: The abstracts' purpose is to provide information about Obstructive Sleep Apnea (OSA) and its treatment in children (1–4% of OSA cases.) al.

Methods: OSA is a disorder of breathing during sleep, characterized by prolonged partial upper airway obstruction, which disrupts normal ventilation leading to many complications (neurobehavioral, cardiovascular, endocrine etc). The main symptom, reported by parents is snoring - harsh, snorting noises caused by vibration of the soft palate in 7.45% (meta-analysis).

Results: The results are based on literature for etiology and treatment of OSA in children. There is no specific age in which the disease occurs but there is a higher risk for boys aged 11–13 compared to 5–10 aged boys and girls. Each case is different that is why it is really important to make the needed testing (polysomnography – PSG is the gold standard) and analysis of the full health status of each patient. The PSG diagnosis is defined as apnea-hypopnea index (AHI)>1/hr or AHI ≥1.5 hr. Other methods are cardio-respiratory monitoring, electromyography, and electroencephalography. The main choice of treatment for children is surgical – Adenoidectomy and/or Tonsillectomy (A&T). Another commonly used treatment for children is orthodontic. Medical treatment is helpful for the postoperative period: anti-inflammatory therapies with intranasal steroids and leukotriene modifiers for 12 weeks help in the postoperative period and Continuous positive airway pressure ventilation (CPAP) – for persisting OSA after A&T.

Conclusions: The main aim of the Ear Nose Throat (ENT) specialist for OSA during childhood is to prevent the side effects as well as the development of the disease during adulthood. A&T with the following medical treatment lead to significant improvements in OSA in children. PSG and CPAP are the key for diagnostics and management of the disease.

Disclosure: Nothing to disclose.

SLEEP AND GENDER

P575 | Effect of gender, obesity and neck circumference on the severity of obstructive sleep apnea in Egyptian patients

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Objectives/Instruction: Obstructive Sleep Apnea (OSA) is a common disease due to risk factors such as obesity, upper airway anatomical abnormalities or hormonal influences. Previous studies assessed the gender related differences in patients with OSA and showed discrepancies between men and women. Thus, our aim was to compare the clinical and polysomnographic features between Egyptian men and women diagnosed with OSA and to determine the factors affecting the severity of their Apnea Hypoapnea Index (AHI).

Methods: This retrospective study was conducted on 1012 patients who underwent polysomnography at the Cairo Center for Sleep disorders, Cairo, Egypt, between January 2012 and December 2016. Their medical data were reviewed and statistically analyzed. Patients were classified into mild (AHI 5–15), moderate (AHI 15–30) and severe (AHI > 30) OSA. Males and females were compared and the correlation between Age, Gender, Body Mass Index (BMI), Neck Circumference (NC) and the Epworth Sleepiness Scores (ESS) with the AHI and other sleep parameters was explored.

Results: A total of 838 patients (678 males, 160 females) were diagnosed with OSA. Patients with mild, moderate and severe OSA were 24.3% (204), 17.4% (146) and 58.2% (488) respectively. BMI was insignificant between men and women (34.18 ± 13.53 vs. 36.73 ± 23.25, $p = 0.07$). Females were older than males (58.87 ± 10.25 vs. 54.39 ± 22.96, $p = 0.001$). NC was higher in men than women (43.56 ± 5.3 vs. 39.34 ± 4.41, $p = 0.001$). ESS were similar between men and women (10.23 ± 6.48 vs. 10.82 ± 6.11, $p = 0.304$). Men exhibited more arousals than women (37.92 ± 24.81 vs. 26.5 ± 22.85, $p = 0.001$). AHI was higher in men than women (47.97 ± 31.22 vs. 37.95 ± 31.72, $p = 0.001$) with severe OSA found more in men than women (61.5% vs. 44.4%, $p = 0.001$). No significant difference was found between pre and post menopausal women. A positive significant correlation was found between BMI, NC, ESS with the AHI, Arousal index, Average SpO_2 and Desaturation index ($p = 0.0001$). BMI and NC were the only independent factors affecting the severity of the AHI ($p = 0.002$ and 0.0001 respectively).

Conclusions: Our results suggest that the prevalence of severe OSA in Egyptian patients is more common in men than women. Linear regression analysis showed that BMI and NC but not gender independently affected the severity of the disease.

Disclosure: Nothing to disclose.

P576 | A study of physical activity, sleep and mood in Finnish adolescents

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Objectives/Introduction: To assess whether the impact of physical activity on mood is mediated by sleep in adolescents.

Methods: All adolescents with a home address in Helsinki, Finland, born between 1/1/1999 and 31/12/2000, with Finnish registered as their native language ($N = 7,539$, 50% males), were invited to participate in a 30 min online survey. 1,367 valid responses were received (18% of invited cohort; 33% males). Of interest to this study was the physical activity, sleep, and mood data. Physical activity questions included; how often they participated in physical activity after 6 pm, how often they were very active in the hour before bedtime, how often they participated in exercise in their free time, and on average how long they exercised in one session. Sleep variables were measured by The Munich Chronotype Questionnaire; total sleep time (TST), sleep onset latency (SOL), and chronotype. Mood was measured by the Beck Depression Inventory (item 16 refers to sleep difficulty and was omitted from analyses).

Results: Bootstrapping analysis found the three proposed mediation models were significant for girls, but not for boys. For girls more physical activity in free time was a significant predictor of longer TST, $b = 0.01$, SE = 0.002, $p = <0.001$, and longer TST was a significant predictor of better mood, $b = -0.24$, SE = 0.03, $p = <0.001$. Similarly, more physical activity after 6 pm was a significant predictor of later chronotype, $b = -0.10$, SE = 0.03, $p = 0.001$, and later chronotype was a significant predictor of better mood, $b = 0.20$, SE = 0.02, $p = <0.001$. Lastly, more physical activity after 6 pm was a significant predictor of shorter SOL, $b = -1.05$, SE = 0.44, $p = 0.02$, and shorter SOL was a significant predictor of better mood, $b = 0.01$, SE = 0.002, $p = <0.001$.

Conclusions: Evidence was found for the mediating relationship of sleep between physical activity and mood with notable gender differences. Although the three proposed mediation models were supported for adolescent girls, there were no significant results for boys. More research is needed to replicate and test these relationships longitudinally.

Disclosure: Nothing to disclose.

P577 | Sleep related symptoms and gender in France: an analysis of the Reseau Morphee database

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Objectives/Introduction: Description of sleep related symptoms among responders to an online sleep questionnaire.

Methods: Observational study of responses to an online questionnaire developed by a consensus of sleep experts.

Results: 15,596 participants completed the questionnaire and all responses were included. 69% were women, mean age was 42.37 ± 14.94. Participants were mainly white-collar workers 4,376 (28%) and professionals 3,978 (26%). 10% were students, 9% unemployed and 11% retired. Mean IMC was 24.59 ± 5.02. Responses were evenly distributed across France.

The most common complaint was insomnia: 82% sleep maintenance insomnia, 59% sleep onset insomnia, and 71% early morning waking. Apart from early morning waking, all insomnia complaints were significantly more frequent in women ($p < 0.0001$). Sleep onset insomnia and non-restorative sleep were more common in younger patients while sleep maintenance and early morning waking increased with age. Sleep onset insomnia was not affected by menopause, but all other complaints were more prevalent in women over 55 compared to women under 45 ($p < 0.0001$).

Respiratory problems were common: snoring in 30% and respiratory pauses in 9%. Symptoms were significantly more frequent in men and increased with age. The combination of snoring and pauses was seen in 7% and was more common in men (14% vs. 5%, $p < 0.0001$). Morning headaches affected 36% and were more frequent in women and younger patients whereas nycturia was slightly more frequent in men and increased with age.

While the presence of pain in the legs in the evening was reported by 30%, possible restless legs (evening pain increased by rest and reduced by movement) was more common in women (13% vs. 10% $p < 0.0001$) of whom 16% also had leg movements at night.

The mean ESS was 9.48 ± 4.9 with a significant difference between men and women (9.02 ± 4.9 vs. 9.68 ± 4.92 $p < 0.0001$). Women were more likely to have a score >10 (43% vs. 36% $p < 0.0001$) 27% reported falling asleep at the wheel: this was more frequent in men than in women (32% vs. 24% $p < 0.0001$).

Conclusions: Sleep problems are frequent in the French population with 82% reporting insomnia, 7% symptoms compatible with sleep apnea and 12% possible restless legs syndrome.

Disclosure: Nothing to disclose.

P578 | Gender differences in aging process of sleep behavior: the Korean Genome and Epidemiology Study

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Objectives/Introduction: Age-related changes in sleep are often accompanied by gradual increase of sleep complaints. We investigated the effects of gender on the aging process of sleep behavior in the Korean general population.

Methods: We analyzed 2,351 subjects (mean 52.02 ± 6.97 years old, 51.2% female) of the Korean Genome and Epidemiology Study (KoGES) participants, who completed two-time-point sleep behavior questionnaires in 2005–2006 and in follow up visit (mean follow up duration 6.83 ± 1.05 years). We also assessed their sleep quality objectively by ambulatory polysomnography at the follow-up visit.

Results: The mean time in bed (TIB, $p = 0.030$) and sleep latency (SL, $p = 0.001$) were longer in the advanced age group. As the consequence, the habitual sleep efficiency (SE = SD/TIB) was decreased with age ($p < 0.001$) even though subjectively reported sleep duration (SD) did not significantly different between age group ($p = 0.360$). The Mid-Sleep on Free days Corrected for Sleep deficits during weekdays (MSFsc) was advanced ($p < 0.001$), and the social jet lag was decreased ($p < 0.001$) with age. Women reported significantly poorer sleep quality in all sleep behavior measure, however, age group stratification revealed most of the gender differences became insignificant after 65 years old. The difference of longitudinal change between sex was significant in TIB ($p = 0.002$), SD ($p = 0.001$) and MSFsc ($p < 0.001$). And the change of MSFsc was also significantly different between age groups ($p = 0.024$). Objectively measured sleep latency was increased in women ($p < 0.001$) as subjective measure, however, the other sleep quality related metrics including sleep efficiency ($p < 0.001$) and arousal index ($p < 0.001$) were significantly poorer in the men as well as sleep disordered breathing parameters.

Conclusions: In both genders, increasing age was associated with poorer sleep quality on a range of both subjectively and objectively measured sleep parameters. Our study demonstrated substantial evidence of gender differences in sleep evolution across the senescence, which is fundamental to provide the extent to which sleep changes in each gender require particular attention for further investigation and proper intervention.

Disclosure: This study was supported by a grant of Korean Centers for Disease Control and Prevention, Korean Ministry for Health and Welfare [Grant 2005-E71001-00, 2006-E71005-00, 2011-E71004-00, 2012-E71005-00, 2013-E71005-00, and 2014-E71003-00].

P579 | Subjective sleep quality, fatigue and depressive symptoms during and after pregnancy

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Objectives/Instruction: Future and new mothers experience sleep changes during pregnancy and after childbirth. These are important to manage as they can affect women's physical, mental and emotional well-being, including the development of depressive symptoms and postpartum depression. We aimed at gaining more insight in sleep parameters, fatigue and depressive symptoms during late pregnancy and in postpartum. Additionally, differences in breast- and bottle feeding mothers are investigated.

Methods: At 35–37 weeks gestation, 2 and 8 weeks postpartum, women filled out a socio-demographic questionnaire, the Pittsburgh Sleep Quality Index (PSQI), the Insomnia Severity Index (ISI), the Fatigue Severity Scale (FSS) and the Center for Epidemiological Studies Depression Scale (CES-D). Women without exclusive breast- or bottle feeding at the time of measurement were excluded from analyses.

Results: One hundred fifteen woman were included at the first, 61 at the second and 35 at the third time point. During late pregnancy, the whole sample showed a mean global PSQI score of 7.4 (SD 3.20, range 1–15), with 79.8% scoring above the cut-off value for poor sleep (PSQI 5). The sample showed a mean ISI score of 8.82 (SD 4.21, range 0–21), with 56.5% showing subclinical (ISI 8–14) and 8.7% moderately/severe (ISI 15–22) insomnia. Mean FSS and CES-D scores fell within the normal range. Mean PSQI and FSS further increased at 2 weeks postpartum, mean ISI remained unchanged and mean CES-D decreased in the whole sample. At 8 weeks postpartum, all mean global scores decreased as compared to the first time point, with only mean PSQI (5.46, SD 2.68, range 1–12) exceeding the cut-off value. Sixty percent of the women still experienced poor sleep. At 2 and 8 weeks postpartum, there were no significant differences (p = 0.05) in any global score between breast- and bottle feeding mothers.

Conclusions: Mean global PSQI, ISI and FSS of the whole sample were highest at 2 weeks postpartum and lowest at 8 weeks postpartum as compared to late pregnancy. Mean CES-D scores decreased over time from pregnancy till 8 weeks postpartum. No significant differences were observed between breast-feeding and bottle feeding mothers.

Disclosure: Nothing to disclose.

P580 | Breastfeeding, prolactin release and sleep

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Objectives/Introduction: Becoming a mother is a major life-changing event for any woman. Much needed restorative sleep during this time is often interrupted with night wakening, mainly for infant care and feeding. Despite the need for mothers to obtain adequate sleep, the association between maternal sleep and breastfeeding behaviors is rarely examined.

Objective: The aim of the present study was to explore the relation between breastfeeding and prolactin release with sleep.

Methods: A systematic literature review was performed. We used standard search strategies involving the querying of two online databases (MEDLINE® and EMBASE), for English language articles using the key words (breastfeeding + prolactin + sleep) followed by evaluation of the bibliographies of relevant articles.

Results: The principal lactogenic hormone is prolactin (PRL). Prolactin′s primary role is to help stimulate milk production after childbirth. PRL secreted by the anterior pituitary is critical to the establishment of lactation and breastfeeding. Pituitary PRL secretion seems to be, at least in part, sleep-dependent. PRL secretion is enhanced during the whole sleep period, as inferred from plasma levels. Some studies reveal that women who breastfed exclusively (B/F) seems to have more nocturnal sleep than women who used formula at night and demonstrated a marked increase in slow wave sleep. The most likely explanation for the altered sleep architecture noted to occur in women who are fully breastfeeding their infants is an increase in circulating PRL, which occurs in lactating women.

Conclusions: Breastfeeding may promote sleep during postpartum recovery. Enhanced Slow Wave Sleep may be an important factor to support breastfeeding in the postnatal period.

Disclosure: Nothing to disclose.

P581 | Relation between menstrual cycle, sleep and daytime sleepiness

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Objectives/Introduction: Premenstrual syndrome (PMS) is common in young women. Premenstrual dysphoric disorder (PMDD) is a subtype of PMS with severe mental symptoms. Women often experience insomnia and/or daytime sleepiness before menstruation. This study, therefore, aimed to investigate disturbance in sleep and wakefulness in young women with PMS/PMDD.

Methods: Thirty-six healthy Japanese women, aged 19–24 years, participated in the study. PMDD, moderate to severe PMS, or no or

mild PMS were judged using the PMDD scale (Miyaoka, et al., 2011). Insomnia and daytime sleepiness after the menstruation ended (after menstruation) and before the next menstruation started (before menstruation) were assessed using Athens Insomnia Scale (AIS) and Epworth Sleepiness Scale (JESS), respectively. Five-minute psychomotor vigilance task (PVT) was administered after and before menstruation, and reaction time and number of errors were analyzed. Activity during sleep was monitored using wActisleep+ Monitor (ActiGraph, Pensacola, FL). The averages of sleep efficiency for the seven nights after and before menstruation were calculated. Statistical analyses were performed using non-parametric tests. This study was approved by the ethics committee of the Hokkaido Pharmaceutical University.

Results: Four women were judged to have PMDD, nine women moderate to severe PMS, (PMS (+)), and twenty-three women no or mild PMS (PMS (–)). The JESS score was significantly higher in the PMS (+) group than in the PMS (–) group before menstruation ($p = 0.010$). The AIS score was significantly higher in the PMS (+) group than in the PMS (–) group both after and before menstruation ($p = 0.013$ and 0.000, respectively). Neither the reaction time nor the number of errors was different between the PMS (+) and PMS (–) groups. The sleep efficiency was significantly lower in the PMS (+) group than in the PMS (–) group after menstruation ($p = 0.043$), and the similar tendency was observed before menstruation ($p = 0.053$). In addition, the sleep efficiency was lower before menstruation than after menstruation in the whole subjects ($p = 0.016$). AIS and JESS scores before menstruation were positively correlated in the whole subjects ($p = 0.014$).

Conclusions: Young women with premenstrual symptoms experience insomnia and daytime sleepiness before menstruation more strongly than those without. This might be related with lower sleep efficiency.

Disclosure: Nothing to disclose.

P582 | Gender differences of cardiovascular risk in population with sleep disturbance in Russia/Siberia: WHO program MONICA-psychosocial

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Objectives/Introduction: To determine the gender differences in the effect of sleep disorders on risk of myocardial infarction (MI) and stroke in an open population 25–64 years in Russia/Siberia over 16 years of follow-up.

Methods: Under the third screening of WHO program MONICA - Psychosocial a random representative sample of both gender aged 25–64 years in Novosibirsk was examined in 1994 (men: $n = 657$, 44.3 ± 0.4 years; women: $n = 689$, 45.4 ± 0.4 years). The sleep assessment was performed using the Jenkins Sleep Questionnaire. There were 15 cases of new onset MI in women and 30 in men, as well as new-onset stroke 35 cases in women and 22 in men from 1994 to 2010. Univariate and multivariate regression model of Cox proportional hazards (Cox-regression) was used for risk assessments.

Results: In an open population aged 25–64 years 48.6% of men and 65.9% of women had sleep disorders ($p < 0.001$). Univariate Cox regression analysis showed 2.4-fold risk of MI in those males with SD over 16-year of follow-up (95% CI 1.1–5.3; $p < 0.05$) but not for women. In multivariate Cox regression model we also did not get to influence the risk of CVD in women ($p > 0.05$). The risk of MI in men who was never married was 3-fold higher (95% CI 1.9–9; $p < 0.0001$). In divorced persons HR = 4.3 (95% CI 2.1–8.9) and in widowed men HR = 7.5 (95% CI 2.5–22; $p < 0.0001$) compared to married ones. In univariate analysis risk of stroke was higher in men HR = 3 (95% CI 1.2–7.6; $p < 0.05$) than in women HR = 1.9 (95% CI 1.03–3.7; $p < 0.05$). Multivariate analysis revealed in men with SD 2.8-fold risk of stroke (95% CI 1.1–7.1; $p < 0.05$) and women HR = 2.7 (95% CI 1.4–5.42; $p < 0.01$). Stroke risk was higher in men with lower educational level and SD. There was an increase in the risk of stroke in women with a college education and SD HR = 3.7 (95% CI 1.1–11.9; $p < 0.05$).

Conclusions: Our results demonstrated sleep disorders as a risk factor of MI in men only and stroke for both gender. Negative social gradient increases cardiovascular risk in urban inhabitants with sleep disorders.

Disclosure: Nothing to disclose.

P583 | Is use of systemic hormone therapy associated with better sleep? A large, registry-based study of pre-, peri- and post-menopausal women in Norway

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Objectives/Introduction: Good sleep is a key factor for the maintenance of quality of life. Sleep quality changes during life, influenced by various factors such as level of hormones, life style, and age. The menopause, with declining estrogen levels is considered to represent a particularly vulnerable period of life with regard to threatened sleep quality. Objectives were to examine possible associations between use of systemic hormone therapy (HT) and sleep quality in a large population sample adjusted for possible confounders.

Methods: Female participants aged 45–75 years without any report of heart disease or previous radiation therapy for gynecological cancer were selected from the Norwegian Health Study in Nord-

Trøndelag (HUNT3, 2006–2008) (*N* = 14,278). Data from HUNT3 were linked to the Norwegian Prescription Database, to identify individuals who collected prescriptions of systemic HT (Estogen, Progesterone and Estrogen in combination), and sleep medication. Sleep quality was dichotomized: good sleep quality was defined as reporting insomnia symptoms never/rarely or sometimes versus reporting such symptoms several times a week. Data were analyzed using multiple logistic regression.

Results: Of the 14,278 analysed women a majority reported good sleep, 93.8% (*n* = 13,398) while 6.2% (*n* = 880) reported not having good sleep. In total, 998 women used HT, with the highest prevalence of 10.5% reported in women from 55 to 64 years. After adjusting for relevant covariates, using HT was associated with higher odds for better sleep, however this association was not statistically significant (OR = 1.23, 95% CI [0.95–1.59], $p = 0.12$). Being a HT user did not seem to sufficiently alleviate the problems regarding having hot flashes, as 62.5% of HT users reported being bothered with hot flashes both during day and/or night. Perceived good health, aged between 65 and 75, not using sleep medication and being satisfied with life, were factors showing the strongest associations with good sleep quality.

Conclusions: The low use of HT and high prevalence of hot flashes, both in non-users and users of HT, might indicate that many women remain untreated despite climacteric symptoms, and that many women were not using a sufficient dose of HT to alleviate their symptoms and likely improve their sleep.

Disclosure: Nothing to disclose.

P584 | "What about us?" Men in the face of childbirth - their sleep and experiences of stress around the time of birth

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Objectives/Introduction: While many studies deal with the sleeping problems of pregnant women and mothers, few studies have focused on the sleep of fathers and fathers-to be. Although fathers in many countries accomplish their role differently than they used to, it is known that men also suffer from sleep difficulties around the time of birth although not as frequently as women. The goal of this study is to evaluate male sleep difficulties and experiences of stress around the time of birth.

Methods: 69 fathers-to be were included in the study. In a longitudinal study (T1 in the last trimester of pregnancy and T2 3 month's postpartum) sleep difficulties based on PSQI and sleep diaries were assessed. Beyond that the perceived stress scale (PSS) was calculated. In addition to that other factors as age, parity, parental leave, participation in prenatal classes, their baby's frequency of night waking, and cognitions of their baby's sleeping habits were inquired.

Results: A paired-sample t-test was conducted to compare fathers in parental leave (A) (*n* = 36) with fathers without parental leave (B) for all relevant variables. A significant difference for PSQI(A) and (B); $t(67) = -1.98$, $p = 0.05$, in frequency of night waking(A), (B); $t(67) = -3.64$, $p = 0.001$ and in how recovered fathers feel after sleeping (A), (B); $t(67) = -2.69$, $p = 0.009$. Furthermore, 26 fathers rate the sleeping habits of the baby as a problem. Beyond, significant higher stress scores according to the PSS was measured for first time fathers; $t(67) = 3.93$, $p = 0.000$.

Conclusions: With constantly changing division of tasks between partners and new expectations concerning fathers, men should be prepared during pregnancy for the changes which occur postpartum, particularly relating to sleep habits and coping with stress. Since the study hints at potential insomnia among fathers on parental leave, a case that is often only discussed in regard to mothers on parental leave, men planning to go on parental leave should take this step cautiously. Routine check-ups for sleep difficulties during pregnancy and the time after could avoid health issues and provide a functioning transition into parenthood.

Disclosure: Nothing to disclose.

P587 | A big data approach to objective measurement of sex differences in sleep schedules

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Objectives/Introduction: Consumer-targeted wearables enable objective measurement of sleep in a large group of people over a prolonged period of time. Fitness trackers with a Polar Sleep Plus™ feature utilise data from an in-built accelerometer to determine sleep parameters using a proprietary algorithm. A comparison against polysomnography suggests that the algorithm is suitable for research use with children, adolescents (1) and adults (unpublished data). Our aim was to study sex differences in sleep schedules among users of Polar fitness trackers.

Methods: We selected a sample of anonymised measurements with Polar Sleep Plus™ from the Polar Flow database. Users with less than five measurements were excluded. The measurements came from 121,223 users aged 18 to 64. The measurements were synched to the database during a 6-month period, totalling over six million nights. We compared differences in Fell asleep time (sleep onset), Woke up time (sleep offset), and Sleep time (time elapsed from sleep onset to offset) between women and men in four different age groups (18–29, 30–39, 40–49, 50–64).

Results: On average, women slept for 7 hr 32 min and men for 7 hr 10 min ($p < 0.0001$). In all age groups, women slept longer than men ($p < 0.0001$). An average Fell asleep time was 23:34 for women and 23:55 for men indicating an earlier circadian timing of sleep for women ($p < 0.0001$). Similar differences in Fell asleep time between

the sexes were found in all age groups ($p < 0.0001$). An average Woke up time was 07:10 for women and 07:10 for men.

Conclusions: This big data approach using wearable technology confirmed sex differences in sleep schedules. A trend of longer sleep duration and the earlier circadian timing for women was consistent across age groups.

References: 1. Pesonen AK and Kuula L. The Validity of a New Consumer-Targeted Wrist Device in Sleep Measurement: An Overnight Comparison Against Polysomnography in Children and Adolescents. J Clin Sleep Med. 2018 Mar 30. pii: jc-17-00529. [Epub ahead of print].

Disclosure: K Martinmäki, L Leinonen and T Korhonen work as researchers in Polar Electro Oy.

P588 | Sex differences in the circadian and sleep dependent regulation of sleep spindles in humans

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Objectives/Introduction: Sleep spindles (SP) are closely associated with both the physiological and cognitive aspects of sleep and have been shown to be modulated by homeostatic and circadian effects. A sexual dimorphism has been demonstrated for the association of sleep spindles with cognition as well as in the circadian and sleep dependent regulation of cognitive performance. However, it is not known whether the circadian and sleep dependent modulation of sleep spindles is modulated by sex.

Methods: 34 young (18 females, age: 25.1 ± 3.4) healthy subjects completed a 10-day forced desynchrony protocol, in which a 28-hr sleep-wake cycle was imposed while living in a dim light environment (<5 Lx). Sleep EEG was recorded throughout the protocol (231 sleep episodes) from 12 electrodes. Slow sleep spindles (SSP) (11–13 Hz) and fast sleep spindles (FSS) (13–15 Hz) were detected based on a fully automatic approach. Detailed topographical analysis of multiple sleep spindle parameters was undertaken. Circadian phase was derived from the assessment of the Dim Light Melatonin Onset based on blood samples collected during the protocol.

Results: There was a main effect of sex on FSP density and frequency with women presenting higher values compared to men ($p < 0.005$). The density effect was greatest over the frontal region whereas the frequency effect was most pronounced over the posterior region. Men presented higher SSP density over the frontal region only ($p < 0.05$). There was no effect of sex on spindle duration. Both FSP density and frequency showed a marked sleep dependent increase across all major brain regions ($p < 0.001$). This increase was greater in women than men over the frontal region ($p < 0.005$) for FSP density and over all brain regions for FSP frequency ($p < 0.01$ all regions). There was a circadian modulation of both SSP and FSP density and frequency ($p < 0.05$) with an interaction with sex ($p < 0.05$). Sex differences emerged during the circadian night only when melatonin was highest.

Conclusions: There is a marked sexual dimorphism in the circadian and sleep dependent modulation of sleep spindles across the different brain regions. This has implications for understanding the sexual dimorphism in the cognitive and psychiatric correlates of sleep.

Disclosure: The authors report no conflict of interest.

P589 | What are the characteristics associated with increased slow wave sleep?

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Objectives/Introduction: Slow Wave Sleep is associated with various sleep related functions, including cognitive functions and removal of noxious substances. Decreased slow wave sleep occurs in different sleep disorders. There is few data analysing factors associated with increased SWS. The objective if this study was to evaluate demographic, clinical and polisomnographic features associated with increased SWS on routine PSGs.

Methods: Clinical case series. The percentage of SWS was evaluated from a database of full polysomnographies (PSGs) performed in a university hospital sleep lab, from a neurology department. Exclusion criteria included total sleep time (TTS) less than 4 hr and PSGs with EEG artefacts. SWS was classified as decreased (<10%); normal (10–25%); increased (>25%) of TTS. The group of patients with increased SWS was compared with the reference (normal) group for demographic, clinical and PSG variables with T test for quantitative variables or Qui2 for categorical variables. Significance value was 0,05.

Results: From 719 PSG, there were 75 (10.4%) patients with increased SWS percentage. Decreased SWS occurred in 43.5% and normal SWS percentage in 46.0%. Compared to patients with normal SWS percentage patients with increased SWS were more frequently females (70%), had less wakefulness after sleep onset, increased sleep efficiency and lower percentages of N1 and N2 sleep. Age, BMI, RDI, PLM index and other sleep macrostrutural measures were similar.

Conclusions: A low albeit significant proportion of patients show increased SWS on routine PSGs. These patients have more consolidated sleep, despite similar percentages of sleep related pathologies including obstructive sleep apnea and periodic limb movements. Other mechanisms are possibly involved in enhancement of SWS, namely factor associated with female gender. Further studies are necessary to evaluate its associations and possible clinical consequences.

Disclosure: Nothing to disclose.

POSTER SESSION 3

BIOCHEMISTRY & NEUROBIOLOGY 2

P590 | The possible role of P2X7 receptors of ATP in the induction of recovery sleep following sleep deprivation

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Objectives/Introduction: The basal forebrain (BF) is a key area in sleep regulation and implicated in the induction of recovery sleep (RS). ATP, as a neurotransmitter, enhances the release of cytokines via type 2 purinergic receptors and may be involved in sleep regulation. It is speculated that ATP, as a neurotransmitter, might also be involved in the induction of RS. To test this hypothesis, we studied how the local BF administration of A438079, a P2X7 receptor antagonist of ATP, during sleep deprivation (SD) influences the subsequent RS.

Methods: In 7 male Han-Wistar rats with implanted EEG/EMG electrodes and guide cannulae for microdialysis probes, the probe targeted into the BF was perfused (1 μl/min) with artificial cerebrospinal fluid (CSF) on the baseline day. Then, on the subsequent SD days, the rats were sleep deprived for 12 hr in the light period, and during SD, the microdialysis probe was perfused with CSF (SD+CSF) or 5 mM A438079 (SD+A). Sleep was recorded for 24 hr on the baseline and SD days and also on the days immedeiately following the SD days.

Results: SD+CSF enhanced NREMS during the subsequent RS (ANOVA followed by Tukey-test, $p < 0.05$), SD+A resulted only in a tendency to increase NREMS. NREMS following SD+CSF and SD+A did not differ significantly from each other, blocking of P2X7 receptors during SD by A438079 resulted only in a tendency to supress the following NREMS rebound (baseline night: 25.7 ± 2.0%; postdeprivation nights: 35.2 ± 2.2 and 32.0 ± 1.5% following SD+CSF and DS+A respectively). Both SD+CSF and SD+A enhanced REMS during the subsequent RS (ANOVA followed by Tukey-test, $p < 0.05$), REMS following SD+CSF and SD+A did not differ from each other (baseline night: 6.5 ± 0.9%; postdeprivation nights: 15.2 ± 0.8 and 15.7 ± 1.1% following SD+CSF and SD+A respectively).

Conclusions: Our present findings give only very little support to the hypothesis that ATP and its P2X7 receptors might be involved in the induction of RS, the application of a stronger P2X7 antagonist is needed to clarify this question. Such experiments are planned in the future.

Disclosure: This work was supported by the Academy of Finland.

P591 | Elevated glutamate levels in the anterior cingulate cortex after a sleep-inducing dose of gamma-hydroxybutyrate in humans: a magnetic resonance spectroscopy study

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Objectives/Introduction: Gamma-hydroxybutyrate (GHB) is a $GABA_B$-/GHB receptor agonist that is medically used as anesthetic and for the treatment of narcolepsy and alcohol withdrawal. Recently, GHB was proposed as repurposing candidate for the treatment of neuropsychiatric disorders such as Parkinson's and Alzheimer's disease, fibromyalgia and major depressive disorder. Insomnia is a common comorbidity of these pathologies and GHB's ability to enhance slow-wave activity (SWA) might be a hallmark of its beneficial effects on above disease courses. Despite its clinical relevance, no study has investigated the impact of GHB-facilitated NREM sleep on metabolite levels in disease relevant brain regions such as the anterior cingulate cortex (ACC) in humans.

Methods: A single oral dose of GHB (50 mg/kg body weight) or placebo were administered to 16 healthy male volunteers at 2:30 am, in the middle of a sleep episode from 11 pm–7 am, to specifically increase SWA in the second half of the night. Current source density analyses of EEG data were performed with low-resolution electromagnetic tomography. Levels of disease relevant metabolites, including glutamate and GABA, were quantified in the ACC upon awakening (8:30–9:00 am) with J-resolved magnetic resonance spectroscopy (JPRESS-MRS).

Results: In the second half of the night, GHB prolonged NREM and reduced REM sleep compared to placebo ($p_{all} < 0.05$). Furthermore, power in delta and theta (1–8 Hz) frequencies was increased ($p < 0.05$). This increase in oscillatory power was most pronounced bilaterally over prefrontal cortices ($p < 0.05$). Interestingly, JPRESS-MRS analyses revealed increased glutamate levels in the ACC in all subjects after GHB compared to placebo ($p < 0.001$). By contrast, GABA levels remained unaffected.

Conclusions: This study indicates that intra-night GHB administration increases ACC glutamate levels on the next morning. These metabolic alterations may result from increased SWA in the ACC during the night, because due to GHB's short half-life time ($t_{1/2}$ ~ 30–60 min), no acute drug effects may be expected at the time of MRS assessment. The ACC plays a critical role for cognitive performance, including attention and cognitive control. The elevated concentration of glutamate may thus provide a neurochemical explanation for GHB's ability to reduce symptoms of fatigue and impaired cognitive performance in neuropsychiatric disorders.

Disclosure: Nothing to disclose.

P592 | Preclinical evaluation of the potential use of Pitolisant as new intervention for sleep abnormalities in Prader-Willi syndrome

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Objectives/Introduction: Prader-Willi syndrome (PWS) is a rare neurodevelopmental disorder that is linked to genomic imprinting abnormalities. PWS patients suffer from sleep disturbances such as excessive daytime sleepiness (EDS), rapid eye movement (REM) sleep alterations and, in some cases, cataplexy. Here we present a pre-clinical study in which we tested the effects of *Pitolisant*in a mouse model of PWS, carrying a deletion of *Snord116*, which presents sleep, feeding and metabolic abnormalities. Pitolisant is an inverse agonist of histamine 3 receptor (H3R) and, recently, has been proposed as new therapeutic intervention for EDS and narcolepsy.

Methods: We characterized sleep architecture in PWS ($PWScr^{m+/p-}$) mutant mice compared to wild-type littermate controls ($PWScr^{m+/p+}$). In particular, we recorded EEG/EMG and temperature profiles before and after injection of *Pitolisant*or placebo in both groups. Mice were constantly monitored for a total of 48 hr, starting at the beginning of light-off phase (active phase). Pitolisant (20 mg/kg) placebo was injected after 24 hr of baseline profiling, and mice were monitored for additional 24 hr.

Results: The profile of sleep in mutant $PWScr^{m+/p-}$ mice recapitulated our previous discovery that REM sleep is significantly increased in this mutant line.However, in this new study, mutants treated with Pitolisant presented a reduction of REM sleep during the active phase (i.e. dark phase, the 12 hr immediately following the injection, $p = 0.001$). This latter effect on REM sleep was present also in $PWScr^{m+/p+}$ mice, in whichREM sleep was almost suppressed during active phase. On the other hand, sleep during inactive phase (i.e. light phase, from 12 to 24 hr after pitolisant/placebo injection) was unaffected in both genotypes. The effects of *Pitolisant*on REM sleep were accompanied by a dramatic decrease in body temperature in all mice.

Conclusions: Our preliminary results demonstrate that *Pitolisant*enhances wakefulness and reduces EDS during the day in PWS mice. Moreover, the effects on REM sleep may be mediated by alteration of the core body temperature. Therefore, further investigation is necessary to clarify the direct or indirect control of sleep by *Pitolisalnt*, as well as its clinical use to ameliorate the quality of sleep in PWS patients.

Disclosure: Nothing to disclose.

P593 | Optogenetic control of sleep slow waves to improve recovery after ischemic stroke

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Objectives/Introduction: Sleep-wake disturbances are frequent after stroke and are associated with poorer rehabilitation and long-term outcomes. Clinical and experimental studies suggest a favourable effect of sleep on post-stroke neuroplasticity and functional recovery. Here, we investigate the role of sleep Slow Wave (SW)-like oscillations on motor recovery following ischemic stroke using optogenetic and in vivo electrophysiology techniques in mice.

Methods: Ischemic stroke was induced in wild type mice via middle cerebral artery occlusion (MCAO). Different optogenetic opsins were targeted to pyramidal neurons using local infusion of CamkII-ChR2-EYFP (ChR2) CamkII-ArchT-EYFP (ArchT) and CamkII-mCherry (control) adeno-associated viruses (AAV) within the peri-lesional primary somatosensory forelimb (S1FL) cortex. Optical stimulations were designed to mimic SW-like bistability during sleep during the recovery period. Optogenetic SW-like were delivered daily (2 hr/day, at ZT 09:00) starting on post-stroke day 5 until day 15. Behavioural tests were conducted on post-stroke days 4, 7, 10 and 15 to assess the effect of optogenetically-evoked SW on motor outcomes.

Results: We showed that MCAO induced an increased amount of NREM sleep ($n = 5$, t-test, $p < 0.05$) following ischemic stroke, where ipsilesional SW where longer in duration compared to control animals ($n = 5$, t-test, $p < 0.05$) We showed that both optogenetic activation (ChR2, $n = 7$) and silencing (ArchT, $n = 7$) of pyramidal neurons within the per-lesional S1FL cortex successfully induced SW-like bistability in ipsilesional and contralesional cortical electroencephalography (EEG) recordings. Next, we showed that chronic optogenetic induction of SW-like bistability, predominantly during NREM sleep, significantly improved the recovery of fine motor movements (two-way ANOVA, $p < 0.05$) as compared to control mice ($n = 7$). Interestingly, the induction of SW-like bistability post-stroke did not affect strength or symmetry of movements.

Conclusions: Our findings showed that optogenetically-induced SW-like bistability through manipulation of peri-lesional pyramidal neurons activity significantly improves functional outcomes after stroke. In line with the literature, our results suggest a positive role of sleep in motor recovery following ischemic stroke.

Disclosure: Nothing to disclose.

P594 | Functional consequences of brain glycogen deficiency on the sleep-wake cycle regulation in PTG-KO mice

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Objectives/Introduction: In the brain, glycogen is localized in astrocytes where its levels are linked to neuronal activity. Astrocytic glycogen synthesis is regulated by glycogen synthase activity (GSa) that is positively controlled by the protein targeting to glycogen (PTG) expression levels. We previously demonstrated that a 6 hr gentle sleep deprivation (GSD) increased PTG mRNA expression and GSa in mice brain. Glycogen levels were also paradoxically maintained following GSD. In order to gain further insight on the role of PTG in this process, we studied the sleep/wake cycle in basal and GSD conditions in homozygous PTG knockout mice (PTG-KO).

Methods: We used 10 C57BL/6J *mice* (WT) and 10 PTG-KO maintained in standard conditions (22 ± 1°C; L:D 12:12). Vigilance states were recorded and visually scored during 24 hr of baseline and during 6 hr of GSD (ZT0-ZT6) followed by 6 hr of recovery. The spectral analysis of sleep EEG was performed. Glycogen was biochemically assayed in different brain regions in baseline conditions and following GSD.

Results: Cortical and hippocampal glycogen levels were extremely reduced (−77 ± 1.5%; −75.7 ± 2.3% respectively) in PTG-KO. During the dark period of baseline, PTG-KO displayed a more fragmented wakefulness with a significant increase in the number of slow wave sleep episodes (+26.1 ± 8%; $p < 0.05$) and a shortening of waking episodes duration (−21.6 ± 7.2%; $p < 0.01$). While no quantitative change of paradoxical sleep (PS) was observed, a significant increase in the power of the theta band (7–8.5 Hz) was present in PTG-KO during this state. Following GSD, PTG-KO did not display significant PS rebound despite maintaining of glycogen levels in brain.

Conclusions: The drastic decrease of glycogen content induced by the blockade of PTG synthesis affected the maintenance of wakefulness during the active period. Together with the impaired homeostatic regulation of PS following GSD, these results might indicate an involvement of glycogen metabolism for sustained cortical activation. Interestingly, the increase in theta power in baseline PS observed in PTG-KO also underlines a link between glycogen and PS regulation that warrants further investigation.

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P595 | Acoustic modulation of slow-wave sleep in rats: effect of boosting or inhibiting delta activity in SWS on motor learning

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Objectives/Introduction: Slow oscillations (SOs), the hallmark of slow-save sleep (SWS), play a major role in sleep-dependent memory formation, including learned motor tasks. SOs consist of an upstate where neurons have an increased excitability, followed by a downstate where neurons are silenced. Previous studies in humans established that targeting auditory pulses to SOs' upstate - in-phase modulation - constitutes a privileged time window for improvement in memory reactivation, whereas intervening SOs' downstate - out-of-phase modulation - seems to disrupt slow oscillatory patterns and diminish recall performance. We hypothesize that in-phase acoustic stimulation in healthy rats during motor training by pellet reaching task can increase SWS activity, which translates into enhanced learning of motor skills, whereas out-of-phase stimulation offers the opposite effect.

Methods: A newly auditory closed-loop protocol for rodents was established to target SOs' upstate or downstate phases and deliver clicks of pink-noise (25 ms, 35 dB) with 8 ms jitter. In our model, sleep is recorded by electroencephalography/electromyography while acoustic stimulation is applied in two conditions: to enhance or disrupt SOs and ultimately modulate deep sleep. No noise is presented in a third condition as control. For that, a real-time NREM detection feature (RMS [δ (0.1–2 Hz)/β(20–30 Hz)] ∧ RMS [EMG (10–1,000 Hz)]) runs alongside a predictive phase-locked loop (1 Hz band target) as a derivative function of endogenous signal individually.

Results: Closed-loop acoustic stimulation is fully established in rats. In-phase closed-loop acoustic stimulation can increase delta-power up to a median of 15% (IQR = −5.8% to 18.4%, $p = 0.07$, $n = 5$) without altering sleep amount (two-way ANOVA, $p > 0.05$, $n = 5$). Primary data comparison shows increases up to 79% (paired *t*-test, $p < 0.001$, $n = 5$). In & out-of-phase acoustic stimulation can be used to modulate memory consolidation in the single-pellet reaching task. Animal experiments are ongoing.

Conclusions: In-phase acoustic stimulation can increase slow wave activity while out-of-phase hasthe opposite effect in rats. These conditions can be used to modulate memory consolidation in rats on the single pellet reaching task.

Disclosure: Nothing to disclose.

P596 | Extended photoperiod alters sleep, circadian rhythmicity and expression of synaptic pasticity-associated genes. The impact of blue-enriched light

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Objectives/Introduction: Light can have complex effects on the brain. It has been suggested that blue-enriched light promotes alertness in both humans and rodents through signaling via intrinsic photosensitive retinal ganglion cells. The brain's ability to maintain cognitive alertness depends on sleep, circadian rhythmicity and synaptic plasticity - an increase or decrease in synaptic strength in response to neural activity patterns. Here we use a model of prolonged photoperiod (20 hr light, 4 hr dark; 20:4 LD) of two different light spectra (white and blue-enriched) to characterize the effects of an extended photoperiod on sleep, circadian rhythmicity and synaptic plasticity-associated genes important for mood and cognition in rats.

Methods: For telemetric recording of the circadian rhythm (body temperature, BT) and sleep (electroencephalogram and electromyogram), rats (n = 6/group) were housed in standard 12:12 LD condition, followed by exposure to 7 days (E7) of extended photoperiod (20:4 LD) in either white or blue-enriched light conditions. Tissue from a separate set of animals (n = 10/group) was collected on E7 at ZT12, from anterior cingulate cortex (ACC; implicated in mood regulation) and prefrontal cortex (PFC; implicated in mood and cognitive performance). Tissue samples were analyzed with qPCR for expression of immediate early response genes implicated in synaptic plasticity (Arc, KLF10 and NPAS4), and compared to time-matched 12:12 LD controls.

Results: At E7, the circadian rhythm of BT remained at 24 hr, but the acrophase was shifted to co-occur with the dark phase. Only white light increased total sleep time (white: 8.9 ± 3.6%, p = 0.004 vs. blue: 3.6 ± 1.5%, p = 0.155) and time in slow-wave sleep (SWS) (white: 8.9 ± 3.7%, p = 0.014 vs. blue: 4.1 ± 1.7%, p = 0.193) compared to baseline. Independently of spectral qualities, expression of Arc (ACC and PFC; $t's_{(15–18)} > -3.74$, $p's < 0.002$) and KLF10 (ACC; $t's_{(17–18)} > -2.51$, $p's < 0.02$) was decreased. NPAS4 was decreased in the blue-enriched condition only (PFC; $t_{(15)} = -3.53$, p = 0.003).

Conclusions: Extended photoperiod disrupted the acrophase of body temperature. Blue-enriched light inhibited an increase in sleep parameters observed in white light condition. Furthermore, the effect on synaptic plasticity markers depends on the spectral quality and brain regions central for mood-regulation and cognition.

Disclosure: Nothing to disclose.

P597 | Variability in habitual nighttime sleep predicts white matter integrity of neural impulsivity network

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Objectives/Introduction: We examined whether habitual sleep time differences between weekdays and weekends were associated with white matter integrity in tracts connecting ventral striatum (vSTR) and ventromedial prefrontal cortex (vmPFC), which relate with impulsive behavior.

Methods: Participants were part of a cohort follow-up study since infancy. Bedtime (BT) and wake-up time (WT) for weekdays and weekends were detected by an automated method applied to actigraphic data recorded for a week. Differences in BT and WT between weekend and week days were categorized based on the median of their distribution. Through diffusion tensor imaging studies, tracts connecting vSTR-vmPFC were identified by FSL (FMRIB Software Library) probabilistic tractography to estimate white matter integrity parameter [fractional anisotropy, mean (MD), axial and radial diffusivities]. Linear Regression and univariate GLM including sex as covariate were used for data analysis.

Results: Thirty-two participants were included, 41% were female and mean age was 21.7 ± 1.9 years. Mean BT and WT were: (a) weekdays: 1:06 am ± 1.3 hr and 09:25 am ± 1.7 hr and (b) weekend: 2:05 am ± 1.9 hr and 10:23 am ± 2.1 hr. Median BT and WT difference between weekend and week days were: 0.8 ± 2.4 hr and 0.5 ± 2.4 hr. Significant results were found for MD, later WT on weekends was related with decreased MD ($\beta = -0.374$, $p < 0.05$) values in vSTR-vmPFC tracts. Compared to WT on weekdays, participants who delayed ≥0.8 hr their WT on weekends ($F(1,30) = 3.8$; p = 0.05) showed lower MD values relative to those who delayed <0.8 hr or even wake-up earlier on weekends (0.723 vs. 0.745×10^{3}; p = 0.05).

Conclusions: This study shows a relationship between difference in nighttime sleep length during weekdays and weekends and white matter integrity in young adults. Participants who extend their sleep on weekends presented greater white matter integrity (lower MD values) in vSTR-vmPFC tracts. Since this neural network relate to impulsivity, our results may help understand the link between sleep and impulsive behavior.

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Disclosure: Nothing to disclose.

P598 | Local non-REM sleep enabled through heterogeneous thalamic burst propensity

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Objectives/Introduction: Sleep is a global vigilance state, yet its cerebral correlates are locally heterogeneous. We explore the expression of locally different sleep features and investigate their underlying cellular and circuit mechanisms, as well as their relevance for local circuit function.

Methods: We record in mice (n = 22) the palette of regional activities in-vitro within the major thalamic rhythm pacemaker (the thalamic reticular nucleus TRN), and the local variations of sleep oscillations in multiple cortical areas in-vivo.

Results: We identify TRN $Ca_V3.3$ calcium channels as a molecular source for cortical heterogeneity in mouse non-REM sleep. $Ca_V3.3$-channels enabled a graded form of repetitive burst discharge: strongest in somatosensory, intermediate in auditory, and weak in non-sensory sectors of the TRN. In undisturbed sleep, the corresponding somatosensory (but not auditory and prefrontal) cortices, showed fast, strong and locally synchronous sleep spindles. Without $Ca_V3.3$ channels, somatosensory areas expression in delta waves was enriched, and spindles became homogenous across sensory and non-sensory cortices. Furthermore, the tight locking of fast spindles to the upstate of cortical slow-oscillation was disrupted. Finally, we recently obtained evidence that the effects of Cav3.3 gene deletion can be reproduced by pharmacogenetic inhibition of TRN cells.

Conclusions: Here, we unravel the critical role of the thalamus in shaping local heterogeneities of non-REM sleep and in imposing forms of spindle-enriched sleep in the major sensory modality of mouse.

Disclosure: Nothing to disclose.

P599 | Thalamic dual-control of sleep and wakefulness

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Objectives/Introduction: Slow-waves (0.5–4 Hz) predominate in the cortical electroencephalogram during non-rapid eye movement sleep (NREM) in mammals. They reflect the synchronisation of large neuronal ensembles alternating between active (UP) and quiescent (DOWN) states and propagate along the neocortex. However, the thalamic contribution to cortical UP-states and sleep modulation remains unclear.

Methods: We used wild-type freely bahaving mice chronically implanted with multisite optrodes in thalamus and cortex. Sleep was recorded during the dark period.

Results: Using multisite tetrode recordings in freely behaving mice, we show that spontaneous centromedial thalamus (CMT) neuronal firing is phase advanced to global cortical UP-states, as well as NREM-to-Wake transitions but not temporally-locked to sensory thalamic neuronal firing. Optogenetic tonic activation of CMT neurones induces rapid NREM-to-Wake transitions, whereas burst activation mimics UP-states in the cingulate cortex (CING) and enhances brain-wide synchrony of cortical slow-waves during sleep, through a thalamic relay located in the antero-dorsal thalamus (AD). Finally, we demonstrate that both CMT and AD relay neurones are critical for the traveling of slow-waves and recovery of sleep.

Conclusions: These findings suggest that tuning of CMT neuronal firing alone can modulate brain-wide cortical activity during sleep and provides dual control of sleep-wake states.

Disclosure: Nothing to disclose.

P600 | Volume of subcortical brain areas is associated with sleep macrostructure in healthy young individuals

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Objectives/Introduction: Human sleep is highly dependent on subcortical areas. How difference in the structural characteristics of these areas affect sleep is not established. These types of issues are difficult to address with standard neuroimaging neuroimaging techniques. Here, we employed a tool that allows to predict brain volumes of different brain subcortical regions based on full genome genetic variations and we assessed the associations between these predicted brain regional volumes and sleep architecture in young individuals.

Methods: Electroencephalography of 200 healthy young male volunteers (aged 18–31 years, mean = 22.07 ± 2.71) was recorded during an 8 hr baseline sleep. Sleep architecture was extracted from automatic sleep scoring (Aseega, Physip). Blood sample were collected in all participants to assess common Single Nucleotides Polymorphisms (SNPs) over the entire genome. ENIGMA's genome-wide association meta-analyses (http://enigma.ini.usc.edu/research/download-enigma-gwas-results/) was employed to predict the intracranial volumes and volume of 7 different subcortical brain regions.

Results: Linear correlations reveal significant associations between sleep metrics and 2 predicted feature of brain volume. Predicted

intracranial volume was significantly linked to the sleep efficiency (r = –0.16, p = 0.027) and the percentage of REM sleep (r = –0.15, p = 0.035). Furthermore, the predicted volume of the nucleus accumbens was significantly associated with the percentage of the N2 sleep (r = –0.18, p = 0.014) and the percentage of the REM sleep (r = 0.14, p = 0.044).

Conclusions: Our preliminary results show that one can predict unassessed brain volume feature and relate then to measure sleep phenotypes. They suggest that predictions of entire brain volume and nucleus accumbens volume are linked to sleep architecture.

Disclosure: FNRS, ULiège, ARC, FEDER, Welbio, FMRE, Clerdent Foundation.

P601 | IL-1β, IL-6 and TNF-α, induced by upper airway resistive breathing, downregulates respiratory controller response to hypercapnic stimuli

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Objectives/Introduction: Upper airway resistive breathing remains a hallmark of Obstructive Sleep Apnea Syndrome. Upper airway resistive breathing induces IL-1β, IL-6 and TNF-α in the diaphragm, the lung and plasma. Our aim is to investigate the role of these cytokines, induced by resistive breathing, on the respiratory controller output.

Methods: 8 IL-1β deficient mice (IL-1$\beta^{-/-}$), 8 IL-6 deficient mice (IL-6$^{-/-}$), deficient mice (TNF-$\alpha^{-/-}$) where used, together with 8 appropriate wild type (WT) controls (C57/BL6), all males 8 to 10 weeks old. All mice were subjected to whole body plethysmography (WBP) to assess ventilatory responses during exposure to the following mixtures: 21% O_2–79% N_2, 100% O_2, 7% CO_2–93% O_2, 7% CO_2–21% O_2–72% N_2, 7% CO_2–10% O_2–83% N_2, 3% CO_2–10% O_2–87% N_2 και 10% O_2–90% N_2. After all mice underwent tracheal banding (TB), a procedure to reduce their trachea surface by 50% and thus to induce upper airway resistive breathing. A final WBP followed after 24 hr.

Results: The WT control mice that underwent TB presented lower Minute Ventilation responses by 71.8% and 73.2% at gas mixtures 7% CO_2–10% O_2–83% N_2 and 3% CO_2–10% O_2–87% N_2 respectively. The TNF-$\alpha^{-/-}$ mice presented lower Minute Ventilation (MV) responses by 50.6% and 45.5% for the same gas mixtures (p = 0.043 and p = 0.044 respectevly, compared to WT controls). The IL-6$^{-/-}$ mice presented lower MV responses by 46.8% and 46.9% for the same gas mixtures (p = 0.022 and p = 0.022 respectevly, compared to WT controls).

Conclusions: IL-1β, IL-6, TNF-a induced by upper airway resistive breathing, due to tracheal banding, downregulate the Minute Ventilation respiratory controller response for hypercapnic stimuli.

Disclosure: Nothing to disclose.

P602 | Carotid Body Deafferentiation in mice with upper airway resistive breathing downregulates respiratory controller response to hypoxic stimuli

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Objectives/Introduction: The carotid body, a well-recognized peripheral chemoreceptor, is one of the three main afferent neural pathways which contribute to the control of breathing (together with the phrenic nerve and the vagus nerve). Our aim is to investigate the role of resistive breathing, on the respiratory controller output, via the carotid body.

Methods: 16 appropriate wild type mice (WT, C57/BL6), all males 8 to 10 weeks old, divided in two groups each (n = 8). All mice were subjected to whole body plethysmography (WBP) to assess ventilatory responses during exposure to the following mixtures: 21% O2–79% N2, 100% O2, 7% CO2–21% O2–72% N2, 7% CO2–10% O2–83% N2 and 10% O2–90% N2. After 24 hr each of the two groups underwent one of two following operations: Carotid Body Deafferentiation (CBD, bilateral dissection of the carotid sinus nerve) or a sham operation. After 48 hr all mice underwent tracheal banding, a procedure to reduce their trachea surface by 50% and thus induce resistive breathing. A final WBP followed after 24 hr.

Results: WT mice that underwent the sham operation exhibit statistical significantly higher minute ventilation (MV) responses (presented as % change compared to the MV response to the to 21% O2–79% N2 roomair gas mixture) for the 7% CO2–10% O2–83% N2 and 10%O2–90% N2 gas mixtures, compared to the WT mice that underwent CBD (p = 0.007 and p = 0.008 respectively). Gas mixtures 100% O2 and 7% CO2–21% O2–72% N2 didn't show statistical significant differences between MV responses of the group that underwent CBD compared to the sham operation (p = 0.56 and p = 0.36 respectively).

Conclusions: Resistive breathing, due to tracheal banding, downregulates the respiratory controller MV response for hypoxic stimuli, via the carotid body.

Disclosure: Nothing to disclose.

P603 | Diurnal changes in Glutamate levels from childhood to adulthood assessed by Magnetic Resonance Spectroscopy

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Objectives/Introduction: In healthy young adults, we recently demonstrated that ^{1}H-MR spectroscopy is a sensitive tool to measure diurnal changes in Glutamate + Glutamine (GLX) levels. More specifically, GLX showed a decrease from evening to morning and this decrease was correlated with the decrease in EEG slow wave activity (SWA), suggesting a relationship between GLX and the recovery function of sleep. Because sleep undergoes maturational changes during development, we examined the changes in GLX in children and adolescents.

Methods: In an ongoing study, MR spectra of 14 healthy children/adolescents (4 female, 12.4 ± 1.7 years) were measured in the left parietal lobe in the evening around two hours before a night of sleep and in the subsequent morning around two hours after lights on using a 3 T MRI scanner. GLX concentrations were quantified as ratios to Creatine with LC Model and compared to GLX levels of 16 healthy adults (6 female, 21.3 ± 2.2 years) who were measured using the same protocol.

Results: Our preliminary analyses show that compared to adults, children did not show a significant change in GLX levels from evening to morning (p = 0.3). Pooling all data (n = 30), we found a positive association between age and the diurnal changes in GLX (p = 0.001, r = 0.56). Between group analysis revealed that evening GLX levels did not differ (p = 0.1), but morning levels differed significantly (p = 0.003).

Conclusions: These preliminary results indicate that an overnight reduction in GLX might be age dependent and may suggest that there is a developmental change in the regulation of GLX during sleep.

Disclosure: Nothing to disclose.

CHRONOBIOLOGY & CIRCADIAN RHYTHMS 3

P604 | Heart rate variability and its circadian variation in patients with disorders of consciousness: a diagnostic tool?

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Objectives/Introduction: Current research suggests that the integrity of circadian temperature or activity rhythms is related to consciousness levels in patients with disorders of consciousness (DOC). Until now however, little attention has been paid to circadian variations of cardiac activity in DOC patients. In healthy individuals, heart rate variability (HRV) changes across the sleep-wake cycle and has been suggested to reflect the ability of individuals to react adequately to changes in the environment. We thus investigated day-to-night variations in HRV and how they relate to the diagnosis of DOC patients as assessed with the Coma Recovery Scale-Revised (CRS-R).

Methods: Long-term (24–48 hr) polysomnography including 3-lead electrocardiography was recorded in 11 DOC patients (6 in vegetative state/unresponsive wakefulness syndrome [VS/UWS], 5 in a minimally conscious state [MCS]) and in 3 healthy controls. Light levels in the patient rooms were <500 lux during day (7 am–9 pm) and <10 lux during night (9 pm–7 am). We computed non-parametric rank-based tests to identify group differences (VS/UWS, MCS, controls) in HRV as well as correlations between CRS-R scores and HRV parameters. Results with $p < 0.05$ were considered significant, $p < 0.1$ denoted a trend.

Results: Results indicate that the interbeat variability during day differentiated between diagnoses (i.e. VS/UWS, MCS, controls) (p = 0.016). Specifically, VS/UWS patients had a significantly lower interbeat variability than MCS patients (p = 0.035) and controls (p = 0.035). MCS patients showed by trend a lower interbeat variability than controls (p = 0.090). Moreover, higher CRS-R arousal scores were associated with higher sympathetic activity during the day as measured by very low frequency power (VLF, 0.003–0.04 Hz; p = 0.026). Interestingly, MCS but not VS/UWS patients presented by trend an increase in parasympathetic activity during the night as measured by high frequency power (HF, 0.15–0.4 Hz; p = 0.068).

Conclusions: The results suggest that patients with higher consciousness levels generally have a higher HRV and more pronounced circadian differences. They thus seem to be able to better adapt to environmental changes and their autonomic nervous system appears to follow the circadian cycle more adequately.

Our findings render HRV parameters an interesting tool to learn more about the state of severely brain-injured patients.

Funding: FWF Y-777.

Disclosure: Nothing to disclose.

P605 | Sleep, chronotype and social jet lag in a sample of Portuguese college students

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Objectives/Introduction: Sleep plays a critical role in health and psychosocial functioning. A decrease in sleep quality and quantity has been associated with worse health outcomes. The current study probed the relationship between sleep, chronotype and health status in a Portuguese sample of college students.

Methods: 396 young adults (24.65 ± 5.67 years (mean ± SD), age range 18–35 years; 57.6% females) completed an online questionnaire including sociodemographics(age, body mass index (BMI)), behavioral characteristics (use of caffeine, alcohol, cigarettes), and questionnaires/scales to assess chronotype and sleep quality: the Morningness and Eveningness Questionnaire (MEQ), the Munich ChronoType Questionnaire (MCTQ), the Pittsburgh Sleep Quality Index (PSQI) and the Epworth Sleepiness Scale (ESS). Means and standard deviations were calculated for continuous variables, frequencies and percentages were calculated for categorical variables. Bivariate correlations between the independent variables (e.g., social jet lag - the difference in the midpoint of sleep between work days and free days) and dependent variables of interest (e.g., BMI) were examined

Results: Sleep duration was 7:55 ± 1:26 hr:min and 8:53 ± 1:39 hr:min during work days and free days, respectively, with 11.4% of participants sleeping 6 hr or less on work days. MEQ-based chronotype distribution was 2.8% for extreme eveningness, 23% for moderate eveningness, 63.1% for intermediate, 5.8% for moderate morningness, and 5.3% for extreme morningness. The averaged daytime sleepiness was 7.87 (±4.57) (34.3% of participants with excessive daytime sleepiness, i.e. ESS³10), mean social jet lag was 1.04 ± 1.13 hr:min. BMI was negatively associated with sleep duration (r = –0.112, p = 0.026). Cigarettes consumed was negatively associated with sleep duration (r = –0.301, p = 0.032) and with daytime sleepiness (r = 0.310, p = 0.027). Caffeine intake was negatively associated with sleep duration (r = –0.151, p = 0.010) and positively associated with BMI (r = 0.188, p = 0.001). Eveningness was positively associated with caffeine intake (r = 0.123, p = 0.042). Furthermore, social jet lag was positively associated with daytime sleepiness (ESS; r = 0.14, p = 0.005) and with evenigness scores (MEQ; r = 0.125, p = 0.016).

Conclusions: These findings confirm the impact of sleep duration and quality on behavioral measures associated with health and quality of life in college students. Future studies should test the impact of sleep duration and quality in academic achievement and psychosocial adjustment in this population.

Disclosure: Nothing to disclose.

P606 | Daytime sleepiness, salivary cortisol and melatonin levels during 4-week blue light blockade. Do we adapt?

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Objectives/Introduction: Blue light (BL, short wavelength, ca. 480 nm) is known to influence circadian rhythm system, alertness, cognitive and affective functioning of humans. In this experiment we limited the BL exposure to approximately 10%, by providing the participants with amber contact lenses - to be used continuously during 4 weeks. It may be hypothesised that reduced BL stimulation would result in lowered general alertness and weaker suppression of melatonin (its higher levels) and its earlier onset time.

Methods: The participants were 19 healthy volunteers (11 women), aged 23.58 ± 2.76 years; extreme chronotypes excluded. Their declared sleep was longer than 6.5 hr and PSQI (Pittsburgh Sleep Quality Index) lower than 5 pts. (mean 3.00 ± 1.16). Here we report observations of their daytime sleepiness assessments (Epworth Sleepiness Scale) as well as salivary cortisol and melatonin levels. Additionally, actigraphy recordings (MotionWatch8) were analysed.

Results: There were no differences in dim light melatonin onset, but a slight increase in the mean evening level of saliva melatonin appeared after 4 weeks of BL blockade: from 13.76 to 15.80 pg/ml (t = 2.023, p = 0.059). Cortisol pattern (mean morning level, CAR, evening level) did not show any alterations. Total ESS score did not differ significantly between baseline and BL blockade conditions (although item 1 of ESS, i.e. chance of dozing while "sitting and reading" exhibited significant increase during BL blockade; $p < 0.03$). No difference was observed in timing and length of sleep (7 hr 27 min vs. 7 hr 21 min).

Conclusions: There are two possible interpretations of our results: - people adapt quickly to lowered levels of BL and even low exposure (10% of the regular level) to BL may regulate circadian rhythmicity of sleep and hormones' secretion; - the impact of social *zeitgebers* is so strong (in everyday life) that sleep-wake timing stays constant and this regulates an overall rhythm. Those results relate only to alertness indices; cognitive and affective aspects of human functioning in BL blockade require further exploration.

Disclosure: Nothing to disclose.

P607 | Two dimensions of chronotype - some personality, mood, and behavioural correlates of subjective circadian phase and amplitude

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Objectives/Introduction: Chronotypes is usually defined with preferred sleep timing and 'feeling best time', i.e. morning-evening orientation, or 'subjective phase'. Chronotype Questionnaire proposes to supplement the picture with self-assessment of circadian amplitude. This scale relates to stability of sleep-wake pattern, ability to overcome drowsiness or to take a nap at a given moment of the day, diurnal variability of mood, sensitivity to external synchronisers (*zeitgebers*), and time awareness. Eveningness has been identified as a risk factor for some problematic behaviours and vulnerability to various psychopathologies (like seasonal, unipolar and bipolar affective disorders). Does the distinctness of the rhythm also play role?

Methods: Here we set up together three independent studies which linked morningness-eveningness and amplitude dimensions with personality, affective and behavioural issues, analysed in various age-social groups. The methods included Positive and Negative Affect Schedule, Ten Item Personality Inventory, General Procrastination Scale, Coping Inventory for Stressful Situations.

Results: Study I: 334 graduates and undergraduates, aged 21–30 years (mean 24.86, SD 2.56). Larger subjective amplitude was associated with lower positive affectivity and higher negative affectivity (PANAS); the correlations were much stronger ($p < 0.001$) than those of eveningness and affectivity ($p < 0.06$). Study II: 179 corporate workers (118 females; mean age 25.66, SD 6.61). Both eveningness and large amplitude correlated significantly ($p < 0.03$) with procrastination (GPS), emotional instability and low consciousness (TIPI). Study III: 143 young adults (119 females; mean age 23.15, SD 3.69); analysis of strategies of coping with stress (CISS). Subjective amplitude correlated negatively with strategy focused on problem solving, and positively with emotion regulation and avoidance strategy ($p < 0.04$).

Conclusions: It seems that subjective amplitude is a valuable supplementation of chronotype description, as its scores correlate significantly with personality factors, mood, and behavioural tendencies (procrastination, coping). The links are at least as strong as those, widely described in the literature, consequences of morningness-eveningness.

Disclosure: Nothing to disclose.

P608 | Human iPSC-derived fibroblasts as a model to investigate genetic and epigenetic contributions to regulation of circadian rhythms

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Objectives/Introduction: Circadian rhythms are expressed at different levels, from behavioural to cellular rhythms. Across tissues, these rhythms are related. For example, cellular rhythms measured in human primary skin fibroblasts correlate with human behavioral chrononotype: people whose cellular oscillations have longer period length have significantly later chronotypes. In healthy subjects, genetic variations partially explain these differences in the speed of cellular oscillations. However, in animal models environmentally driven epigenetic modifications also play a strong role, and it is reasonable to assume that the same might be true in humans. A growing body of evidence shows that circadian dysfunctions are related to many diseases, from diabetes to neurodegenerative disorders. We hypothesize that disease-related epigenetic modifications have important influence upon circadian rhythms. The aim of this study is to assess the contribution of genetic vs. epigenetic variations to clock function in human cells.

Methods: Induced pluripotent stem cells (iPSCs) provide a unique system to distinguish genetic vs. epigenetic effects, since epigenetic changes (as well as clock function) are erased in iPSCs. By comparing clock properties between fully genotyped skin fibroblasts and iPSC-derived fibroblasts from the same subject, we were therefore able to quantify genetic and epigenetic influence upon circadian rhythms. Cellular oscillations re measured by transducing the cells with lentivirus carrying a circadian reporter.

Results: In collaboration with the StemBANCC consortium, we first characterised rhythms in primary skin fibroblasts collected from different patients: diabetes (71 patients), Alzheimer's disease (22), Parkinson disease (147), bipolar disorder (39), neuropathy (44), and control (33). We found that especially in the neuropathy group, many lines of primary skin fibroblasts had very low amplitude rhythms and in some cases even lost the rhythms. Rhythms were then compared with those of iPSC-derived fibroblasts from the same subjects, and significant variance was detected in the circadian properties of primary and iPSC-derived fibroblasts. High-throughput characterization of genetic and epigenetic differences correlated across cell lines from different individuals will be used to identify possible sources of this variance.

Conclusions: Our results suggest that cellular circadian oscillations are affected by disease state. iPSC-derived fibroblasts point to both cell-intrinsic (i.e. genetic) and acquired (i.e. epigenetic) characteristics explaining these differences.

Disclosure: Nothing to disclose.

P609 | Validation of the French version of Children's Chronotype Questionnaire in school-aged children: a study in Luxembourgish population

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Objectives/Introduction: Human behaviour diferences are determined by factors such as the circadian phase preference. Adults have been well examined concerning performance variation during the work schedules depending on chronotype. However there is a serious gap on research of children respecting the evaluation and understanding of their sleep patterns, specifically referring the chronotype variability. The main goal was to validate the Children's Chronotype Questionnaire (CCTQ, Werner, LeBourgeois, Geiger et al., 2009) for French language and to identify chronotype and specific sleep habits differences of young children of Luxembourgish schools, according to age and different school schedules.

Methods: After completing the procedure for the adapation of the CCTQ to the French Language, the instrument was administrated, during a 2 month-period, to the parents of 173 children, aged between four and 11 years old, in Luxembourg. The CCTQ measures the sleep and wake behaviours in three specific levels/scales with a total of 27 items: midsleep phase (duration of sleep time) for free days and school days (1), morningness and eveningness (M/E) (2), and chronotype (3).

Results: The CCTQ presented good internal consistency (α 0.70) but lower compared to the original version (0.81). Correlation coefficients were positively high (r = 0.91). Children showed different punctuations considering the M/E (58 morning type, 66 evening type, the other subjects were identified as intermediate type) being that the morning type demonstrated lower midsleep phase (a difference of 23 min) with statistical significance compared to the evening type subjects (n = 173, p = 0.017, η^2 0.06). Their sleep habits significantly differ ($p < 0.05$) regarding awake and sleep behaviors and schedule preferences considering age (p = 0.000, η^2 0.83) - mostly between four and 10 yr old - and considering school timetables (p = 0.009, η^2 0.136) - mostly between children attending to the full day school timetable (that includes classes during both morning and afternoon, differently from the other two timetables: only morning or only afternoon).

Conclusions: This study presents the first validated French version of the CCTQ and highlights that chronotype of children should be strongly considered by valid measures such as the CCTQ to understand how to implement more adequate timetables for testing in specific academic areas.

Disclosure: Nothing to disclose.

P610 | Not all circadian disruption protocols are created equal

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Objectives/Introduction: Light is the primary entraining cue for the circadian system, adjusting biological time to the external environment, however it also has direct effects on arousal and sleep. The demands of our modern 24/7 society, with increasing exposure to artificial light at inappropriate times of day, is widely considered to be detrimental to our physiology. Evidence comes from studies using aberrant light/dark (LD) cycles to produce circadian disruption in mouse models. A range of different protocols have been used, including constant light (LL), jet-lag (JL), dim light at night (DLAN), and non-24 hr LD cycles (T-cycles). To date, no detailed comparison of the effects of these different protocols has been conducted.

Methods: We used passive infra-red (PIR) sensors to simultaneously measure activity and immobility-defined sleep in wild-type C57BL/6J mice under different protocols, including LL, JL, DLAN and T20 (10 hr light: 10 hr dark). We compared the effects of these different protocols on commonly used measures of circadian disruption including periodogram power (Qp), intradaily variability (IV) and interdaily stability (IS), as well on the architecture of immobility-defined sleep.

Results: Different LD conditions produced different effects on circadian activity. Whilst IV is increased and IS were decreased under all conditions (n = 24, IV ANOVA $F(1,20) = 28.8$ $p < 0.0001$, IS ANOVA $F(1,20) = 295.6$, $p < 0.0001$) decreases in Qp were only observed under LL and T20 (LL $p < 0.0001$, T20 $p = 0.0053$). All conditions change the distribution of immobility-defined sleep. Moreover, the effects of some protocols persisted after animals were returned to normal LD conditions.

Conclusions: Our data suggests that commonly used protocols exert different effects on sleep and circadian rhythms. These data provide a framework to understand the effects of these protocols on other biological processes such as cognition.

Disclosure: Nothing to disclose.

P611 | Chronotypes differ influence in the weekday/weekend variability of pain in patients with fibromyalgia

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Objectives/Introduction: Chronotypes have been associated with pain. Pain is dynamic and change day to day by individual difference. However, little is known about the pain lever between weekday/weekend in patients with fibromyalgia among difference chronotype.

Therefore, the aim of this study was to investigate the relative contributions of chronotypes and weekday-to-weekend differences to the variability of pain in patients with fibromyalgia.

Methods: We constructed a cross-sectional study and recurred patients with fibromyalgia according to the 2010 American College of Rheumatology criteria and Polysymptomatic Distress Scale (PDS) score ≥13. Participants' will be excluded if they have any of the following: (1) age ≤18 years old; (2) shift work; Pain was assessed by the Visual Analogue Scale (VAS) and participants recorded pain scores seven consecutive days at same time (before sleep). Weekdays were defined from Sunday to Thursday and weekends was from Friday to Saturday. Participants' chronotypes were determined using the Morningness/Eveningness Questionnaire (MEQ). Demographic data and health-related factors were also assessed as potential confounding factors. A generalized estimating equations (GEE) will be used to test the whether MEQ score had a significant effect on the pain between weekdays and weekends.

Results: Among 80 patients with fibromyalgia included in the study, 11 (13.75%) were classified into a morning type (M-type) group, 25 (31.25%) were classified into a nither type (N-type) group, and 44 (55%) were classified into an evening type (E-type) group. The median age M-type group higher than E-type. The sex, employment status, FIQR, CPSQI, exercise habits, and analgesics use were not sing significantly difference among in those chronotypes groups. The mean of pain score were 4.9, 5.0, and 5.6 in M-type, N-type, and E-type groups, respectively, on weekdays, and the mean of pain score were 4.6, 5.3, and 5.7 in M-type, N-type, and E-type groups, respectively, on weekends. The interaction effect between difference chronotypes and weekdays/weekends for pain was significantly difference $\beta = 0.52$; SE = 0.26 ($p = 0.04$) after adjusting for age and employment status.

Conclusions: Chronotype could be influence variability of pain in patients with fibromyalgia, regardless of weekday/weekend.

Disclosure: Nothing to disclose.

P612 | Chronotypes differ influence in the weekday/weekend variability of pain in patients with fibromyalgia

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Objectives/Introduction: Chronotypes have been associated with pain. Pain is dynamic and change day to day by individual difference. However, little is known about the pain lever between weekday/weekend in patients with fibromyalgia among difference chronotype. Therefore, the aim of this study was to investigate the relative contributions of chronotypes and weekday-to-weekend differences to the variability of pain in patients with fibromyalgia.

Methods: We constructed a cross-sectional study and recurred patients with fibromyalgia according to the 2010 American College of Rheumatology criteria and Polysymptomatic Distress Scale (PDS) score ≥13. Participants' will be excluded if they have any of the following: (1) age ≤18 years old; (2) shift work; Pain was assessed by the Visual Analogue Scale (VAS) and participants recorded pain scores seven consecutive days at same time (before sleep). Weekdays were defined from Sunday to Thursday and weekends was from Friday to Saturday. Participants' chronotypes were determined using the Morningness/Eveningness Questionnaire (MEQ). Demographic data and health-related factors were also assessed as potential confounding factors. A generalized estimating equations (GEE) will be used to test the whether MEQ score had a significant effect on the pain between weekdays and weekends.

Results: Among 80 patients with fibromyalgia included in the study, 11 (13.75%) were classified into a morning type (M-type) group, 25 (31.25%) were classified into a nither type (N-type) group, and 44 (55%) were classified into an evening type (E-type) group. The median age M-type group higher than E-type. The sex, employment status, FIQR, CPSQI, exercise habits, and analgesics use were not sing significantly difference among in those chronotypes groups. The mean of pain score were 4.9, 5.0, and 5.6 in M-type, N-type, and E-type groups, respectively, on weekdays, and the mean of pain score were 4.6, 5.3, and 5.7 in M-type, N-type, and E-type groups, respectively, on weekends. The interaction effect between difference chronotypes and weekdays/weekends for pain was significantly difference $\beta = 0.52$; SE = 0.26 ($p = 0.04$) after adjusting for age and employment status.

Conclusions: Chronotype could be influence variability of pain in patients with fibromyalgia, regardless of weekday/weekend.

Disclosure: Nothing to disclose.

P614 | Investigation of sleep structure with polysomnograhy in the patients with first episode psychosis

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Objectives/Introduction: Sleep researches allow the structure of sleep to be analyzed at macro and micro levels of sleep changes. These researches reveal a different perspective on the understanding of the pathophysiology of schizophrenia. Sleep disturbance in schizophrenic individuals is common among healthy individuals. These disturbances usually occur before the symptoms of the disease and are considered as an important risk factor. In this study, sleep architecture of drug-naive non-affective first episode psychosis patients and healthy controls was investigated, and the relationship between the sleep structure and clinical features of the patients during the active psychotic period and after the active psychotic period was investigated.

Methods: Twenty-one non-affective drug-naive first-episode psychotic patients and 11 of these patients that had been followed for

at least 6 months (with one psychotic episode) and 18 healthy volunteers matched for age and education. Two consecutive night polysomnography studies were conducted in all sample. Positive and Negative Syndrome Scale (PANSS) was administered during the onset of the psychotic episode and ongoing. Sleep consistency and sleep structure variables were compared between patients and healthy groups. Correlation analyzes were performed between patients′ sleep continuity and changes in sleep structure and their clinical characteristics.

Results: Compared to healthy controls, there was an increase in sleep latency ($p < 0.022$) and a decrease in sleep efficacy ($p < 0.004$) in patients with non-affective first-episode psychosis. Patients showed a significant decrease in slow wave sleep ($p < 0.001$). 6th month follow-up of the patients after active psychotic episodes, the variables related to sleep continuity and sleep structure were not different from healthy controls. There was a positive correlation between PANSS positive subscale scores and sleep latency in first-episode psychosis patients, and a negative correlation between PANSS negative subscale scores and slow-wave sleep.

Conclusions: The findings indicate that the decrease in slow-wave sleep in patients with non-affective drug-naive first-episode psychotic patients is significant. The fact that reduced slow wave sleep is associated with negative symptoms in first-episode psychosis patients and that sleep structure returns to normal after a psychotic episode suggests that it may be related to underlying physiopathology of the disease.

Disclosure: Nothing to disclose.

P615 | Phase advance jet lag disorder: results of the JET study

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Objectives/Introduction: The JET study measured the effects of a 5-hr and 8-hr phase advance on nighttime sleep as a model of Jet Lag. Jet Lag Disorder occurs when an individual's circadian rhythms become misaligned due to rapid change in time zone that occurs after rapid transmeridian travel. By simulating such a time zone change in a lab setting, the effects of phase shifting can be studied in the absence of confounders that occur during travel including variable sleep deprivation and light exposure.

Methods: This study investigated multiple interval phase advances in 319 patients (Intervals: 5-hr: $n = 86$; 8-hr: $n = 233$). The phase advance was determined by the patient's usual bedtime and then put to bed either 5 or 8 hr ahead of that bedtime. Sleep was measured by polysomnography (PSG).

Results: A significant difference was demonstrated between the 5 and 8-hr phase advance in SE during each of the three thirds of the night: first third of the night SE (5-hr: 45.5%; 8-hr: 54.1%, $p = 0.02$), second third of the night SE (5-hr: 53.4%; 8-hr: 24.8%; $p < 0.0001$), and third of the night SE (5-hr: 76.8%; 8-hr: 33.3%; $p < 0.0001$).

Conclusions: This study demonstrates that in-lab phase advance can be used to study 5- to 8-hr phase advance Jet Lag as the model was able to show significant differences in PSG-measured sleep efficiency between a 5-hr phase advance and an 8-hr phase advance during each third of the night. These results also support this study design as a model to be used in developing therapeutics for the treatment of phase advance disorders including Jet Lag Disorder.

Disclosure: Nothing to disclose.

P616 | A proposal of circadian markers and indexes for the study of chronodisruption in sleep and circadian pathologies

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Objectives/Introduction: In developed societies, sleep disorders are frequently due to circadian alterations. In turn, sleep alteration commonly leads to chronodisruption. Thus, diagnosis and treatment of circadian and sleep disorders should be jointly addressed. This work proposes several indexes for quantifying the quality of circadian rhythms in different sleep and circadian disorders and in healthy subjects.

Methods: The study included 20 healthy control volunteers (C) and 254 patients: Obstructive Sleep Apnoea (OSA), $n = 12$; Delayed Sleep Phase Disorder (DSPD), $n = 58$ and primary insomnia (PI), $n = 184$. Their rhythms of wrist temperature (T), motor activity (A), body position (P) and light exposure (L) were assessed during one week through Ambulatory Circadian Monitoring (ACM) using a multichanel device (Kronowise®, Chronolab, University of Murcia).

Sleep-wake states were inferred from the integrated variable TAP, (obtained from T, A and P) which expresses general activation. TAP was subsequently analysed by non-parametric analysis to calculate indexes of interdaily stability (IS), intradaily variability (IV) and relative amplitude (RA). From those, a Circadian Function Index (CFI) was obtained to assess circadian robustness. Midsleep time was estimated from the central time of TAP-L5 (5 consecutive hours of lowest values). Environmental synchronization, ES, (synchronization between TAP-L5 and the central time of the environmental dark phase) and internal synchronization among variables (ISync) were also calculated. All these indexes were subject to one-way ANOVAs with between-groups factor *pathology* (PI, OSA, DSPD and C).

Results: Significant differences between PI, OSA, DSPD and C were found in all the indexes (all $ps < 0.05$). C showed greater CFI than the other three groups, while DSPD and OSA exhibited lower

ES than PI and C. DSPD showed the latest TAP-L5, the lowest amount of light exposure during the day and the highest during the night. Finally, the lowest ISync was observed in OSA.

Conclusions: ACM allowed a reliable assessment of circadian disruption in different sleep and circadian pathologies. Our results revealed significant chronodisruption in OSA and DSPD, and confirmed a relationship between circadian desynchronization and an abnormal rhythm of light exposure. As a conclusion, these findings highlight the importance of circadian assessment in sleep medicine.

Disclosure: Nothing to disclose.

P617 | Sleep structure and awakening threshold in delayed sleep-wake phase disorder (DSWPD)

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Objectives/Introduction: We aimed to quantify the awakening threshold (AT) in DSWPD-patients and healthy controls and investigate a possible relationship with sleep stage. A secondary objective was to study habitual sleep structure by polysomnography (PSG) in DSWPD.

Methods: Twenty DSWPD patients (mean age 24.8 years) and 16 controls (mean age 24.4 years) had two nights with PSG in a sleep laboratory. Participants followed their habitual sleep-wake schedule on the first night and a forced sleep-wake schedule (00:00–07:00 hr) on the second night. A custom-made alarm clock was used to measure AT the second morning.

Results: AT was higher in patients than controls; 75.5 dB vs. 72.6 dB, Mann-Whitney $p = 0.01$, and the difference could not be explained by sleep-time differences (ANCOVA). Patients who were in REM sleep upon attempted awakening had a higher AT compared to patients who were in NREM sleep; 80.0 dB vs. 74.7 dB, ANOVA $F = 6.4$, $p = 0.02$. Patients had increased sleep onset latency by PSG during the first laboratory night (20.6 vs. 12.1 min, $p = 0.004$), but no differences were observed for other sleep structure variables.

Conclusions: Difficult early-morning awakening was related to REM sleep in DSWPD-patients, confirming our previously published results from another patient group. Sleep onset problems, even with habitual bedtimes, does also seem be a feature of DSWPD.

Disclosure: Nothing to disclose.

P618 | Comparisons of subjective and actigraphic measurements of sleep between shift-working and daytime psychiatric nurses

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Objectives/Introduction: Shiftwork is known to be one of the common causes of sleep and health problems and finally causes the decreased quality of life. The purpose of this study was to investigate the sleep patterns of shift-working and daytime psychiatric nurses using actigraphy and compare it with subjective assessment for sleep.

Methods: Twenty-three shift-working and 25 daytime nurses were enrolled. They rated their sleep quality using Pittsburgh Sleep Quality Index (PSQI) and other self-rating scales were measured for psychosocial aspects. Actigraphy was applied to the subjects for a total of 7 days to measure the sleep parameters. They also wrote sleep diaries during the period of wearing actigraphy. Sleep-related parameters of actigraphy, global score and components of PSQI, and the results of other self-rating scales were compared between shift-working and daytime nurses.

Results: Although the global score of PSQI did not show significant difference, the PSQI components showed significant differences between two groups: the shift-working nurses showed lower sleep quality, more sleep disturbance and hypnotic medication use, and worsened daytime dysfunction than daytime nurses ($p < 0.01$, respectively). The shift-working nurses showed significantly shorter total time in bed and total sleep time, lower sleep efficiency, and longer average awakening time than those of daytime nurses in actigraphy ($p < 0.05$, respectively).

Conclusions: The results showed that shift-working nurses experienced more sleep disturbances in both subjective and objective aspects of sleep than daytime nurses. This study also suggests that actigraphy may be useful to measure the objective aspects of sleep that are difficult to assess with subjective questionnaires alone.

Disclosure: Nothing to disclose.

P619 | A new monitoring tool for detecting human circadian rhythms: a mathematical approach using a thoracic temperature sensor

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Objectives/Introduction: The 24-hr biological rhythms known as circadian rhythms have been a fast-growing field of research for decades. Recently, the study of circadian rhythms has become important and promising in medical research especially in the field of cancer

treatment. This is due to the fact that perturbations in circadian rhythms have been associated with the progression of cancer and wrongly timed chemotherapy sessions. Nevertheless, the study of the myriad circadian rhythms can be implicative in many areas of research in both biology and medicine. Yet many researchers in biology and medicine are not experts with the implementation and computerization of these mathematical approaches. In this context, this study aims at developing graphical user interface software that comprises Fourier analysis and Cosinor analysis in a clear and systematic manner that aids researchers in studying a set of rhythms including biological rhythms readily with a click of a button.

Methods: We have developed a graphical user interface where it combines two of the powerful tools in analyzing biological rhythms; Fourier analysis and Cosinor analysis. This software is intended for researchers that are acquainted with the concepts of signal processing and mathematical modeling by necessarily experts.

Results: The unprecedented advantage of the developed software is that it computes and displays the results of the two methods side by side allowing the user to decide upon which method is optimal depending on the outcome and error. In this pretext, the monitoring tool includes the calculation of the root mean square error, in addition to residual sum of square RSS, between the data and models, thus giving even more information regarding the comparison between the two analysis method.

Conclusions: The rhythm parameters estimated by both methods can provide useful information to researchers in the field of chronobiology and other field of research involving data series to be analyze.

Disclosure: Nothing to disclose.

P620 | A new monitoring tool to detect an irregular Sleep-Wake circadian rhythm based on the automatic dichotomy index computation

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Objectives/Introduction: The success of chemotherapy treatment is achieved based on "Chronotherapy": the concept of administering the correct drug at the accurate time based on the circadian rhythm study. The objectives of this study were to detect the rest/activity cycle and calculate automatically the dichotomy index (I < O), as both parameters are proved to be reliable indices of the circadian rhythm.

Methods: To achieve our purposes, this study was performed in three phases. Firstly, DARC "Détection Automatique du Rythme Circadien" algorithm was used to segment automatically the rest-activity phases. Then, a Graphical User Interface (GUI) was implemented to provide an automatic I < O calculation across several days of records and smooth the analysis. Lastly, an experimental study was conducted based on 9 control subjects in order to validate the automatic method.

Results: The student-test results and mean squared error measurements show no significant difference between I < O outcomes calculated automatically and manually (p-value = 0.718, MSE = 0.022). Additionally, the outcomes of this study minimize patients' intervention, facilitate user involvement and reduce the required time for data analysis.

Conclusions: This work affords an easy-to-use graphical user interface. It incorporates our listed purposes with several analysis options that vary according to the user requirements for an enhanced I < O study such as an improved chronotherapy. Moreover, it provides an enhanced analysis for several illnesses treated through the circadian rhythm interpretation and I < O examination such as insomnia, sleep apnea and others.

Disclosure: Nothing to disclose.

LEARNING, MEMORY AND COGNITION 3

P621 | The relationship of stimulus emotionality to sleep-dependent memory consolidation: Testing contrasting theories using memory for negative, neutral and positive emotionally-toned photographs and stories

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Objectives/Introduction: This study compares the sleep-dependent memory effects for negative, positive, and neutral stimuli using two tasks, photograph recognition and story recall. The relative benefit of sleep for positive versus negative emotional stimuli was used to test between theories that predict that emotionally negative stimuli are preferentially consolidated during sleep, versus theories that emotional stimuli in general, whether negative or positive, are prioritized over neutral stimuli.

Methods: Participants were randomly allocated to either the sleep (n = 31; 17 females, 14 males; mean age = 21, SD = 1.77) or wake conditions (n = 30; 13 females, 17 males; mean age = 21.23, SD = 1.74). 120 images taken from the Nencki Affective Picture System (NAPS) database were presented, each consisting of photographs rated as positive (n = 40), neutral (n = 40), or negative (n = 40). Memory for these was tested by eliciting 'new' or 'old' responses from participants to 60 of the presented photographs and 60 matched photographs that had not been presented. The three stories were also learned prior to the nap/wake period, all three texts were closely matched for total number of nouns, verbs and adjectives

(~62), word count (~162), and number of sentences (n = 11). All participants arrived at the sleep laboratory at 10:00 to 10:30. Training on the two learning tasks was immediately followed by testing (T1). A two hour nap opportunity, or control wake period, then occurred. Testing at time point two (T2) commenced at approximately 14:00 to 14:30.

Results: The Sleep condition had better retention of the photographs than did the Wake condition, $F(1,53) = 5.196$, $p = 0.027$, there was no Emotion x Condition interaction, $F(2,106) = 1.028$, $p = 0.361$, nor a main effect of emotion, $F(2,106) = 1.336$, $p = 0.267$. Story memory was also better retained by the Sleep condition than by the Wake condition, $F(1,54) = 9.796$, $p = 0.003$. Independent t-tests revealed that emotional story recall was higher in the Sleep condition relative to Wake for both negative ($t(54) = 2.35$, $p = 0.023$) and positive texts ($t(54) = 3.09$, $p = 0.003$); there was no difference between conditions on neutral text recall ($t(54) = 1.36$, $p = 0.180$).

Conclusions: The results show that sleep benefits memory consolidation of positive and negative emotional stimuli. For story recall emotional stimuli were prioritized over neutral stimuli during sleep.

Disclosure: Nothing to disclose.

P622 | The impact of memory strength for sleep-dependent memory consolidation

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Objectives/Introduction: Memory consolidation during sleep is highly selective in nature. That is, sleep does not equally consolidate all memories formed throughout wakefulness, but rather favours the consolidation of certain memories over others. Besides other factors, memories' initial strength has been discussed as making a difference when it comes to sleep-dependent consolidation. Problematically, previous studies intermixed different ways to strengthen memories, namely restudy and retrieval-practice. These two processes are, however, non-equivalent and can induce very different memorial effects. In this study, we examined whether sleep-associated memory consolidation depend on items' initial strength, when strength is manipulated solely by varying the number of study trials.

Methods: 90 healthy subjects (M = 22.9, SD = 2.59 years) participated in a 3x2 mixed-factorial design with the between-subject factor DELAY (9 hr-sleep, 9 hr-wake, short-delay; n = 30) and the within-subject factor memory STRENGTH (weak [S−], high [S+]). All subjects studied a list of 80 word-pairs. One half of the word-pairs was presented twice (S−), the other half thrice (S+). The 9 hr-sleep-group studied the word-pairs in the evening and performed a cued-recall test on the subsequent morning. The 9 hr-wake-group studied the word-pairs in the morning and performed the test in the evening of the same day. Subjects in the short-delay-group studied the word-pairs either in the morning or in the evening and performed the memory test after a retention period of 40 min. Test performance was quantified by recall-rates and reaction-times.

Results: Results revealed significant main effects for DELAY and STRENGTH ($p < 0.001$). Post-hoc comparisons indicated poorer recall-rates and prolonged reaction-times for subjects in the 9 hr-wake-group compared to both the 9 hr-sleep-group and the short-delay-group ($p < 0.001$). In contrast, no performance difference was found between the 9 hr-sleep-group and the short-delay-group ($p > 0.49$). In addition, superior recall-rates and shortened reaction-times were found for S+ compared to S− in all three groups ($p < 0.01$). A DELAYxSTRENGTH interaction was only found for the dependent variable recall-rate ($p < 0.05$). This interaction revealed that, compared to the short-delay-group, the 9 hr-wake-group showed slightly pronounced forgetting-rates for S− compared to S+ (S−: $\Delta M = -30.44$; S+: $\Delta M = -21.56$), which was not present in the 9 hr-sleep-group.

Conclusions: Sleep-associated memory consolidation does not depend on the amount of item re-exposure before sleep.

Disclosure: Nothing to disclose.

P623 | Academic performance, sleep duration and chronotype in Korean adolescents

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Objectives/Introduction: The aim of this study was to investigate the relationship between sleep-related factors and the academic performance in Korean adolescents

Methods: The computer-assisted online survey was performed in July 2011. 150 schools were selected nationwide including junior high and high schools in Korea. Questions included sleep duration on schooldays and weekend, Beck depression (BDI), Epworth sleepiness scale (ESS) and superscience morningness-eveningness scale (MEs). Academic performance was measured by self-reported grades at the school (1–5 scale, from top 20%, 20–40%, 40–60%, 60–80%, 80–100%). They also reported their ranks for Korean, Mathematics and English subjects.

Results: A total of 25,940 students aged 13 to 18 years (male, 51.4%) participated in the survey. Senior high school students had lower MEs than younger high school students and middle school students suggesting older adolescents had more delayed circadian type 24.7 ± 4.4 vs. 27.1 ± 4.3, $p < 0.001$). The students with better school grades slept less on school days than those with the lowest

grades (389.3 ± 74.4 vs. 408.2 ± 90.5, $p < 0.001$) as well as on weekends. MEs was higher in the students with better school grades than those with lower grades (25.8 ± 4.5 vs. 24.8 ± 4.6, $p < 0.001$). This pattern was similar in the analysis of their ranks in the class for each subject (English, math and Korean)

Conclusions: Korean adolescents with better academic performance had shorter sleep duration and more morning chronotype than those with worse performance. Although sleep is known to be crucial for better cognition, the factors influencing academic performance in adolescents seem to require more factors beyond sleep duration.

Disclosure: Nothing to disclose.

P624 | Are prenatally learned nursery rhymes recognized at birth? A high-density EEG study

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Objectives/Introduction: Research on prenatal learning indicates that already fetuses are capable of learning and remembering speech as early as 34 weeks of gestational age with this fetal voice processing being highly influenced by the maternal voice. Exciting new research has also shown that human speech rhythms are capable of entraining the amplitude and phase of MEG oscillations in the adult auditory cortex. To date it is however not clear if the same holds true for sleeping babies in the first weeks of life and whether prenatal exposure to these speech rhythms makes a difference. We therefore investigated the role of maternal speech processing in the brain of 2 to 5 weeks old babys.

Methods: 28 pregnant women participated in our study. All mothers were asked to present a previously recorded (familiar) nursery rhyme (FR) (in their own familiar maternal voice, FV) twice daily to the unborn fetus at about 80 dB from 34 weeks gestational age onwards. Two and five weeks after birth the same familiar rhyme as well as an unfamiliar new rhyme was presented to the newborn in the familiar mother's voice (FV), as well as another unfamiliar female voice (UV).

Results: We then analyzed speech envelope coupling with the babies brain responses as recorded by 128 high-density EEG. Mutual information was used as the coupling metric on the Hilbert transformed amplitude data. A non-parametric single-sided Kolmogorov-Smirnov Test with a 5% significance level is used to determine the differences between the groups. Preliminary results show a significant difference between maternal and non-maternal voice at 1 Hz ($p < 0.001$) and at 4 Hz ($p < 0.05$), while at 2 and 4 Hz no significant differences were observed ($p > 0.72$). For familiar vs. unfamiliar rhyme contrasts no significant differences were observed.

Conclusions: Results indicate that even sleeping baby brains (days after birth) couple more strongly to the familiar maternal voice, yet seem to be unable to recognize prenatally replayed rhymes.

Disclosure: Nothing to disclose.

P625 | Gross motor adaptation benefits from NREM2 sleep and fast spindle activity during nocturnal sleep after training

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Objectives/Introduction: This study tested the impact of nocturnal sleep versus diurnal wakefulness on the performance of a gross motor adaptation task (i.e., riding an inverse steering bicycle).

Methods: 44 healthy male students (M = 24.84, SD = 4.01 years) were randomly assigned either to a sleep or a wake group. 26 of these participants were included in the analyses as they sufficiently mastered to cope with the motor adaptation task. This was important to ensure that the subjects are able to complete the test where performance was quantified by the steering angle (accuracy) and the riding time (speed) during riding the inverse steering bicycle for 5x30 m straight line. A 16-channel EEG system was used for polysomnography during sleep. Sleep was scored visually according to AASM criteria and sleep spindles were detected automatically (The Siesta Group, Vienna, Austria).

Results: While subjects who slept during the retention interval maintained their performance levels over night, subjects who spent the retention interval awake became significantly less accurately (t12 = −3.688, $p = 0.003$) and more slowly (t12 = −3.071, $p = 0.010$). At re-test, both groups still performed similarly accurately, but the sleep group performed significantly faster than the wake group (t22 = −2.316, $p = 0.030$). After training subjects spent more time in stage N2 sleep (t10 = 2.257, $p = 0.048$) and showed higher activity of fast sleep spindles (t10 = 2.753; $p = 0.005$) compared to the adaptation night without preceding gross motor adaptation training. The higher the fast spindle activity after training, the faster subjects performed after sleep (t11 = 0.673, $p = 0.023$).

Conclusions: Sleep helps to keep motor adaptation stable, whereas wakefulness not only led to more inaccurate but also slower performance. Among those subjects who slept during retention, N2 sleep duration as well as activity of fast sleep spindles (13–15 Hz) increased after motor adaptation. Furthermore, post-training high activity of fast sleep spindles was related to faster performance at re-test in the morning. This link between sleep-related motor adaptation and fast spindle activity is well in line with results from fine-motor tasks (e.g. motor sequence learning, mirror tracing) and

provides evidence that a retention interval containing nocturnal sleep helps to maintain the adaptation of a real-life, gross-motor task.

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Disclosure: Nothing to disclose.

P626 | Subjectively defined optimal/non-optimal time of day modulates controlled but not automatic retrieval processes in verbal memory

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Objectives/Introduction: We investigated the impact of subjectively defined optimal/non-optimal time of day on verbal memory retrieval, using an adaptation of the Jacoby 1991 Process-Dissociation Procedure (PDP) that allows estimating the respective contributions of automatic and controlled memory retrieval processes within a same memory task.

Methods: Participants (N = 40; 23.35 ± 1.76 years) were tested at the time of day they individually defined as most optimal (n = 20) or worst (n = 20) for cognitive performance, between 7:00 and 19:00. Neutral to moderate chronotype, habitual sleep quality and preceding night duration/ quality were similar between conditions ($ps >$ 0.26). Participants were instructed to memorize successively presented French words (e.g., "chacal"). For each word, a stem to complete (e.g., cha—) was proposed after a variable lag (0, 3, 12 intermediate words), under two counterbalanced conditions. In the Inclusion condition, they must complete the stem with the previously presented word (e.g., cha-cal), alternatively with the first word coming to their mind, i.e., successful performance could be supported by explicit recollection or familiarity processes. In the Exclusion condition, they must provide a word different than the previously presented to complete the stem (e.g., cha-que), i.e., performance above chance level requires explicit recollection of the word to avoid. In the PDP procedure, computations based on Inclusion and Exclusion scores generate estimates of the respective contributions of automatic and controlled processes in verbal memory.

Results: As expected, sleepiness was higher in Non-Optimal (KSS mean/SD: 4.3 ± 2.11) than Optimal (mean and SD: 3.125 ± 1.24; $p < 0.05$) conditions. In the word-completion task, estimates of controlled processes were higher for participants evaluated at Optimal than Non-optimal moment (0.71 ± 0.13 vs. 0.57 ± 0.22; $p < 0.01$). For automatic processes, no moment effect was found (0.28 ± 0.25 vs. 0.34 ± 0.23; $p > 0.05$).

Conclusions: Our results are in line with the hypothesis that subjective time of day optimality impacts cognitively demanding controlled but not automatic processes, underlying the individual specificity of biological, social and cognitive factors on diurnal variations in performance.

Disclosure: The authors are not aware of any affiliation, funding or financial holdings that might be perceived as affecting the objectivity of this study. The authors declare that there is no biomedical financial interest or potential conflict of interest.

P627 | Obstructive sleep apnea and non-invasive ventilation treatment-related effects on semantic memory integration in a false memory generation paradigm

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Objectives/Introduction: Generation of false memories at recall may reflect the normal processes by which new verbal material is integrated and associated into preexisting long-term memory systems. For instance, after learning new words, healthy participants presented later on with never learned but conceptually related elements erroneously recognize it as previously learned due to semantic contamination. Obstructive sleep apnea (OSA) is know to exert a deleterious impact on cognitive functioning, in particular attention and vigilance, but its effects on verbal learning are unclear, as well as beneficial effects of compliant continuous positive airway pressure (CPAP) treatment. We investigated here OSA and CPAP treatment-related effects on verbal memory integration.

Methods: 22 patients with OSA (35–73 years; AHI > 15) were tested at three time points:

(1) after diagnosis polysomnography (PSG) (no treatment),
(2) after a first night with CPAP and PSG, and
(3) after 3-months of compliant ambulatory CPAP treatment.

At each time point, they had to learn 10 lists; each list comprised 15 semantically related words. Afterward, they had to recognize learned words in a list comprising 20 really studied words, 20 lures (new words semantically related to the learned lists), and 20 distractors. For each item, they specified whether recognition was based on controlled recall (R), item familiarity (K) or guess (G).

Results: CPAP treatment decreased AHI/hour (pre 39 ± 19 vs. post 9.9 ± 8) and increased REM sleep and perceived sleep quality ($ps <$ 0.001), persisting 3 months later. Recognition of studied and lure words increased after CPAP initiation, both after 1 night and 3 months of treatment ($ps < 0.005$). R responses for studied words also increased after 1 night and 3 months of CPAP ($ps < 0.05$).

Conclusions: CPAP effects on sleep quality were effective from the 1st night and persisted on the long term, as expected.

Furthermore; our results evidence unambiguous CPAP treatment-related effects on verbal learning abilities (learning and semantic memory generalization) and cognitive functioning in treated OSA patients, suggesting the reinstatement of normal memory mechanisms while sleep quality is restored.

Disclosure: Nothing to disclose.

P628 | Clustered and temporally organised occurrence of NREM-stage2 sleep spindles mediates motor memory consolidation

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Objectives/Introduction: Sleep benefits motor memory consolidation. This mnemonic process is thought to be mediated by thalamocortical spindle activity and associated reactivations of task-related neural patterns during non-rapid-eye-movement (NREM) sleep. However, the particular role of NREM-stage 2 and NREM-stage 3 sleep spindle activity upon this mnemonic process still remains controversial. Hence, using novel metrics sensitive to the clustering and temporal organisation of spindle events, we sought to identified stage-specific sleep spindle patterns underlying motor memory consolidation.

Methods: Twenty right-handed young adults were required to perform a 5-element motor sequence learning (MSL) task, as rapidly and accurately as possible, and to rehearse practice over 14 training blocks. MSL consolidation was assessed by computing the difference (%) in performance between immediate and delayed 24-hr post-training testing sessions. EEG sleep data were then recorded the night following training. Spindle detection was applied to all artefact-free NREM2 and NREM3 epochs at the Pz derivation. Sleep spindles were considered if events lasted 0.3–2 s, occurred within the 11–16 Hz frequency range and with an onset within NREM2 and NREM3 sleep periods.

Results: Results revealed that NREM2 spindle local density (SLD; spindle-centred 60-s window) positively correlated with the degree of overnight performance gains ($r = 0.64$, $p < 0.01$), while no correlation was evident between NREM3 SLD and overnight MSL gains ($r = 0.27$, $p = 0.23$). In addition, we assessed sleep spindle temporal organisation (i.e., inter-spindle interval [ISI]) and showed a negative correlation between NREM2 ISI and overnight performance gains ($r = -0.62$, $p < 0.01$), while no correlation was observed between NREM3 ISI and MSL gains ($r = -0.21$, $p = 0.43$).

Conclusions: The present findings strengthen the critical role of NREM2 sleep, over NREM3 sleep, upon MSL consolidation. Our results also show spindle patterns that may reflect information-processing mechanisms required for overnight consolidation. Specifically, they reveal that both SLD and ISI during NREM2 sleep, but not NREM3 sleep, relate to MSL consolidation. Hence, despite the apparent erratic occurrence of spindles during NREM sleep, we provide here the first-time evidence that NREM2 sleep spindles may iteratively occur within clustered and temporally organised patterns in order to efficiently reactivate and further consolidate specific motor memories.

Disclosure: Nothing to disclose.

P629 | Split sleep is superior to consolidated nocturnal sleep for memory retention in sleep restricted adolescents

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Objectives/Introduction: The question of whether sleep in humans should be obtained in a single bout of nocturnal sleep or split between nocturnal and daytime sleep periods is hotly debated. Daytime naps provide consistent benefits to post-nap memory, but it remains unclear how both pre and post-nap learning are affected under a split sleep schedule when adolescents undergo sleep restriction.

Methods: We compared long-term memory in 58 participants who learned across 3 consecutive days with consolidated (6.5-hr nocturnal sleep opportunity) or split sleep (5 hr nocturnal sleep +1.5 hr daytime nap opportunities). On each day, participants spent one-hour learning detailed facts about six species of amphibian in the morning (11:00), and six different species of amphibian after the nap period in the afternoon (17:00).

Results: Participants were tested the following evening after a nocturnal recovery sleep opportunity (9-hr), via 360 two-alternative forced choice questions. A mixed ANOVA with group (5 hr + Nap/6.5 hr) and learning-time (morning/afternoon) showed a significant main effect of group ($p = 0.046$) and a group*learning-time interaction ($p = 0.021$). The 5 hr + Nap group remembered significantly more about species learned in the afternoon ($p = 0.01$), while groups did not differ for species learned prior to the nap in the morning ($p = 0.23$).

Conclusions: This suggests that when available nocturnal sleep is curtailed to suboptimal levels, a split sleep schedule enhances learning after a nap opportunity, but critically this schedule does not impair morning learning, where less preceding nocturnal sleep was obtained. A split sleep schedule is therefore superior for the learning and retention of educationally relevant factual information if available nocturnal sleep is limited.

Disclosure: Nothing to disclose.

P630 | Phase amplitude coupling facilitates pre-post-sleep consolidation of declarative and but not of procedural memories

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Objectives/Introduction: The interaction between slow wave oscillations (SWO) and sleep spindles is believed to facilitate memory consolidation and underlying synaptic refinements. More specifically, only specific SWO-phase-spindle-amplitude configurations appear to support memory consolidation. However, it remains largely unknown if SWO coupling with spindles is specific for either declarative or procedural memories.

Methods: To address this question, we associated the phase amplitude coupling (modulation index, Tort, 2010) between SWO and spindles in NREM sleep in 20 young healthy adults (10 females, 10 males, mean age 27.1 ± 4.6 years) with declarative (word list task, WLT) and procedural (mirror tracing task, MTT) memory testing.

Results: We found that the modulation index, against our expectation, did not significantly correlate with neither declarative nor procedural over night memory consolidation ($p > 0.05$ for both). However, the precise temporal interaction of SWO and spindle activity was significantly associated with declarative but not procedural memory consolidation (circular-linear correlation, WLT: $r = 0.64$, $p < 0.01$; MTT: $r = 0.09$, $p > 0.05$).

Conclusions: We therefore speculate that specifically the temporal organization of phase amplitude coupling is a key player in sleep-related declarative memory consolidation.

Disclosure: Nothing to disclose.

P631 | Sleep and memory consolidation of reward-motivated encoding

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Objectives/Introduction: Sleep plays an active role in memory consolidation. It has been suggested that memories with increased salience, such as through reward, are processed preferentially during sleep. Furthermore, when seemingly trivial events are in temporal proximity to related salient events, these initially weak memories can be tagged for later consolidation. The present study investigated whether sleep preferentially consolidates rewarded memories, and facilitates consolidation of conceptually-related items through behavioral tagging.

Methods: Participants encoded pictures of animals and objects in two phases, immediately following one another. Different pictures from the same categories were encoded in each phase. During the second encoding phase, participants received a monetary reward for correct recognition of pictures from the two categories. Following a 12-hr delay including daytime wakefulness ($n = 29$) or nocturnal sleep ($n = 29$), participants completed a surprise recognition test for their memory of pictures from both encoding phases.

Results: Repeated Measures ANOVA indicated a significant main effect of Group ($p < 0.05$) and a significant Group*Phase interaction ($p < 0.01$). Participant in the sleep group remembered significantly more pictures than participants in the wake group. Specifically, the sleep group remembered significantly more pictures encoded during the reward phase compared to the wake group ($p < 0.01$, mean ± SD sleep group: 21.76 ± 9.02, wake group: 13.31 ± 9.23), but not during the pre-reward phase (mean ± SD sleep group: 20.55 ± 10.83, wake group: 17.21 ± 9.13).

Conclusions: Recognition memory was better following a period of sleep compared to wake. This benefit of sleep for memory was only found for pictures from the reward phase. Reward may have tagged pictures encoded during the reward phase for subsequent sleep-dependent memory consolidation. Alternatively, the reward phase may have been consolidated preferentially during sleep as it was encoded closest to the retention interval. More research is needed to disentangle the relationship between sleep, memory and reward.

Disclosure: Nothing to disclose.

P632 | The effect of sex hormones on sleep and cognitive performance

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Objectives/Introduction: Sex hormones fluctuate across a monthly cycle:

- **(I)** follicular phase (days 1–14), and
- **(II)** luteal phase (days 15–28).

Whereas estrogen shows a dominance and a peak during the follicular phase, progesterone is more pronounced in the luteal phase. There is growing evidence that these fluctuations in sex hormones may influence sleep and cognitive performance. Therefore the presented study investigated the interactions of sex hormones, sleep and cognitive performance (i.e., declarative memory, intelligence).

Methods: 58 healthy women (age: 22.31 ± 3.19) spent two nights (baseline, experimental) in the sleep laboratory. Polysomnography was recorded during the nights. Before and after sleep saliva samples were collected. Preceding the experimental night subjects encoded 160 word-pairs. Retrieval of these word-pairs was assessed before (RET1) and after sleep (RET2). Furthermore subjects

performed the Raven's Advanced Progressive Matrices to examine intelligence. Sleep was scored visually according to AASM criteria and sleep spindles were detected automatically (The Siesta Group, Vienna, Austria). Progesteron and estragen were analysed by using an ELISA kit according to the recommendations of Demeditec Diagnostics. Because of problems with the saliva samples 12 subjects had to be excluded from the analyses.

Results: Memory performance was significantly improved after sleep ($t = -4.874$, $p < 0.001$; RET1: 70.09 ± 18.85%; RET2: 72.41 ± 19.46%). However, we did not find any relation between memory consolidation and sleep architecture or sleep microstructure (i.e. sleep spindles, slow oscillations). Women showing stronger fast (13–15 Hz) sleep spindles during both nights performed better in the intelligence task ($r = 0.376$, $p = 0.012$). Analyses of the sex hormones revealed a relationship between fast sleep spindles and progesterone level: the higher the progesterone level, the higher the sleep spindle density ($r = 0.384$; $p = 0.017$).

Conclusions: Our dataset replicates earlier findings, that sleep spindles serve as a biological marker for general cognitive abilities. While we did not find any changes in sleep macro- or microstructure after declarative learning, our data revealed that women with elevated endogenous progesterone levels show increased fast sleep spindles. Our results support prior findings suggesting a role of endogenous progesterone in the production of sleep spindles. The menstrual cycle seems to moderate thalamo-cortical communication, which has to be considered when exploring the role of sleep features in sleep-related memory consolidation.

Disclosure: Nothing to disclose.

SLEEP DEPRIVATION 2

P633 | Poor housing quality is associated with short sleep duration in New Zealand

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Objectives/Introduction: Housing quality and household overcrowding have been associated with a range of adverse health outcomes but very few studies have investigated the influence of physical aspects of a home on sleep health.

Methods: The present study is secondary analysis of adult data (≥15 years) from the New Zealand Health Survey (2013/2014). Respondents were asked "How many hours of sleep do you usually get in a 24-hr period, including all naps and sleeps?" which was categorised according to National Sleep Foundation recommendations for each age category as appropriate/may be appropriate versus short or long. Housing quality was based on responses to items on household temperature and the presence of household dampness, mould and smell which were aggregated into a single housing quality scale that ranged from 1 (highest quality) to 5 (lowest quality). Household overcrowding was a binary variable determined using the Canadian National Occupancy Standard. Logistic regression analyses were undertaken, controlling for gender, age, socioeconomic status and ethnicity.

Results: Data were analysed from 13,309 respondents (43.5% male, age range 15 - >75 years). Approximately 90–95% of respondents in each age category (10 years bins) reported their sleep duration as appropriate/may be appropriate, with the exception of those ≥75 years (84.4%). Between 2.7–8.8% of respondents in each age category reported short sleep. Housing quality was associated with an increased odds of short but not long sleep durations. A housing quality score of 3 and 4 increased the odds of short sleep 1.48 times (95% CIs 1.0–2.2) and a housing quality score of 5 increased the odds of short sleep 1.69 times (95% CIs 1.1–2.7). Household overcrowding was not independently associated with either short or long sleep duration.

Conclusions: The quality of the home environment is independently associated with the occurrence of short sleep. Improving the quality of the home environment by ensuring homes are warm and dry is a potential public health approach that warrants further investigation. This could decrease the occurrence of short sleep and reduce inequities in sleep health in the wider population.

Disclosure: Nothing to disclose.

P634 | Sleep-wake dependent changes in molecular markers of synaptic plasticity in humans: a PET/MRS study

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Objectives/Introduction: We recently found that sleep deprivation increased the availability of metabotropic glutamate receptors of subtype 5 (mGluR5) in the human brain. The effect of recovery sleep was not investigated and the repercussions of prolonged waking and sleep on the mGluR5-regulated molecular markers of synaptic plasticity, brain-derived neurotrophic factor (BDNF) and fragile X mental retardation protein (FMRP), are unknown. To investigate a role of mGluR5 in sleep homeostasis, we simultaneously quantified mGluR5 availability and dynamic changes in brain metabolites, as well as BDNF and FMRP levels in plasma, after prolonged waking and recovery sleep.

Methods: Thirty-one healthy men completed a controlled in-lab study, in which 3-Tesla PET/MR-Spectroscopy scanning and blood sampling were conducted at the same circadian time in baseline,

after 40 hr prolonged waking and recovery sleep. mGluR5 availability was quantified with the novel PET radioligand ^{18}F-PSS232, whereas concentrations of glutamate, the glutamate/glutamine (GLX) ratio and GABA in basal ganglia (BG) and dorsolateral prefrontal cortex (dlPFC) were measured with dedicated PRESS/MEGAPRESS MRS sequences. The levels of BDNF and FMRP were quantified with ELISA. Statistical analyses included mixed-model ANOVAs and least significant differences (LSD) where appropriate.

Results: Prolonged waking induced an increase in whole-brain and striatal mGluR5 availability, which normalized after one night of recovery sleep ($p_{all} < 0.05$). Glutamate and GLX in BG ($p_{all} < 0.01$) and blood FMRP levels ($p < 0.02$) were higher after sleep loss than in baseline and tended to normalize after recovery sleep ($p_{all} > 0.05$ compared to baseline). By contrast, GABA levels in BG, metabolite concentrations in dlPFC, and blood BDNF levels were unaffected by changes in sleep history ($p_{all} > 0.1$).

Conclusions: Sleep-wake dependent changes in mGluR5 availability, glutamate/GLX dynamics, and blood FMRP concentration suggest a role of the BG glutamatergic system in the homeostatic regulation of sleep in humans. Research supported by SNSF (grant # 320030-163439) and CRPP "Sleep & Health".

Disclosure: Nothing to disclose.

P635 | On the high levels of delta power after prolonged wakefulness: reflection of a continuous process or a discrete NREM sleep sub-state?

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Objectives/Introduction: During NREM sleep, increased cortical synchrony of slow-waves is observed in frontal cortical areas. The most widely used method for quantifying this process is through power spectrum analysis of the EEG delta-band (0.75–4 Hz). However, recent evidence has suggested that the slope of NREM slow-waves may also provide a window into the kinetics of sleep-wake driven processes. This study sought to determine whether a combination of slope and spectral analysis could yield previously unknown slow-wave properties, following spontaneous or enforced waking.

Methods: Male C57BL/6 mice were implanted with EEG/EMG, and exposed to 48-hr of baseline (12 hr Light: 12-hr Dark) conditions, followed by a 6-hr sleep deprivation (SD). A subset of mice were implanted with thermistors to record cortical temperature ($n = 8$) or tetrodes for local activity ($n = 4$).

Results: Slope analysis of NREM sleep revealed a rapid decrease in the period (or increase in speed) of the slow-wave, following sustained bouts of enforced and spontaneous waking. This was followed by a more in-depth analysis of the power spectrum during the first 6-hr of recovery after SD. Remarkably, a discrete NREM sub-state emerged, dominated by significantly increased power in the fast delta range (delta-2, 2–4 Hz), dissipating within the first hour of recovery, subsequently decaying at the same rate as slower delta (delta-1, 0.75–1.75 Hz; $n = 38$, $p < 0.0001$). Further analysis indicated a strong correlation between these dynamics and other physiological changes in muscle tone, neuronal spiking rate, and brain temperature, and were present under baseline where extended bouts of wake took place.

Conclusions: Sleep homeostasis is assumed to be a process that is in a continuous and quantitative relationship with prior sleep-wake distribution. Detailed dissection of the time-course of EEG delta power during recovery sleep, revealed high and steeply decaying values in EEG delta power are specific to a narrow range (delta-2) and are discontinuous. As delta-2 dynamics were paralleled by dynamic changes in EMG, cortical firing, and brain temperature, we interpret these three variables to reflect a transient and discrete sub-state of NREM sleep. It is during this time in which the animal's physiology quickly recalibrates from an aroused and active state, to one typical of the >95% remaining NREM sleep.

Disclosure: Nothing to disclose.

P636 | Working memory performance is better maintained in older compared with young adults after sleep deprivation

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Objectives/Introduction: The prefrontal hypothesis suggest that sleep deprivation worsens executive components of working memory and is therefore comparable to normal aging. In contrast, others argue that sleep deprivation mainly impairs non-executive components. However, only a few studies have focused on the combined effect of aging and sleep deprivation on working memory. Thus, we investigated the effect of sleep deprivation on working memory performance in young (18–30 years) and older adults (60–72 years).

Methods: Subjects were allocated into a young control ($n = 63$), young sleep deprived ($n = 61$), old control ($n = 47$) and an old sleep deprived ($n = 47$) condition. They performed a Sternberg working memory task, where they were to answer if a probe letter matched any of the previous letters presented in groups of 4 or 6 letters, targeting low and high executive load. We used generalized linear mixed-models for the analyses. In addition, half of the subjects performed a stress test ~1 hr before the test, which was controlled for in the analysis.

Results: Overall, sleep deprivation impaired accuracy (d': M_{diff} = 0.43, 95% CI [0.27, 0.59], $p < 0.001$), but not response times (M_{diff} = −25.12 ms, 95% CI [−83.26, 33.01], $p = 0.86$). Sleep deprivation had a significantly larger impact on young compared with older adults in terms of accuracy (d': M_{diff} = 0.57, 95% CI [0.25, 0.89], $p < 0.001$). Older adults were on average slower than young in both sleep conditions (M_{diff} = −206.81 ms, 95% CI [−264.95, −148.68], $p < 0.001$). Performance was worse in the 6-letter condition, but there were no interactions of sleep and age condition with executive load. Omission rate was higher after sleep deprivation (M_{diff} = −0.05, 95% CI [−0.08, −0.02], $p < 0.001$), especially for low compared with high executive load (M_{diff} = −0.06%, 95% CI [−0.10, −0.02], $p = 0.002$).

Conclusions: Our data support an impairment of mainly non-executive components of working memory after sleep deprivation for younger adults, while older adults' performance is better maintained. Response times were affected by age but not sleep deprivation. Together, these findings indicate that sleep deprivation is not directly comparable to normal aging and that the effects of sleep deprivation on working memory is different in young and older adults.

Disclosure: This study is funded through a grant from the Bank of Sweden Tercentenary Foundation.

P637 | Mood impairment is less strong in older than in young adults after sleep deprivation

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Objectives/Introduction: Sleep deprivation commonly impairs affective regulation and causes worse mood. However, previous research mainly studied young adults. Since sleep, susceptibility to sleep deprivation and emotion regulation change profoundly across the adult life span, we investigated whether the effect of sleep deprivation on mood is less pronounced in older than in young adults.

Methods: In an experimental design, young (18–30 years) and older adults (60–72 years) participated in either a sleep control (NSD) (young: $n = 63$, older: $n = 47$) or a total sleep deprivation condition (SD) (young: $n = 61$, older: $n = 47$). Sleepiness, mood and common symptoms of sleep deprivation were measured using established questionnaires and rating scales (Karolinska Sleepiness Scale, Positive and Negative Affect Schedule (PANAS), Profile of Mood States (POMS), CHICa scale).

Results: Sleep deprivation was associated with a significant increase in sleepiness ($p < 0.05$) and deterioration in mood in both young and older adults (Total Mood Disturbance Mean ± SD: young NSD: 1.0 ± 17.1, young SD: 36.3 ± 28.8; older NSD: −4.8 ± 13.4, older SD: 9.2 ± 16.4). However, older adults mood was significantly less affected for the majority of outcome measures as indicated by age*sleep deprivation interactions ($p < 0.05$).

Conclusions: The results show that older adults are emotionally less affected by sleep deprivation than young adults. This could possibly be related to the well-known *positivity effect* in older age, which suggests that older adults may prioritize regulating their emotions to optimize well-being. The results also highlight that caution needs to be warranted when generalizing results across the adult life span.

Disclosure: This study is funded through a grant from the Bank of Sweden Tercentenary Foundation.

P638 | Oculomotoric evidence for a speed-accuracy trade-off in selective attention tasks during sleep deprivation

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Objectives/Introduction: The effects of sleep deprivation (SD) on selective attention can be studied by visual search tasks, such as conjunction (CST) and spatial configuration (SST) search. As in other task domains, SD leads to a cognitive slowing and a decrease in accuracy, but also to a deficiency in adjusting response time to an increase in the number of items in the search display. It is currently unclear what mechanism underlies the decrease in accuracy in selective attention under sleep loss. Here we used gaze tracking in visual search tasks, hypothesizing cognitive slowing to result in longer fixation durations and slower saccades.

Methods: Visual search performance (response time, accuracy as sensitivity d') and associated gaze behavior were recorded in sleep deprived participants ($N = 24$, age: 25 ± 5 STD; 12 women), kept awake during a 24 hr period, and in a control group ($N = 24$, age: 26 ± 4 STD; 10 women) with a time-in-bed of 8 hr.

Results: We were able to replicate the increase of response time under SD compared to the control group (CST: $p = 0.019$; SST: $p < 0.001$) and a decrease in sensitivity d' (CST: $p = 0.03$; SST: $p < 0.001$).The oculomotoric measures provided indications of a cognitive slowing in slower saccade velocities for the SD group compared to the control group (CST: $p < 0.001$; SST: $p < 0.001$). In contrast, fixation durations decreased in the SD group relative to the control group (CST: $p = 0.018$; SST: $p = 0.008$). Moreover, the change in fixation duration due to sleep deprivation (i.e. difference from baseline) was positively correlated with the change in task accuracy (CST: $\rho = 0.29$, $p = 0.048$; SST: $\rho = 0.33$, $p = 0.022$).

Conclusions: The oculomotoric changes under sleep deprivation suggest that tasks requiring selective attention may suffer not only due to general cognitive slowing, but also from an unfavorable speed-accuracy trade-off: decision speed per item - as derived from fixation durations - increases, while accuracy decreases in turn.

Disclosure: Nothing to disclose.

P639 | Exploring the effect of 24-hr sleep deprivation on social decision-making

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Objectives/Introduction: Sleep deprivation (SD) is known to have a negative effect on cognitive functions. However, the impact of SD on social functions remains unclear with limited research on the relationship between sleep loss and social decision-making. The current study aimed to investigate the effect of 24-hr of sleep deprivation on social decision-making.

Methods: Thirty-five healthy young adults (mean age = 20.5, 23 females) were recruited to the study and randomly assigned to either SD or control group. Following a week of habitual sleep with actigraph and sleep diary, participants went through a 3-day experimental protocol. On Day 1, participants completed questionnaires on personal characteristics (e.g. chronotypes, personality, emotion intelligence) during daytime and had a polysomnography (PSG)-monitored night of normal sleep at home. On Day 2, the SD group stayed awake at the lab for the whole night while control group had normal sleep at home. On the last day, measures of sleepiness, vigilance, and social decision-making were administered. Participants were asked to distribute $100 between himself/herself and the next participant on the Trust Game and accept or reject 10 offers of a split of $10 each (unfair offers: $1, $2, $3; fair offer: $5) by previous participants on the Ultimatum Game, which measures rational decision-making.

Results: Participants in the SD group were sleepier ($t(33) = 5.10$, $p < 0.001$) and less vigilant ($t(33) = 3.99$, $p < 0.001$) than the control group on Day 3. However, there was no significant difference between the amount of money offered in the Trust Game and the accepting rate in the Ultimatum Game.

Conclusions: To our knowledge, only one study has investigated the impact of total sleep deprivation on social decision-making using Trust Game and Ultimatum Game, and that study adopted 36 hr of SD. The current study with 24-hr of SD did not show an effect of sleep loss on social decision-making. Future research is warranted to elucidate the precise relationship between SD and social decision-making as well as the potential roles of factors such as individual differences in cognitive affective resources and parameters of study paradigm.

Disclosure: Nothing to disclose.

P640 | Theta and alpha oscillatory activity changes during visual and auditory cognitive tasks after sleep deprivation

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Objectives/Introduction: During sleep deprivation (SD), attention and alertness are reduced. Under SD, spontaneous EEG activity follows well known changes. However little is known about the dynamics of the theta and alpha oscillatory activity during cognitive tasks. The goal of the present study was to determine the impact of SD on visual and auditory attention networks by studying alpha and theta oscillatory activity during attentional tasks.

Methods: Twenty healthy participants performed an auditory and a visual cued attentional task before and after a night of SD. Each day, participants had five sessions separated by intervals of 2 hr. Recorded continuous EEG was segmented into epochs target-locked. Reaction time (RT) and accuracy of the responses were also measured. Frequency bands were selected per each individual alpha frequency (IAF). Alpha was determined as IAF at baseline ±2 Hz and theta as IAF at baseline −4/−6 Hz. SD effects on performance and frequency amplitude were assessed with parametric and non-parametric statistics.

Results: For both tasks, alpha activity had a decrease in amplitude (desynchronization), followed by an increase in amplitude (synchronization). After SD, alpha synchronization was higher in frontal areas (t-test, $p < 0.03$) for both tasks. For the auditory task, alpha desynchronization was reduced ($p < 0.02$) and alpha synchronization increased ($p < 0.01$) in parietal areas, after SD. A theta synchronization was observed in frontal areas, and was significantly reduced in amplitude after SD ($p < 0.003$) for visual task. For the auditory task, theta activity did not show significant differences between sleep conditions. SD produced, a decrease of performance and an increase of RT ($p < 0.001$).

Conclusions: Alpha inhibition theory says that alpha desynchronization is related to neuronal activation and alpha synchronization is related to an inhibitory activity. SD interferes similarly for auditory and visual attentional tasks during de resetting of neuronal activity (alpha synchronization). Theta oscillatory activity in frontal areas is probably related to integration and processing of target stimulus during attentional tasks and is impaired during SD, as seen with the visual stimulus. For the auditory stimulus, a strong theta evoked response could entangle the theta induced activity in the frontal areas.

Disclosure: Nothing to disclose.

P641 | Sleep deprivation impairs social memory

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Objectives/Introduction: Several studies have found that sleep deprivation has a negative effect on memory and learning. However, most of these studies have been performed using actual memory tasks, and few, if any, have looked at memory of a social setting. In this study we wanted to see whether people's memory from a social situation, not prompted by a memory task, would be affected by sleep deprivation.

Methods: 182 participants (mean age 25.3 years, 103 women) were randomized into a sleep condition (3 nights of 8–9 hr in bed) or a sleep deprivation condition (2 nights of 8–9 hr in bed followed by 31 hr of wakefulness). They spent the day following the last night with an experimenter, performing several different tasks. The experimenter was blind to the condition of the participant. One week later, the participants filled out a follow-up questionnaire, where they were asked to provide the name and hair colour of the experimenter.

Results: Participants who were sleep restricted (N = 91) were significantly less likely to remember the experimenter's name than those who had slept (N = 91) (40% vs. 57% correct, p = 0.026). However, there was no difference regarding memory of the experimenter's hair colour (79% vs. 81% correct, p = 0.853)

Conclusions: In line with previous findings, showing that sleep loss impairs encoding, sleep deprivation affected participants' ability to remember details from a social situation when they were unaware they would be asked to do so. However, some aspects of such memory seem to remain intact, such as remembering someone's appearance. This may be indicative of a difference in effects on episodic and semantic memory, although it may also be due to the smaller range of possible options for hair colour vs. names.

Disclosure: Nothing to disclose.

P642 | Investigation of the possible effects of the BDNF Val66Met polymorphism on the sleep EEG in a large, homogenous sample

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Objectives/Introduction: Animal studies indicated a causal link between brain-derived neurotrophic factor (BDNF) and sleep homeostasis. Investigation in a small human sample of the impact of the functional Val66Met polymorphism of *BDNF* (rs6265) suggested that the sleep EEG in Val/Val homozygotes differed from Met-allele carriers, and that the differences resembled the effects of sleep deprivation. Here we aimed at corroborating these earlier findings in a larger sample.

Methods: All-night sleep EEG recordings in baseline and recovery nights after 40 hr prolonged wakefulness were collected in 118 healthy young men (18–34 years; 78 Val/Val and 40 Met-allele carriers). Sleep stage scoring was performed by multiple trained scorers. Sleep variables and EEG power spectra of entire nights and consecutive NREM-REM sleep cycles were analyzed. Statistical analyses were conducted with PERMANOVA, linear mixed-effects, and generalized additive models.

Results: Prolonged wakefulness reliably increased slow wave sleep and NREM sleep EEG power in the ~ 0.5–11 Hz range, and reduced power in the ~ 13.75–15 Hz band. By contrast, in baseline and recovery nights, sleep architecture and EEG spectra in NREM and REM sleep were strikingly similar in Val/Val and Met-allele carriers. In addition, the response to sleep deprivation did not differ between the genotypes.

Conclusions: More robust inferential statistics may disclose subtle differences between the genotypes. Nevertheless, the ongoing analyses indicate that the impact of rs6265 of *BDNF* on sleep and the sleep EEG may be less pronounced than previously suggested.

Disclosure: Nothing to disclose.

P643 | Excessive daytime sleepiness and occupational accidents among resident doctors in Kocaeli city

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Objectives/Introduction: Extended working hours, high number of night shifts and sleep deprivation are part of the work life of resident physicians. İn general, there is a view that long working hours support better education for these physicians. Excessive daytime sleepiness (EDS) resulting from these conditions can prepare the ground for work accidents such as needlestick-sharps injuries (NSİ) and work related traffic accidents (WRTA).

This study aimed to evaluate the EDS status of resident doctors and reveal the relationship between EDS and occupational accidents among resident doctors.

Methods: This cross-sectional study was conducted in 2017. The studied universe constitutes of 350 resident physicians who work in two hospitals providing postgraduate medical education in Kocaeli. The participation rate for this study was 83% (n = 289) of the universe.

Socio-demographic characteristics, working conditions, occupational accidents belonging to the participants were questioned by using a

data collection form. Epworth Sleep Scale (ESS) was used. The data were collected by the researcher, face to face with the residents. Descriptive analysis was performed. Factors related to EDS (ESS ≥ 10) were assessed by chi-square test. Additionally, ESS scores were assessed by NSI and WRTA relationship, which revealed with using Mann-Whitney *U* test.

Results: The average age of the participants was 28.7 ± 2.4 years. The mean of sleep duration was 6.4 ± 1.0 hr. Among the residents, the EDS frequency was 36.6% for married persons ($p = 0.047$); 34.4% for non-child owners ($p = 0.050$); 37.4% for sleeping less than 7 hr in a day, 25.4% for sleeping 7 hr or more in a day ($p = 0.029$); 43.2% for working in surgical branches and 24.0% for those working in other branches ($p = 0.001$). Statistically, no significant relation found between EDS and other socio-demographic characteristics and working conditions. The mean of the ESS was found to be 9.22 ± 4.26 for residents who experienced NSI, 6.62 ± 3.94 for others ($p = 0.000$). Also, the mean of the ESS score was found to be 10.29 ± 4.64 for residents who experienced WRTA ($p = 0.010$).

Conclusions: We found a relationship between sleepiness level and the number of NSI and WRTA. It should be ensured that the their daily sleeping time is over 7 hr and the occuptional factors should be improved in surgical branches.

Disclosure: Nothing to disclose.

P644 | Sleep loss in shift-working long-haul truck drivers

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Objectives/Introduction: Sleep loss is implicated in road traffic accidents. Long-haul truck drivers are at risk for sleepiness and curtailment of sleep due to long driving bouts and circadian misalignment. More information is needed about the dynamics of sleep loss build-up in irregular shift systems.

Methods: We recorded the sleep and working hours of 48 truck drivers during a 2-week period. The drivers were 22 to 58 years old and had an average of 15 years of trucking experience. Sleep was verified with wrist-worn actigraphy and sleep logs. Daily sleep was compared to individual self-estimated sleep need (SN). Our outcome measure were the sleep compared to SN in 72 hr prior to shift end, and the accumulating sleep compared to SN during the study period, using midnights as checkpoints.

Results: Mean daily sleep was 7:46 (SD 2:02) hours, an average of 2 min (SD 2:06 hr) less than SN. Sleep 72 hr prior to shift end averaged −0:37 (SD 4:10) hours less than SN. Less than 4 hr of sleep compared to SN was observed in over one fourth of night shifts, 29% of morning shifts, and 11% of day/evening shifts using the 72 hr time span. 60% of drivers had at least once accumulated less than four hours of sleep compared to SN.

Conclusions: Truck drivers working irregular shifts have marked variance in the sleep they obtain daily, but on average sleep close to what their sleep need is. Sleep loss is more pronounced in association with night and morning shifts than with day or evening shifts. Future studies should examine the shift combinations that are connected to sleep loss build-up.

Disclosure: Nothing to disclose.

P645 | A questionnaire study on sleep-wake pattern and sleep quality in TMJ & orofacial pain clinic

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Objectives/Introduction: Patients with temporomandibular disorder (TMD), especially those with a chronic pain condition, also complain of sleep disturbances frequently. The sleep-wake pattern and sleep quality could effect on orofacial pain condition in several way. Therefore, this study tried to investigate the sleep-wake pattern and sleep quality in TMD & orofacial pain patients and evaluate the association between the sleep-wake pattern and sleep quality and pain condition via questionnaire.

Methods: We examined 3,279 patients with TMD, who visited the Orofacial Pain Clinic at Yonsei University College of Dentistry during January 1, 2015 to August 31, 2016. We conducted a survey using the Pittsburgh Sleep Quality Index (PSQI) questionnaire and classified TMD patients into two groups based on Diagnostic Criteria for Temporomandibular Disorders (DC/TMD). For statistical analysis, we calculate the correlations between pain intensity, measured by Numeric Rating Scale (NRS), and various factors such as sex, age, total sleep time, sleep efficiency, awaken time, hypnotic medications.

Results: The result from statistical analysis showed correlations between pain intensity (NRS) and some factors in sleep questionnaires. As age increases, the pain tends to be more severe ($p < 0.05$). The lower sleep efficiency, the patients report their pain more severe ($p < 0.05$). However, no significant correlations was showed for other factors such as sex, total sleep time, awaken time and whether the patient taking hypnotic medications or not.

Conclusions: The sleep-wake pattern and sleep quality are highly associated with TMD & orofacial pain. Therefore, a sleep deprivation can cause chronic pain in the orofacial area. We found statistically significant associations between sleep deprivation and orofacial pain. TMD patients with chronic pain suffer from sleep deprivation similar to other chronic pain patients. These results imply that clinicians treating patients with orofacial pain should examine sleep-wake pattern and sleep quality.

Disclosure: Nothing to disclose.

P646 | Neural network recognition of drowsiness using EEG

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Objectives/Introduction: Drivers, aerodrome controllers and other operators doing monotonous work are susceptible to drowsiness which often leads to tragic accidents. Some authors believe that up to 30% of traffic accidents were caused by sleepy drivers. Wireless dry electroencephalographic (EEG) electrodes developed recently could be used to signal them about being in dangerous state immediately. The aim of the study was to develop and test simple algorithm of real-time EEG analysis.

Methods: 30 healthy subjects (14 females and 16 males, 18–35 years old, average 22 years) participated in the study. After sleep deprivation (no more than 4 hr of sleep during previous night) they performed monotonous driving task using simple driving simulator in the darkened isolated room. Experiment duration was 1.5 hr. EEG from 6 electrodes (Fp1, Fp2, C3, C4, O1, O2) was recorded along with car trajectory and video of subject's face. Latter two were then used to define subject's state (awake, drowsy or sleepy). Neural network with two hidden layers (1,024 and 64 neurons, respectively) was trained to recognize whether subject was sleepy or not using EEG spectral characteristics, i.e. theta, lower alpha, upper alpha and beta relative spectral powers. 2-s fragments of EEG were used for the analysis. Cross-validation using 80–20% data split was performed.

Results: We obtained type I error (sleepy subject classified as awake) for 20% cases and type II error (awake subject classified as sleepy) for 19%% cases.

Conclusions: Classification base level is acceptable, but moderate at the time. We plan to improve it further using more complex EEG features and recurrent neural networks. This work was supported by the Russian Academy of Sciences and Russian Foundation for Basic Research (grant № 17-36-00025/2017-OGON).

Disclosure: Nothing to disclose.

P647 | Sleep quality of first year vs. sixth year medical students from the State University of Medicine and Pharmacy of the Republic of Moldova

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Objectives/Introduction: To assess sleep quality (SQ) of first year medical students (1YS) vs. sixth year medical students (6YS).

Methods: In the study were included 102 students (73 females), 1YS - 50 (mean age 19 years), 6YS - 52, (mean age 25 years) from the State University of Medicine and Pharmacy of the Republic of Moldova. Sleep quality assessment was based on self-report using The Pittsburgh Sleep Quality Index (PSQI). Anxiety was assessed by Spielberger-Hanini inventory, depression by Beck depression inventory.

Results: In both groups, tendencies towards low quality sleep was observed, although the quality of sleep in 1YS is lower than in 6YS (8.96 vs. 7.28, $p = 0.0072$). This finding is due to the fact that 1YS showed a voluntary sleep deprivation (PSQI sleep duration scale 2.32 vs. 1.28, $p = 0.0067$), sleeping 2 hr less as 6YS (average sleep duration 4.6 hr vs. 6.7 hr, $p < 0.001$), this reduction being based on late bedtime. Withal, 1YS showed worse results on the PSQI daytime dysfunction scale (1.86 vs. 1.08, $p < 0.0001$). Also, 1YS compared to 6YS presented: very high personality anxiety vs. high, ($p = 0.0141$), increased reactive anxiety vs. normal ($p < 0.001$) and moderate vs. mild depression ($p = 0.0002$).

Conclusions: Medical students have a low quality of sleep. In special, the 1YS reported a worse subjective quality of sleep because of voluntary sleep deprivation. Also, 1YS showed an increased anxiety and higher depression level. All together generate daytime dysfunction and probably have a negative effect on students' performance.

Disclosure: Nothing to disclose.

P648 | Selective slow-wave sleep suppression affects glucose tolerance and melatonin secretion

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Objectives/Introduction: As reported earlier, slow-wave sleep (SWS) suppression impairs morning glucose tolerance [Tasali et al., 2008; Herzog et al, 2013], but exact mechanisms that underlie this effect remains unclear. Among the candidates are changes in melatonin secretion which are closely related to sleep quality [Rao et al., 1996] and influences synthesis, secretion and action of insulin [Cipolla-Neto et al., 2014]. The present study aimed to explore a possible role of melatonin in glucose tolerance impairment after SWS suppression.

Methods: Healthy male volunteers ($N = 14$) with a regular sleep-wake cycle participated in two experimental sessions: a session with selective SWS suppression during night sleep and a session with regular night sleep (control). SWS suppression was achieved by presenting an acoustic tone with gradually rising sound intensity until the occurrence in polysomnogram signs of lighter sleep stages. Salivary samples were collected seven times: three times in the evening

(during dim light melatonin onset); twice in the night; and twice in the morning (immediately after awakening and again 40 min later). The samples were analysed by liquid chromatography-tandem mass spectrometry for melatonin. In the morning an oral glucose tolerance test was performed and blood glucose was measured.

Results: The SWS suppression resulted in a reduction of its overall duration by 58%. Morning glucose tolerance was significantly impaired after selective SWS suppression (p = 0.023). Additionally, SWS suppression led to marginally significant decrease of night melatonin level (p = 0,076) and to the significant increase of melatonin in the moment of awakening (p = 0.010).

Conclusions: Thus, the present study's findings indicate that SWS plays an essential role in the regulation of melatonin production, and a certain amount of undisturbed deep sleep is necessary for its normal secretion. Considering the influence of melatonin on the circadian profile of insulin secretion and action, we may assume that changes of its secretion as a result of disturbed sleep could led to impairment of glucose tolerance.

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Disclosure: Nothing to disclose.

METHODOLOGY & COMPUTATION 3

P649 | Validation of the sleep assessment algorithm in the medical application Nightly and comparing it to polysomnography in 30 healthy individuals

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Objectives/Introduction: The most accurate way to objectively measure sleep is polysomnography (PSG). Unfortunately, it is not practical and too costly to be used in the majority of patients. These problems led to the development of a medical application - Nightly. The application has the potential to combine both diagnostic and therapeutic procedures for patients suffering from insomnia or nightmares. Nightly measures with the use of smartphone sensors the user's motions during sleep and then computes the sleep pattern from the received data. The objective of this study was to evaluate the accuracy of sleep-wake phase (WAKE, NREM and REM) recognition using the Nightly application comparing it to polysomnographic recordings.

Methods: Thirty healthy volunteers (15/15 M/F; mean age 24.2 ± 4.9) were recruited. The subjects spent three consecutive nights at a sleep laboratory. Sleep architecture was assessed using polysomnography, non-dominant wrist actigraphy (CamNTech, Motionwatch 8) and Nightly application installed on iPhone model SE. Sleep stages were scored visually according to AASM manual version 2.4. Bland-Altman plots were used to examine the degree of agreement between PSG, Nightly and actigraphy for sleep latency (SOL), total sleep time (TST), wake after sleep onset (WASO), and sleep efficiency (SE).

Results: Nightly underestimated SOL (9.0 min vs. 15.3 min in PSG, $p < 0.05$), showed good agreement for TST (444.5 min vs. 442.6 min in PSG, not-significant), not-significantly overestimated WASO (30.4 min vs. 24.1 in PSG) and showed very good agreement for SE (91.9% vs. 91.9% in PSG). Actigraphy indicated mean SOL to be 6.0 min ($p < 0.05$ vs. PSG and $p < 0.05$ vs. Nightly), TST 449.8 min ($p < 0.05$ vs. PSG), WASO 22.2 min (not-significant), and SE to be 93.9% ($p < 0.05$ vs. PSG). The mean accuracy of Nightly to detect sleep and wake phases as compared to PSG was 88.3 ± 5.2% (range 69.6% to 96.7%).

Conclusions: Nightly application is an effective tool for assessing sleep and wake phase in healthy subjects as compared to standard assessment methods in sleep medicine. The obtained data encourage further development of this smartphone based application to evaluate and treat sleep disorders.

Disclosure: Agnieszka Gaczkowska and Kornel Rostek are employees and shareholders of DreamJay Inc. that develops Nightly application.

P650 | Gender differences in PSQI according to the main sleep disorders groups

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Objectives/Introduction: The Pittsburgh Sleep Quality Index (PSQI) is a widely used measure of sleep quality in research and clinical settings. The aim of this study was to compare the PSQI scores of the main sleep disorders groups with a sample from the general population as well as to find scores gender differences.

Methods: The total sample was composed by 787 individuals. 341 individuals (mean age 35 ± 12 years old; 69% female) from the general population (GP); 144 from insomnia (IN) (mean age 42.37 ± 12 years old; 67.4% female); 181 from sleep related breathing disorders (SRBD) (mean age 51.51 ± 12 years old; 37.0% female); 35 from central disorders of hypersomnolence (CDH) (mean age 34.14 ± 12 years old; 60.0% female); 41 from circadian rhythms

sleep-wake disorders (CRSWD) (mean age 33.61 ± 12 years old; 30.8% female) and 55 from sleep related movement disorders (SRMD) (mean age 43.25 ± 12 years old; 31.7% female). ANOVA test was used to compare groups and logistic regression was used to test if sex was associated to PSQI score, adjusting for age for each group.

Statistical differences were considered for p value ≤0.05.

Results: The PSQI scores were: GP (5.75 ± 2.91), IN (11.53 ± 3.76), SRBD (9.97 ± 4.78), CDH (9.53 ± 4.68), CRSWD (9.83 ± 4.60) and SRMD (10.79 ± 4.65). The PSQI general score for the GP group was different from all the clinical groups ($p < 0.0001$) as expected. In the clinical groups differences were found between IN and SRBD ($p = 0.006$) with the SRBR presenting the lowest mean value. Evaluating gender differences in the groups they were found in: the GP (OR = 1.15; 95% CI 1.05–1.26; $p = 0.003$); SRBD (OR = 1.13; 95% CI 1.05–1.22; $p = 0.001$) and SRMD (OR = 1.58; 95% CI 1.22–2.04; $p = 0.001$) presenting women the higher risk of have higher scores. No differences were found for the other clinical groups.

Conclusions: Insomnia has the worst sleep quality among sleep disorder groups followed by SRMD. Inside these groups there are some presenting different scores between genders, suggesting that we may have to interpret the PSQI scores taking it into account the patient's sleep disorder.

Disclosure: Nothing to disclose.

P651 | Comparison between polysomnography scoring of auto-analyzing software with trained technician

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Objectives/Introduction: Nowadays sleep disease is known as an independent risk factor for many disease, and for diagnosis this disorder, polysomnography is gold standard, there are many software which design in this field to decrease the time and cost of use the trained technicians, in this study we want to comparison the parameters of automated analyzer software with a trained technician to know which of them maybe reliable and can assist.

Methods: 20 patients who undergone full night polysomnography class 1 randomly selected[A1] at sleep clinic of Baharloo hospital. A sleep technologist who were blind to study, scored epoch by epoch sleep stages and respiratory events according to recommended criteria of AASM 2013 then an auto analysis was done using auto analysis of N-7000 amplifier. Results of auto analysis and the ones scored by trained sleep technologist compared with SPSS software, descriptive statistics were used for data analysis.

Results: Mean age and BMI was 40.85 (9.33) years and 29.9 (6.1) Kg/ M^2. total sleep time and sleep efficiency by A (auto analysis) was significant more than M (manual scoring),(511.82 (35.34) VS 396.85 (75.97) for TST and 95.47 (3.74) VS. 74.14 (35.34) p value <0.01), also, there were no concordance for Sum of apneas, hypopneas during total sleep time which was much higher by A(Median 150 for A vs. 43 by M p value <0.01). However, calculated number of hypopneas (in Non-REM stage) in A and M analysis was quite similar with no statistical significant difference. the least precision was observed in scoring of stages 3 and REM stage for A scoring and the most similarity between the two approaches for scoring stage N2.

Conclusions: Detecting hypopnea in non-REM stage by auto analyzing software maybe the parameters that help the technicians to use for scoring respiratory events, but there wasn't any similarity between these two techniques for scoring polysomnography.

Disclosure: Nothing to disclose.

P652 | Improved actigraphy-based sleep monitoring through optimal parameter tuning

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Objectives/Introduction: Wearable movement sensors have been used for years as cost-efficient and patient-friendly alternative to polysomnographic (PSG) measurements. For different wrist-worn devices, linear functions have been developed to quantify overnight sleep when lights on and off times are known. However, these algorithms show decreased performance when sleep efficiency is low, which limits their field of application to non-fragmented overnight sleep. In order to make movement-based sleep trackers applicable to patient populations with unconsolidated sleep and daytime naps, we aim to optimize the established linear sleep detection algorithms for detecting sleep in longer activity recordings.

Methods: To model daytime activity including naps, we collected data in a sleep laboratory setting where subjects performed alternating cycles of 160 min of wakefulness followed by 80 min of sleep opportunity. They were equipped with an actimeter (Actiwatch Spectrum, Philipps Respironics) and a wearable inertial measurement unit (JUMP, www.zurichmove.com) on their non-dominant wrist. Naps were recorded by PSG measurements. The dataset included in total 58 hr (7054 epochs of 30 s) of recording from two healthy subjects, including 1651 epochs of sleep (23.3%) and 5421 epochs of wake (76.7%), respectively. To score the data of the JUMP sensors, an unconstrained genetic algorithm was used to optimize the eight parameters of the linear algorithm presented by Cole et al. (Sleep, 1992). Two-thirds of the dataset were used for training, one third

for evaluation. The results were validated against PSG ground truth and compared to the Actiwatch results.

Results: With our algorithm, an accuracy of 90.2% was achieved (sensitivity: 88.5%, specificity: 90.8%). Compared to the Actiwatch algorithm (accuracy: 59.6%, sensitivity: 98.3%, specificity: 44.9%), the overall performance given by the accuracy has been considerably increased from below 60% to above 90% while maintaining high sensitivity and improving specificity.

Conclusions: We show that by optimizing the linear sleep detection algorithm for real-world datasets containing more wake than sleep phases, an algorithm initially biased towards sleep can be tuned to favour wake detection. Our movement-based sleep-wake detectors can more reliably classify daytime naps compared to an Actiwatch, which extends the use of sleep trackers to patient populations with fragmented night sleep and daytime naps.

Disclosure: Nothing to disclose.

P653 | A smartphone based machine learning method for the fine characterization of snoring

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Objectives/Introduction: The large scale screening of sleep apnea is limited by the complexity of currently available means of study. Snoring is a cardinal sign of obstructive sleep apnea. However, its subjective evaluation is random and its objective evaluation is done within medical settings that go beyond the purpose of screening. Automatic methods for analyzing snoring have been proposed. These methods are based on either insufficient or unrealistic modeling (specific microphones). Our goal was to build a model of detection, and thus characterization, of snoring by the use of standard smartphones in real life conditions.

Methods: We used a machine learning approach in R: – Construction of a heterogeneous database of nocturnal audio recordings in 50 healthy volunteers (30–60 years old, ~50% males/females) using their personal smartphone at home. - Manual annotation of 10,000 snoring events were done – Spectral / temporal characteristics according to PLoS ONE 8 (12) e84139 were extracted - Those features were used to feed a supervised learning Support Vector Machine algorithm. Performance was evaluated using a Leave-One-Out-Cross Record procedure on the recordings.

Results: This approach yielded a statistical performance as follow: success rate = 80% specificity = 84% sensitivity = 74% Cohen's kappa = 0.52 with F1Score = 0.73.

Conclusions: Using a machine learning method allowed us to implement a powerful acoustic snoring detection model into a standard smartphone environment. This application can be deployed in clinical studies for finely characterizing snoring or to asses positional snoring.

Disclosure: Funding was provided in part by BPI Excellence.

P654 | If you're sleepy and you know it, …

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Objectives/Introduction: The prevalence of sleepiness-related road, work and domestic accidents, suggests that humans may often fail to correctly determine how sleepy they are. Although discrepancies between subjective and objective sleepiness have repeatedly been examined earlier, only very few studies have addressed these inconsistencies using an adequate methodology. The purpose of this study is to evaluate the potential overlap between objective and subjective sleepiness levels, within an Item-Response Theory framework.

Methods: Twenty-two healthy participants aged between 18 and 47 years, enrolled in a 36-hr constant routine protocol. Every two hours, participants reported their subjective level of sleepiness by means of the Karolinska Sleepiness Scale (KSS) before performing a 20-min multiple sleep latency test (MSLT) session. Raw KSS scores and sleep latencies were calibrated into linear subjective and objective measures of sleepiness according to the Andrich Rating Scale Model. Subsequently, measures were equated through Common Person Linking (CPL), allowing to determine -within error- whether participants subjectively over- or underestimate objective sleepiness levels.

Results: Our results show that a 5-category KSS presents with improved measurement properties (rating scale functioning, item fit, reliability/validity testing, measurement invariance). In addition, our findings indicate that after calibration, usual MSLT-thresholds may require optimization, and that four unequally spaced categories better reflect increasing levels of sleep propensity. CPL revealed a general estimation bias for about 64% of the sample. Similar proportions of subjects present with respective over- or underestimation of sleepiness levels. Regarding time-dependent biases, most estimation errors tended to occur within the so-called post-lunch dip (day 1: 14:00; underestimation); during early morning hours (day 2: 4:00; overestimation) and at the final trial (day 2: 20:00; overestimation).

Conclusions: Taken together, our findings suggest that in general, most individuals make estimation errors, with around one third of participants underestimating sleepiness levels. Moreover, these types of errors more frequently occur when homeostatic pressure is high and circadian wake drive is still low.

Disclosure: Nothing to disclose.

P655 | Cardiac activity and wrist movements: SomnoArt a new technology to assess sleep architecture in healthy, depressed and insomniac patients

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Objectives/Introduction: Previously we showed how the integrated analyses of heart rate and body movements during sleep can lead to an equivalent evaluation of sleep architecture and continuity to the one obtained from polysomnographic recordings (Muzet et al. 2016). These data were based on 60 nights records from healthy subjects. The aim of the current study was to confirm that this new approach of sleep stage scoring can also be applied to patients. Furthermore, a larger pool of healthy control subjects has also been assessed.

Methods: The results presented here are based on 590 sleep nights (333 healthy, 55 insomniacs and 202 depressed patients) that have been recorded in 76 healthy volunteers and 151 patients. The recordings combined standard PSG and recording heart rate and body movements. The data were processed for PSG scoring according to the AASM's rules and for heart rate and body movement using the Somno-Art software. A comparison of the extracted sleep architecture and continuity parameters was performed.

Results: Based on the statistical analyses as intra-class correlation coefficient, the band Altman and the box-plot comparisons, shown a good and excellent agreement between the PSG scoring and the Somno-Art analyses for the various sleep parameters.

Conclusions: In conclusion, SomnoArt new sleep scoring approach represents a valid alternative to the cumbersome PSG recordings and brings a valuable advantage over PSG given the fact that of the easy to use recording system which can be carried out repeatedly in ambulatory settings in both healthy subjects and pathological patients.

Disclosure: Nothing to disclose.

P656 | Correlation between the score of "STOP BANG" questionnaire and the severity of the OSA

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Objectives/Introduction: Obstructive sleep apnea (OSA) is the most prevalent sleep-breathing disturbance, affecting 24% of men and 9% of women in the general population.Studies have shown that patients with OSA will have an increased incidence of: coronary artery diseases, hypertension,congestive heart failure, cerebrovascular accidents, gastroesophageal reflux disease, etc… The "STOP BANG" questionnaire has been developed to be screening tool for obstructive sleep apnea. STOP BANG consists of 8 yes or no questions based upon snoring, tiredness/sleepiness, observed apneas, high blood preasure, BMI > 35 kg/m^2, age >50 years, neck circumference >40 cm, and male gender.

Aim: Of our studuy was to determinate a correlation between the score of "STOP BANG" questionnaire and the severity of the OSA.

Methods: We included 70 pts who were highly suspected for OSA. All of them were given a questionnaire STOP BANG. Patients who had a score of more than 4 were included in study.For assessment of severity of the desease it was performed home sleep study .The severity of sleep apnea based upon the AHI and categorized into 4 groups: none (AHI < 5/hr), mild (AHI ≥ 5 to <15/hr), moderate (AHI ≥ 15 to <30/hr), and severe (AHI ≥ 30/hr).

Results: We found that with the score 4, only one patient had >5 AHI, 2 pts had 5–15 AHI, no one had 15–30 AHI, and 1 had more than 30 AHI. With score 5: no one has <5 AHI, 2 pts had 5–15 AHI, 1 had 15–30 AHI, 3 had <30 AHI. With sore 6 no one had AHI <5.3 of ptshad 5–15, 3 had 15–30, and 7 had more than 30 AHI. With score 7, no one had <5 AHI, 3 pts had 5–15, 5 has 15–30 and 10 had <30 AHI. With score 8 No one had <5 AHI, 4 had 5–15, 10 had 15–30 and 15 pts had more than 30 AHI.

Conclusions: High STOP BANG score indicated a higher probability of heavier disease. The probability to have more severe OSA increases with high scores of STOP BANG more sever.

Disclosure: Nothing to disclose.

P657 | Can smartphone sleep applications reliably assess sleep-wake cycle? Preliminary findings from a PSG study

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Objectives/Introduction: Smartphone applications are considered as the prime candidate for the purposes of large scale, low cost and long term sleep monitoring. How reliable is smartphone assessment of sleep remains a key issue and more validation studies with both healthy and patient populations are needed. In this study we compared the performance of four smartphone applications (Sleep Cycle-accelerometer; Sleep Cycle-microphone; Smart Alarm; Sense) with polysomnography (PSG). Our main objective was evaluating whether sleep reports provided by applications offer reliable assessment of standard sleep parameters and establishing which of the application features result more promising for personal home use.

Methods: 20 healthy participants were recorded at home, for two consecutive nights. Four iPhone applications (two per each night)

designed for sleep-wake detection were used simultaneously with continuous PSG.

Results: Pearson's correlation coefficients between PSG parameters (Time in bed, TIB; Total Sleep Time, TST; Wake After Sleep Onset, WASO; Sleep Efficiency, SE; Sleep Latency, SL; NREM Sleep Stages 1–4, N1, N2, N3, N4; Slow Wave Sleep, SWS; Rapid Eye Movement Sleep, REM) and app reports were calculated. Significant correlations are reported below. *Sense*: TIB (app) and TIB (PSG): $r = 0.713$, $p = 0.003$; TST (app) and TST (PSG): $r = 0.777$, $p = 0.001$; Sleep Score (app) and SE (PSG): $r = 0.482$, $p = 0.069$; Light Sleep (app) and N1 + N2 + REM (PSG): $r = 0.424$, $p = 0.062$; Sleeping Soundly (app) and N3: $r = 0.596$, $p = 0.019$; Sleeping Soundly(app) and N4 (PSG): $r = 0.520$, $p = 0.047$. *Smart Alarm:* TIB (app) and TIB (PSG): $r = 0.944$, $p < 0.001$; Time Awake (app) and WASO (PSG): $r = 0.473$, $p = 0.035$; Sleep Quality (app) and SE (PSG): $r = 0.431$, $p = 0.057$. *Sleep Cycle-accelerometer*: TIB (app) and TIB (PSG): $r = 0.672$, $p = 0.002$; Sleep quality (app) and SE (PSG): $r = -0.480$, $p = 0.038$. *Sleep Cycle-microphone:* TIB (app) and TIB (PSG): $r = 0.492$, $p = 0.045$; Sleep quality (app) and TIB (PSG): $r = -0.522$, $p = 0.032$.

Conclusions: Two apps provided partially reliable estimates of SE and showed significant correlations with TST and WASO measured by PSG. Only one app showed significant correlations with SWS parameters. In general, the examined apps do not offer reliable sleep stage data, not discriminating light sleep from deep sleep and especially not providing any estimate of REM.

Disclosure: This work was partially supported by a research grant from Fondazione Altroconsumo.

P658 | Does mattress zoning affect the biomechanics of sleep?

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Objectives/Introduction: A sleep system should provide enough support to keep spinal alignment close to neutral throughout the night minimising muscle activity. Mattress zoning is one of the latest developments in pocket sprung mattress design aiming to improving sleep quality by improving spinal alignment.

Methods: Ten Qualisys™ cameras recorded movement of the spine in 6 degrees of freedom using a multisegment spine model during side lying on two aesthetically identical mattresses, internally one mattress included a zoned area. Subjective measures of perceived mattress comfort and perceived firmness were taken, whilst peak pressure was measured at the hip and shoulder.

Results: On a sample size of 20 healthy participants, there were no significant differences in the peak pressure at the shoulder. However, there was at the hip ($p = 0.004$) with the non-zoned mattress having lower pressures (2.63 kPa) than the zoned (2.92 kPa). There was no significance relating to perceived mattress firmness or comfort though it should be noted that 65% of participants preferred the zoned.

Spinal posture was measured in terms of how far posture varied from a neutral position. Within the sagittal plane there were significant differences between the zoned and non-zoned mattresses at the upper lumbar to lower lumbar region ($p = 0.046$) with the Zoned mattress deviating the least. The coronal plane showed significant differences in the upper thoracic to mid thoracic ($p = 0.038$) and lower thoracic to upper lumber ($p = 0.024$) with Zoned deviating the least. The Zoned mattress demonstrated less rotation within the lower lumber to pelvis segment ($p = 0.012$).

Conclusions: This study suggests that whilst zoned mattresses do not disperse pressure as effectively at the hip, it is in fact more supportive to compensate as it reduces "hammocking" and improves overall spinal alignment. The zoned mattress outperformed the non-zoned mattress in key areas around the lower lumbar to pelvic region suggesting that it may help to reduce torsional strains, potentially helping individuals with LBP. The findings of this study show a multi-factorial approach is beneficial in understanding our interaction with sleep surfaces.

Disclosure: Staff time was funded by a University Investment Voucher, match-funded by Silentnight Group Ltd.

P659 | Automatic human sleep stage scoring using Deep Neural Networks

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Objectives/Introduction: Sleep research and medicine require the analysis of polysomnography (PSG). According to the current standard sleep stages shall be visually scored by an expert. Scoring is time consuming and to some degree subjective. It is important to develop tools for automatic sleep stage detection. Artificial neural networks are used to classify data. Particularly, Deep Neuronal Networks (DNNs) perform better than other machine learning (ML) methods for various problems and types of data, including pattern recognition in images and time-series. Convolutional Neural Networks (CNNs) are the best for images and Recurrent Neural Networks (RNNs), especially the Long-Short Term Memory (LSTM) networks are suited for time-series analyses.

Methods: Data were recorded in two laboratories:

(1) 18 healthy young males (3 nights each);

(2) patients suffering from narcolepsy (n = 23) or hypersomnia (n = 5).

Sleep at night and a Multiple Sleep Latency Test (MSLT; approx. 9 hr continuous recording). We developed networks which included CNN and LSTM modules. The networks worked with raw data. We trained these networks using a subset of the data (healthy subjects only; mixed data) and validated them on the remaining data which were not used for training. We also used classical ML methods for comparison.

Results: All our methods trained on healthy participants performed very well on the data of healthy subjects for all sleep stages (F1 scores 0.85–0.95) except stage 1 (F1 score ~0.4) and slightly worth on patients (0.6–0.8). LSTM networks showed better performance for stage 1 than other methods. Deep learning methods showed better performance than classical ML methods on the patient data, i.e. they generalize better. All methods improved when we included patient data into the training dataset.

Conclusions: We demonstrated that DNNs performance on sleep scoring is close to human expert scoring in both healthy adults and patients. The detection of stage 1 was also similar to experts. Taking the temporal structure of sleep into account was important. DNNs generalized better than other methods. Our algorithms could benefit from larger and more diverse training datasets. Supported by nanotera.ch and the Swiss National Science Foundation.

Disclosure: Nothing to disclose.

P660 | Finding the ideal sleep solution: are you sleeping comfortably?

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Objectives/Introduction: Humans spend around a third of a lifetime in bed. There are a variety of mechanisms that reduce back pain and improve quality of sleep by decreasing spinal muscle activity, improved spinal alignment, and reducing pressure at main contact areas between the body and the sleep surface; one of which involves mattress comfort layers.

Methods: Ten Qualisys™ cameras recorded movement of the spine using a multisegment spine model during side-lying on three visually identical mattresses. Internally mattresses contained a zoned 1,000-count spring configuration, each had a different comfort layer of equal depth (Geltex, Latex and Memory Foam). Peak pressure distribution was measured at the hip and shoulder. Additional comfort and firmness ratings were recorded.

Results: Twenty healthy participants showed a statistically significance difference in the peak pressure of the shoulder ($p < 0.001$). Pairwise comparisons showed that Geltex was significantly different to Latex ($p < 0.001$; 2.36 kPa) and Memory Foam ($p < 0.05$; 2.41 kPa). Mattress peak pressure at the shoulder changed significantly over time ($p < 0.01$) for Geltex ($p < 0.05$) and Latex ($p < 0.05$) but not Memory Foam. Lower peak pressures were shown at the hip for Geltex (2.17 kPa) when compared to Latex ($p = 0.013$; 2.39 kPa) and Memory Foam ($p < 0.001$; 2.51 kPa). Though Geltex was perceived the most firm, hip peak pressure changes significantly over time in Latex ($p < 0.001$) and Memory Foam ($p = 0.004$) but not Geltex. The coronal plane showed statistically significant differences between mattresses ($p = 0.016$) within the lumbar region with differences shown between: Geltex and Latex ($p = 0.011$), Geltex and Memory Foam ($p < 0.05$) and Latex and Memory Foam ($p = 0.002$). The lower lumbar to pelvis segment also showed significant difference ($p = 0.046$) between: Geltex and Memory Foam ($p < 0.05$) and Latex and Memory Foam ($p < 0.05$). The sagittal plane showed statistically significant differences ($p = 0.041$) the lower thoracic and lumbar segment between Geltex and Latex ($p = 0.012$) and Geltex and Memory foam ($p = 0.005$).

Conclusions: Evidence suggests that a Geltex comfort layer disperses pressure at the hip and shoulder more effectively than Latex or Memory Foam. Geltex showed significantly less deviation from the spinal neutral position in key areas around the lower lumber suggesting a more neutral spinal posture improving spinal health.

Disclosure: Staff time was funded by The Silentnight Group Ltd.

P661 | Validation of Russian version of the dysfunctional beliefs about children′s sleep scale

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Objectives/Introduction: The influence of dysfunctional beliefs of a person on assessment of his own activity has been confirmed in studies of cognitive psychologists. Moreover, a special group of dysfunctional beliefs about sleep that lead to chronic insomnia was identified. It can be argued that understanding the psychological factors of sleep disorders in children and adults is important for the research, treatment and prevention of a large class of sleep disorders. The aim of this study was to validate the Russian version of the Dysfumctional Beliefs About Children Sleep Scale (DBACS; Ng et. al., 2012).

Methods: 101 children, ages 5–13 years old (44 females, mean age 8.36 ± 2.41 years) and their parents participated in the study. Children were interviewed about their sleep quality using Sleep Self-Report (SSR; Owens et al., 2000) and checklist measuring their sleep vulnerability (12 reasons for their disturbances: "To what degree your sleep is disturbed by … stress, strong emotions etc.") while their parents (93 females, age 24–52) completed Children Sleep Habits Questionnaire (CSHQ; Owens et. al. 2000), DBACS and the same checklist about their child′s sleep vulnerability. Cronbach′s alpha for children's checklist was 0.68 and for parents' checklist was 0.82. All questionnaires were translated and back-translated.

Results: Russian version of DBACS demonstrated good reliability (Cronbach′s alpha was 0.83). Cronbach′s alpha for SSR was 0.83. DBACS total score correlated with children′s sleep vulnerability both appraised by parents and children (r = 0.35 and r = 0.38, $p < 0.01$), CSHQ total score(r = 0.38, $p < 0.01$), SSR total score and its Daytime sleepiness subscale (r = 0.20 and r = 0.32, $p < 0.01$) that further supported validity of DBACS. No gender differences or age effects were found.

Conclusions: Results support the reliability and validity of Russian version of the DBACS and support the importance of psychological factors of sleep disorders studying. Further research is needed to explore psychological factors of sleep problems across the various clinical groups and the ways of psychological treatment and prevention of that problems in Russia.

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Disclosure: Nothing to disclose.

P662 | Classification of obstructive sleep apnea with and without REM sleep behavior disorder based on convolutional neural network using cardiopulmonary coupling spectrogram

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Objectives/Introduction: This study proposes a method of automatically classifying pateints of Obstructive Sleep Apnea (OSA) with and without REM sleep behavior disorder (RBD) based on convolutional neural network (CNN) using cardiopulmonary coupling (CPC) spectrum induced from a single-channel electrocardiogram (ECG).

Methods: Nocturnal polysomnography (PSG) recordings were obtained during the sleep of 62 subjects (with RBD group: 33, without RBD group: 29) at Samsung Medical Center (Seoul, Republic of Korea). Data were divied into training set of 49 subjects and test set of 13 subjects in order to train and test CNN structure. ECG-based CPC analysis was conducted using Embla CPC (Embla systems LLC, USA). And, CPC spectograms were used as input data of CNN to classify OSA with and without RBD group. CNN has three layer structure (first layer: filter *N*. (80), filter size (2×3), activation function (rectified linear unit, RELU), pooling size (1×4); second layer: 40, 2×3, RELU, 1×4; and third layer: 16, 2×3, RELU, 1×4). Finally, all neurons are fully connectd and learning process is performed through feedforward and back propagation algorithms.

Results: The classification performance showed accuracy, sensitivity and specificity of 84.6%, 88.0% and 80.0% for test set (positive: with RBD, negative: without RBD, respectively.

Conclusions: The CPC-based method has the potential for automatically classifying OSA with and without RBD patients in a home environment without any other physiological signals.

Disclosure: All authors declares that he or she has no conflict of interest.

P663 | Activity monitor setup with two sensors

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Objectives/Introduction: Actigraphy is a common technique for sleep-wake classification and for activity monitoring. Usually for sleep-wake classification, a monitor is placed on the non-dominant wrist. It would be beneficial to have an additional sensor on e.g. the trunk, indicating body position and movement. Using two standard activity monitors results in a problem of synchronizing the signals in long recordings. Use of two devices also doubles the cost of the setup. We combined a standard clinical actigraph monitor and a low-cost movement sensor in a wireless setup.

Methods: ActiGraph GT9X and wGT3X devices (ActiGraph, LLC) have the possibility to store heart rate (HR) from heart rate monitors over Bluetooth. We custom programmed a low-cost, general-purpose, coin-size movement sensor Movesense (Suunto Oy, a subsidiary of Amer Sports Corporation) to transmit position information encoded as HR information. Movesense integrates 9-DOF movement, temperature, heart rate, and ExG sensors with a built-in memory. In this study, the Movesense device single axis acceleration values −1.27 to 1.27 g were transformed and transmitted as 1–255 bpm HR to the ActiGraph monitor and stored synchronously with monitor activity once per second.

Results: We evaluated the setup by connecting the two sensors together and recorded for a period of 2 weeks. The sensors' corresponding acceleration values were identical to resolution of sensor.

Conclusions: With the simple addition of a low-cost movement sensor we created an activity monitor setup with two synchronized signals from different body locations. One sensor provides standard activity monitor data and the other low-cost sensor provides additional information about body position. Instead of body position sensor, the sensor can be programmed to provide e.g. activity counts when placed on the waist, information about standing when placed on the thigh, periodic leg movements when placed on the ankle, or possibly even breathing movement when placed over the thorax.

Disclosure: Nothing to disclose.

P664 | The influence of between shift recovery duration and time of day on sleep: an analysis of 14 field actigraphy studies

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Objectives/Introduction: Shiftwork and flexible working hours are common in modern society. Across shiftwork industries, an immeasurable number of roster combinations of work and rest are used. Sleep duration prior to shift is an important factor in fatigue risk management. While it is clear that shorter recovery times curtail the opportunity to sleep, questions remain on how time of day affects this relationship. Hence, this study used sleep diary and activity data from multiple worksites, to investigate how rest duration and timing between shifts affects sleep duration and sleepiness.

Methods: The analyses were based on diary and actigraphy data from 328 subjects in 14 data collections at 11 work sites in Sweden, Finland and Australia, totally rendering data on 4,000 sleep episodes. The recovery times between shifts were used to predict sleep duration before morning, evening and night shifts using multilevel mixed effects modeling.

Results: Sleep duration was strongly associated to recovery times between shifts, particularly before evening and night shifts (b = +0.31 hr of total sleep time for each hour of recovery time, p = 0.012; and b = +0.34 hr, $p < 0.001$, respectively). More recovery time before morning shifts was also a significant predictor of sleep duration (b = +0.12 hr, $p < 0.001$), but this amount of sleep seemed more affected by schedule specific factors, e.g. the starting time of the morning shift. In addition, sleep duration was strongly affected by work site and individual differences.

Conclusions: Sleep duration prior shifts are curtailed by a number of factors including (1) short recovery times between shifts, (2) circadian influences (most dramatically shortened prior evening and night shifts), (3) shift specific aspects (e.g. change-over times), and (4) individual differences. It is recommended to avoid recovery times shorter than 12 hr off between shifts, since it drastically increase the amount of workers having curtailed sleep.

Disclosure: Nothing to disclose.

P665 | A new tool for automatic detection of microsleeps during sleep restriction: validation in healthy volunteers

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Objectives/Introduction: Hypovigilange is characterized by symptoms which are itchy eyes, slow eyes blink movements, incorrect decision making and microsleeps. Therefore, there is a need for a new tool providing automatic detection at least for microsleeps when people fells drowsiness. Our approach consists to provide a new algorithm based on multisensor electroencephalogram (EEG) measurements.

Methods: 12 healthy males volunteered (20–36 years old, height (mean ± SD): 1.78 ± 0.08 m, weight: 75.1 ± 7.1 kg, body mass index (BMI): 23.8 ± 2.1) were included in this laboratory-controlled protocol. Polysomnographic recording devices were used continuously to collect six channels: frontal (F3-M2, F4-M1), central (C3-M2, C4-M1) and occipital (O1-M2, O2-M1) EEG derivations on MWT. In order to assess the performance of automatic microsleeps detection comparatively with a manual scoring (2 experts of conventional polysomnograms), maintenance of wakefulness test (MWT-40 min) was performed in a previous sleep restriction protocol (Bougard et al 2018). The MWT was conducted in the sleep laboratory, in a darkened bedroom according to the AASM recommendations (Littner et al., 2005).

Results: For all signal considered, the features are extracted in the spectral domain. Traditionally and according to the AASM recommendations, microsleeps were defined as the time sleep episodes between 3–15 s during which 4–7 Hz (theta) activity replaced the waking 8–13 Hz (alpha) background rhythm. Microsleeps episodes were extracted by: (i) smoothing the filtered power of 4–7 Hz Morlet wavelet transform with a Kalman filter and (ii) using a double threshold and persistence greater than 3 s and less than 15 s. The area under the curve of the ROC (Receiver Operating Characteristic) curve was used to characterize performance of the automatic detection comparatively with the traditional visual detection (TPR = 0.76; FPR = 0.12; PPV = 0.86; F1 = 0.81; ACC = 0.82).

Conclusions: Our results establish the validity of our algorithm which appears as a good candidate for automatic microsleeps detection during sleep restriction. Therefore, our algorithm has an obvious potential for reducing the cost and increasing the efficiency of microsleeps scoring.

Disclosure: Nothing to disclose.

P666 | Level of consciousness during anesthesia and sleep is indexed by the spectral scaling exponent of resting EEG

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Objectives/Introduction: The presence of consciousness cannot be reliably inferred from behavioural responsiveness. Indeed, anesthetic agents cause behavioural unresponsiveness; while some (xenon, propofol) promote unconsciousness, others (ketamine) promote dream-like consciousness. This is paralleled by sleep states that promote unconsciousness (N3) and by others that preserve it, with the presence of dreams (REM). It is important for a robust and reliable marker of consciousness to separate unconsciousness beyond behavioural unresponsiveness.

Methods: The decay of the power spectral density (PSD) of resting electroencephalography (EEG) was evaluated as a marker of conscious experience during anesthesia, and validated during sleep loss of consciousness.

The spectral scaling exponent of the PSD was obtained, after debiasing for oscillatory peaks, over a broad band (1–40 Hz) and in two sub-bands. In the anesthesia dataset, three groups of five healthy subjects were measured during and before the anesthesia with either Propofol, Xenon or Ketamine. In the sleep dataset, five healthy subjects were awakened multiple times through the night, resulting in short recordings in different sleep stages.

Results: States supporting consciousness (wakefulness, ketamine-anesthesia) were clearly separated from states of unconsciousness (Propofol, Xenon) by considering the spectral exponent of the PSD, in particular when jointly considering the two sub-bands. The spectral exponent greatly decreased within each subject due to loss of consciousness. Similarly, the exponent was lower in unconscious deep sleep (N3) than in wakefulness and REM sleep.

Conclusions: Unsconsciousness could be reliably discriminated from behavioural unresponsiveness, by a steeper decay of the PSD of resting EEG. In the future, the measure could help to assess intra-operative awareness during anesthesia, to monitor patients with disorders of consciousness and to perform automatic sleep staging.

Disclosure: Nothing to disclose.

P667 | Representation of polysomnography recordings as low dimensional trajectories in latent space

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Objectives/Introduction: Polysomnography (PSG) recordings are the gold standard in the study of sleep, where multiple biophysiological signals are recorded from subjects, such as electroencephalogram (EEG), electrooculogram (EOG), electromyogram (EMG) and respiratory activity (nasal flux and oxygen saturation). The qualitative evaluation of sleep sessions (sleep scoring) is based on the visual identification of sleep stages by experts according to the traditional Rechtschaffen and Kales (R&K) standard and the more recent standard by the American academy of sleep medicine (AASM). The succession of sleep stages results in the hypnogram of the PSG recording. However, recent studies have shown that inter-expert agreement in sleep scoring is variable and in the order of 85%. In addition, hypnograms may not be discriminating enough to identify certain sleep disorders, such as paradoxical insomnia. Our aim is to use modern methods of machine learning in order to obtain an alternative, and hopefully more discriminative description of sleep, that lies between the explicit biophysiological signals of the PSG and the succinct representation of the hypnogram.

Methods: We use autoencoders to project the multi-channel representation of PSG recordings into trajectories in a latent space of 2 or 3 dimensions. Autoencoders are unsupervised machine learning models that learn to compress information into representations of lower dimension (latent space). Importantly, this compression forces the model to represent similar signals into the same regions of the latent space.

Results: A preliminary analysis with a small cohort of healthy subjects enabled to distinguish between successful nights of sleep from more atypical ones by visual inspection of latent space trajectory.

Conclusions: The representation of sleep sessions as trajectories in low dimensional latent space provides an intermediate description of sleep between the highly complex and explicit signals of PSG recordings and the succinct representation of hypnograms. These latent space trajectories are promising tools to complement the standard hypnogram and may enable better identification of sleep disorders.

Disclosure: Nothing to disclose.

BREATHING DISORDERS 5

P668 | Prevalence of reported excessive daytime sleepiness among Moroccan patients diagnosed with Obstructive sleep apnea-hypopnea syndrome and it's correlation with Epworth sleepiness scale

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Objectives/Introduction: A large proportion of adult patients who presents to sleep disorder centers have disorders associated with excessive daytime sleepiness (EDS). These include Obstructive sleep apnea-hypopnea syndrome (OSAHS) which is a common global health disorder characterized by periodic complete or partial upper airway obstruction during sleep despite ongoing respiratory effort. It is associated with sleep disorder symptoms including loud snoring, disturbed and frequent wake-up during sleep and EDS. Because EDS is a subjective symptom that is often confused with chronic fatigue, the Epworth Sleepiness Scale (ESS) has been developped as a simple self-administered questionnaire with less subjectivity. The objective of this study is to assess the prevalence of EDS in a group of Moroccan patients diagnosed clinically and polysomnographically with OSAHS and its correlation with the ESS.

Methods: This is a retrospective study of 53 charts from patients diagnosed with OSAHS in the pulmonology department of Ibn Sina Hospital between October 2016 and December 2017.

Results: We evaluated 53 patients with OSAHS (38 men and 15 women) with a mean age of 47.8 ± 12.9 years. The prevalence of EDS was 98.1% and the ESS was greater than 10 in favor of an EDS in 58.5%. There was no statistically significant relationship between reported EDS and the ESS (*p*: 0.2).

Conclusions: The high prevalence of EDS reported by patients is probably due to the confusion with other conditions essentially chronic fatigue. Although these semiological concepts present fundamental differences from physiological and pathological points of view, general medical literature still often confuses both symptoms because of the lack of distinction in the clinical use of terms. ESS is considered as part of clinical questionnaires and indices that may lead to suspicion of sleep apnea in a person. However, it's interesting to consider new non-invasive, easily realizable and more objective clinical tools.

Disclosure: Nothing to disclose.

P669 | Hypertension control in OSA - data from the European Sleep Apnea Database

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Objectives/Introduction: Obstructive sleep apnea (OSA) is a recognized risk factor for hypertension. The effectiveness of various antihypertensive drugs in OSA is limited and only few small size controlled trials have been published on this topic. We analyzed blood pressure (BP) status and medication in the large European Sleep Apnea Database (ESADA) cohort. We hypothesized that drugs that limit sympathetic nerve traffic may have advantageous hemodynamic effects in OSA.

Methods: 5,568 patients from 33 European centers within the ESADA network were recruited. Office BP was assessed in hypertensive OSA patients receiving monotherapy (*n* = 3,375, mean age 52.2 ± 10 years, BMI 32.7 ± 7 kg/m^2, apnea-hypopnea index (AHI) 33.5 ± 26 n/hr) or dual therapy (*n* = 2,193, mean age 59.3 ± 10 years, BMI 33.5 ± 7 kg/m^2, AHI 33.8 ± 26 n/hr). The following antihypertensive drugs were evaluated; betablockers (BB), diuretics (DIU), renin-angiotensin blockers (RAB), calcium channel blockers (CCB), and centrally acting antihypertensives (CAH). Hemodynamic data were analyzed for any single or combination of drug class by means of generalized linear models. Confounders like age, BMI, gender, AHI and comorbidities including ischemic heart disease, cardiac failure, and diabetes were addressed. Metabolic parameters (HbA1c, cholesterol) were analyzed for each treatment.

Results: In monotherapy, systolic BP in hypertensive OSA patients on BB (*n* = 587) was 2.1 ± 0.8 mmHg and 2.9 ± 1.2 mmHg lower compared with patients on RAB (*n* = 1,895) or CCB (*n* = 339) (fully adjusted model, *p* = 0.011 and 0.017, respectively). In combination therapy, systolic BP in hypertensive OSA patients on BB/DIU (*n* = 180) was 7.8 ± 2.9 mmHg, 6.3 ± 1.6 mmHg and 4.9 ± 1.5 mmHg lower compared with patients on CAH/DIU (*n* = 50), CCB/RAB (*n* = 449), or BB/RAB (*n* = 716) (fully adjusted model, *p* = 0.007, <0.001 and 0.001, respectively). BB/DIU treatment was associated with lower diastolic BP and pulse pressure. No unfavorable metabolic effects of BB treatment alone or in combination with other antihypertensive treatments were detected.

Conclusions: Patients treated with beta blockade alone or in combination with diuretics, had lower office BP independent of important confounders for BP control. RAB antihypertensives were by far the most frequently used, but did not associate with favorable BP or metabolic parameters. A prospective evaluation of optimal BP treatment in OSA, in particular for combination therapies, is warranted.

Disclosure: Nothing to disclose.

P670 | Napping in patients with OSAHS is associated to diurnal fatigue

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Objectives/Introduction: Napping is a cross-cultural phenomenon which occurs across the lifespan and which procures benefits on health. In general, people vary widely in the frequency and the duration with which they nap as well as the improvements in alertness and reduction of fatigue, but it's widely admitted to nap between 10 and 30 min per day. In patients with sleep disturbances, napping tend to be long because of the night sleep quality deficit, moreover some studies showed that the health benefits do not necessarily extend to these patients and could even worsen their condition.

The objective of this study is to assess the prevalence of reported napping in a group of Moroccan patients diagnosed clinically and polysomnographically with OSAHS and its association with diurnal fatigue.

Methods: This is a retrospective study of 53 charts from patients diagnosed with OSAHS in the pulmonology department of Ibn Sina Hospital between October 2016 and December 2017.

Results: We evaluated 53 patients with OSAHS (38 men and 15 women) with a mean age of 47.8 ± 12.9 years. The prevalence of napping was 49.1% with a median duration of 78 min [55;133]. In this group of patients, diurnal fatigue was experienced in 57.7% of cases (p: 0.01).

Conclusions: In patients with OSAHS, it appears that napping is long and contradictorily associated with diurnal fatigue. Indeed, any sleep, including napping, is likely to result in apneas and/or hypopneas and so to a fragmented and non-restorative sleep. This finding could constitute an advice to patients to put the instrumental treatment also when napping. In this context, larger studies would be interesting to conduct.

Disclosure: Nothing to disclose.

P671 | Discrimination of hypopnea in everyday practice: is it worthwhile?

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Objectives/Introduction: Discrimination of hypopneas as obstructive or central is recommended for the correct diagnosis of Sleep Apnea. The proportion of patients at risk of central disturbances is increasing (e.g., patients with cardiovascular diseases) so we have to be sure that we are correctly identifying central hypopneas. The aim of this study was to evaluate if discrimination of hypopneas in everyday practice is worthwhile.

Methods: We conducted a retrospective observational study. All the in-laboratory polysomnography (PSG) of the last 12 months and type III home sleep apnea testing (HSAT) of the last 6 months, realized for suspected sleep apnea, were analyzed.

The noninvasive algorithm proposed by Randerath and the recommendations of the AASM were used for differencing central of obstructive hypopnea. Sleep apnea (AHI > or= 5) was classified as obstructive (OSA) if <20% of central apnea/hypopnea (A/H) events; central (CSA) if > or = 50% and mixed if 20–49%.

Results: 316 sleep study were analyzed: 214 (HSAT) and 102 (PSG). The mean age was 55 ± 13 with a predominance of males (66%). Most patients had comorbidity associated: 49% HTA; 38% Dyslipidemia; 17% Diabetes Mellitus; 6% Coronary disease; 4% stroke history and 4% Atrial Fibrillation.

Sleep apnea was present in 86% patients, most of them had OSA: 95% without hypopnea classification and 84% with hypopnea classification ($p < 0.001$). Regarding severity of sleep apnea, 49% had mild SA, 30% moderate SA and 21% severe sleep apnea. The median proportion of central events with and without hypopnea classification was 4% vs. 0.0% ($p < 0.001$). The prevalence of mixed sleep apnea and CSA was higher with hypopnea classification when compared without hypopnea classification (11% vs. 2%, and 5% vs. 2% respectively, $p < 0.001$).

33 (12%) patients had wrong diagnosis when hypopneas were not discriminated: 27 had diagnosis of OSA instead of mixed sleep apnea; 4 patients OSA instead of CSA and 2 patient mixed sleep apnea instead of CSA.

Conclusions: The clear discrimination of central and obstructive hypopneas is necessary in order to avoid misinterpretation and inappropriate treatment of complicated breathing patterns.

Disclosure: Nothing to disclose.

P672 | Contactless monitoring of breathing rate improves measurement robustness

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Objectives/Introduction: Sleep apnea, manifested by periods of paused or shallow breathing during sleep, is suffered by every tenth person. However, most of the affected population is unaware of the disorder. Current diagnosis methods include polysomnography and polygraphy. The obstructive sensors used in these two methods affect sleep quality, and they cannot be used for long-term monitoring due to significant costs and lack of convenience. Here, addressing the need for less intrusive diagnostic procedures, we present a contactless device to measure breathing during sleep. Furthermore, we assess its performance and robustness compared to the nasal cannula and chest-band respiratory effort sensors used in polygraphy.

Methods: Two patients with self-reported snoring underwent 7 full-night recordings using ApneaLink and a K-band Doppler radar-based contactless monitoring device. Breathing-rate estimates per 30 s epochs were determined from the different measurement channels (e.g. nasal cannula, chest-band respiratory effort, radar device). The results were cross-compared to obtain the measurement correlation and biases between the different sensors. Finally, the accuracy of each measurement throughout the night was evaluated.

Results: The three modalities used to measure breathing achieved a good correlation with each other, and had no consistent biases. The nasal cannula however stopped to produce measurements mid-recording in 2 out of the 7 nights, due to the sensor shifting position when the patient moved.

Conclusions: Non-contact breathing rate measurements based on radar are shown to correlate well with state-of-the-art solutions requiring patient contact. Radar measurements also showed superior robustness to patient shifting positions during the night, when compared to the polygraphy sensors, which were more prone to losing contact with the patient throughout the night.

Disclosure: Marc Rullan and Soumya Sunder Dash are co-founders of Sleepiz AG, Zurich, Switzerland

P673 | Catestatin serum levels in male patients with obstructive sleep apnea

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Objectives/Introduction: Catestatin is a neuroendocrine multifunctional peptide involved in regulation of arterial blood pressure and inhibition of catecholamine secretion and sympathetic activity. Concordantly, obstructive sleep apnea (OSA) is marked by autonomic, cardiometabolic and inflammatory dysregulation thus affecting multiple organ systems. The goal of the present study was to determine and compare catestatin serum levels between male OSA patients and healthy control subjects. Additionally, we aimed to investigate the potential discriminatory role of catestatin as a biomarker of positive OSA status.

Methods: In this cross-sectional study, 40 OSA patients and 40 age/sex/BMI-matched control subjects were consecutively enrolled. Each subject underwent anthropometric measuring and peripheral blood sampling while OSA patients also underwent a full-night polysomnography. Catestatin serum levels were determined by the enzyme-linked immunosorbent assay (ELISA). The area under the curve (AUC) was determined by the receiver operating characteristics (ROC) analysis.

Results: A total of 80 male subjects were enrolled in the study, with no significant differences between OSA and control group in respect to age (50.6 ± 10.4 vs. 50.9 ± 7.7 years, $p = 0.903$) and BMI (30.4 ± 2.9 vs. 29.8 ± 2.9 kg/m^2, $p = 0.356$). Both groups did not differ in any anthropometric measures, except that OSA group had significantly higher neck circumference compared to control group (42.0 ± 3.6 vs. 38.9 ± 2.3 cm, $p < 0.001$). Regarding the baseline polysomnographic parameters of OSA population, mean apnea-hypopnea index (AHI) was 42.8 ± 17.4 events/hr with mean oxygen desaturation index (ODI) of 38.9 ± 18.4 events/hr. Catestatin serum levels were significantly higher in OSA group compared to controls (3.1 ± 1.5 vs. 1.3 ± 0.8 ng/mL, $p < 0.001$). The obtained AUC value for serum catestatin as a predictor for positive OSA status was 0.88 (±SE 0.037, 95% CI 0.81–0.96, $p < 0.001$) with a cut-off value of 2.0 ng/mL providing 80% sensitivity and 80% specificity in detection of OSA status.

Conclusions: Serum catestatin levels were significantly higher in OSA patients than matched control subjects and were a robust indicative of OSA status. However, further studies are required to elucidate the mechanistic role of catestatin in complex pathophysiology of OSA and its suppressive role in sympathetic system overactivity.

Disclosure: Nothing to disclose.

P674 | Depression associated to cardiovascular and/or metabolic comorbidities in Patients with obstructive sleep apnea-hypopnea syndrome

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Objectives/Introduction: OSAHS is a public health concern because of its high prevalence and its association with numerous comorbidities causing a high morbidity and mortality risk. Among

these comorbidities psychological disorders are common in patients with Obstructive Sleep Apnea-hypopnea syndrome (OSAHS) and especially depression as suggested with multiple clinical studies.

In our context, symptoms of depression are under-evaluated and under-diagnosed unlike other comorbidities namely cardiovascular and metabolic.

The objective of this study is to assess the prevalence of depression in a group of Moroccan patients diagnosed clinically and polysomnographically with OSAHS and its association with cardiovascular and/or metabolic comorbidities (diabetes mellitus, obesity).

Methods: This is a retrospective study of 53 charts from patients diagnosed with OSAHS in the pulmonology department of Ibn Sina Hospital between October 2016 and December 2017.

Results: We evaluated 53 patients with OSAHS (38 men and 15 women) with a mean age of 47.8 ± 12.9 years. The prevalence of depression was 49.1%. The association with cardiovascular comorbidities namely hypertension and/or diabetes mellitus and/or obesity was found in 57.9% (*p*: 0.04).

Conclusions: The association of depression and cardiovascular and/or metabolic comorbidities in patients with OSAHS appears to be common. It seems interesting to conduct larger studies for better management of this multidisciplinary and transversal disease.

Disclosure: Nothing to disclose.

P675 | Prevalence of sleep apnea syndrome in a cohort of acromegalic patients

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Objectives/Introduction: Acromegaly is a rare disease, with an estimated prevalence around 2.8–13.7 cases per 100,000 patients. The disease is characterized by an excess secretion of growth hormone with raised Insulin-like growth factor I (IGF-I). On the other hand, Sleep Apnea Syndrome (SAS) affects 67–75% of acromegalic patients.

In acromegaly, Obstructive Sleep Apnea (OSA) is more frequent than Central Sleep Apnea (CSA) due to craniofacial deformations, overgrowth of soft tissues such as the tongue (macroglossia), pharynx or larynx, inducing thickening of the airway.

Methods: We conducted a prospective observational descriptive study including all acromegalic patients treated at Pedro Hispano Hospital. All the patients were submitted to a complete polysomnography at our Sleep Unit, blood gases evaluation and echocardiography.

Results: Of the 23 patients, only 16 accepted to be included in the study. The median age was 63 ± 16 years with a majority of females (69%). Mean BMI was 29 ± 4 and neck circumference 39 (±3.9) cm. The median Epworth was 7 ± 9 and the Stop-Bang Questionnaire 4 ± 3. Only 13 patients had Beck Depression Inventory, with a median score of 6 ± 13. The median fold change referred to standard deviation score for IGF1 at the time of the study was 0.63 ± 0.30. Arterial hypertension, dyslipidemia and diabetes were the most frequent comorbidities with 44%, 25% and 31% respectively.

When the diagnostic of acromegaly was performed, 87% present a macroadenoma and at the time of the sleep study, 81% had controlled acromegaly. In terms of acromegaly treatment, 94% were submitted to surgery, 43% to radiotherapy and 81% to pharmalogical treatment. Left ventricular hypertrophy was found in 25% patients.

The median Respiratory Disturbance Index (RDI) was 19 ± 52 with a median arousal index of 40.95 ± 26. SAS was diagnosed in 87.5% of patients: 23.1% mild SAS, moderate in 38.5%, severe in 38.5%. Nine patients had OSA (7 on Auto-CPAP), 2 CSA (both on servoventilation), 1 with one Obesity Hipoventilation syndrome and one on positional treatment for Positional Sleep apnea.

Conclusions: SAS is highly prevalent in patients with acromegaly. Most present obstructive sleep apnea.

Disclosure: Nothing to disclose.

P676 | The best formula for predicting cpap pressure? We have any?

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Objectives/Introduction: The use of Cpap for the treatment of sleep apnea is consensual, however it is necessary reach the ideal pressure, for the optimization of the treatment. The titration in laboratory would be the ideal method, however its slowness and his cost makes it impractical. Thus, more and more the search for mathematical formulas are real, which may replace this titration in the laboratory, or the use of Auto-cpap, which also increases the treatment cost for this disease and which may also raise doubts in cardiac benefit

The objective of this work is to compare the predictive equations of Cpap, with the pressure of p90 of Auto-cpap in our patients, in the district of Vila Real.

Methods: Based on a review article by Macário Camacho et al., which carried out a systematic review of the international literature, that worked with mathematical equations used to predict the effective pressure of Cpap, we selected 8 formulas, that best represent our population and also those, that better results had, when compared with patients auto-cpap. Then, we compared that formulas, with the P90 values determined by the Auto-cpap of 72 patients, in the readings between the 1st month and the year of use. Only patients meeting the minimum criteria for CPAP were evaluated (4 hr per night for at least 70% of the nights of the month).

Results: The differences of values for Cpap obtained for each formulas are notorious, as well as the results obtained by them in comparation to the P90 of the Auto-cpap.

The variables most used in the predictive formulas were neck circumference, AHI and BMI, present in 5, 5 and 6 formulas respectively.

Conclusions: The differences between the formulas analyzed and the P95 of the Auto-cpap, leads us to admit the need of develop, a new representative formula for our population and also works for an alert, regarding the use of these formulas, that must be cautious and that their effectiveness, should always be checked periodically.

Disclosure: Nothing to disclose.

P677 | Sleep apnea: before and after heart transplant

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Objectives/Introduction: 66-year old man, non-smoker and normal body mass index.

Methods: Cardiac history: Followed in another institution cardiology consultation since 1994 by congenital atrio-ventricular block and aortic disease. Has been submitted to definitive pacemaker (DDD) implantation in april 2002, with preserved left ventricular (LV) systolic function at that time. In august 2008 LVEF (LV ejection fraction) was estimated at 25%. Until september 2010 does not meet conditions for classic aortic valve replacement surgery. April 2011 cardiac catheterization revealed severely depressed LV systolic function. July 2011 echocardiogram showed dilated cardiomyopathy with severely compromised systolic function (23% LVEF) and in september 2011 starts the pre-transplantation cardiac study. LVEF in november 2011 was 18%. Underwent heart transplantation in september 2015.

Results: Pneumology/ sleep history: First evaluation and study for persistent cough in 2003. Between may and july 2007, for suspected respiratory pauses a sleep polygraphy was made revealing an apnea/hypopnea index (AHI) of 22.3/hr; due to the presence of heart failure and central apneas with suggestive cheyne-stokes respiration, adaptive servo-ventilation (ASV) therapy was instituted. Between 2007 and 2008 always well adapted to ASV, but presented some disadaptation in july 2009. Reassessment by polissomnography (PSG) was made in february 2011 showing 14.2/hr of RDI. All the evaluations made between 2011 and 2014, with approximately 100% of ASV utilization, and residual AHI <5/hr. After cardiac transplant continues with ASV by stating not being able to sleep without it. A new sleep assessment was requested and PSG was performed in october 2017 (respiratory disturbance index (RDI) 16.9/hr; central apnea index (CAI): 0/hr). In march 2018, despite excellent adhesion, ASV therapy was suspended and automatically-adjusting positive airway pressure (APAP) prescribed. April 2018 card reading showed AHI <5/hr, 73% use >4 hr and P95% of 11.6 cmH2O; a change to continuous positive airway pressure (CPAP) mode was programmed.

Conclusions: Few cases are known where sleep apnea diagnosis was made several years before heart transplant. To better understand how does sleep apnea can evolve and to ponder about what is the best treatment approach in this context is the objective with this case presentation.

Disclosure: Nothing to disclose.

P678 | Association of respiratory mechanic instability and respiratory parameters in adults with obstructive sleep apnea

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Objectives/Introduction: Respiratory mechanic instability (RMI) is derived from the analysis of the paradoxical thoracoabdominal movements during airway obstruction. This study aimed to evaluate the RMI parameters in obstructive sleep apnea (OSA) patients and the correlation between RMI parameters and other parameters in polysomnography.

Methods: One hundred thirty nine adult patients who attended our clinic during 10 months were enrolled retrospectively, underwent clinical examinations and in-lab polysomnographys. The RMI parameters were measured from thoracoabdominal band during polysomnography.

Results: Subjects were divided into control (n = 17, apnea-hypopnea index [AHI] <5) and OSA (n = 122, AHI ≥5) groups. The OSA group was subdivided into three subgroups according to the AHI (mild, 5 ≤ AHI < 15; moderate, 15 ≤ AHI < 30; severe, AHI ≥30). As AHI increased, all RMI parameters showed the significant rising pattern and difference among control and subgroups. Arousal index (Arl), lowest oxygen saturation (lowest O_2), and oxygen desaturation index ≥3% (ODI3) were significantly associated with all RMI parameters. Using a cutoff values, the areas under the curve of all RMI parameters for predicting mild, moderate, and severe OSAS were approximately larger than 0.85.

Conclusions: All RMI parameters were well related to respiratory parameters of polysomnography, like Arl, lowest O_2, and ODI3. The areas under the curve of all RMI parameters for predicting OSA and subgroups showed the significant diagnostic performance. These parameters may help to identify OSA patients from control.

Disclosure: Nothing to disclose.

P679 | Investigation of KL-6, ET-1 and S100A9 levels in idiopathic pulmonary fibrosis (IPF) patients with Obstructive sleep apnea (OSA)

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Objectives/Introduction: Obstructive sleep apnea (OSA) and idiopathic pulmonary fibrosis (IPF) often coexist and IPF guidelines recently recognize OSA as a serious problem affecting survival. Krebs von den Lungen-6 (KL-6), Endothelin-1 (ET-1) and S100A9 have been found to be elevated in patients with IPF, potentially representing biomarkers of subclinical lung injury. Yet, these biomarkers have not been fully assessed in OSA patients with IPF. The aim of this study was to investigate potential additive effects of OSA in IPF patients in serum and BALF KL6 levels and serum ET-1 and S100A9 levels.

Methods: Seventy nine patients (age 72.5 ± 6.6 years) with newly diagnosed IPF were included. In addition to overnight attended polysomnography and pulmonary function tests, we also measured serum and BAL levels of KL-6, serum levels of ET-1 and S100A9. The relationship of the above biomarkers with indices of OSA severity and pulmonary function was examined.

Results: Twenty four patients with IPF and 40 patients with IPF-OSA were included in the study. Fifteen patients served as controls. There were no differences in gender, age, BMI or comorbidities among the three groups. Serum KL-6 levels were significantly increased in IPF patients compared to IPF-OSA patients (1,420 vs. 1,023U/ml, $p = 0.04$). Furthermore, a negative correlation was found between serum KL-6 and severity of IPF, assessed by DLCO ($r = -0.64$, $p = 0.003$) and KCO ($r = -0.54$, $p = 0.015$), only in IPF group. Serum KL-6 was also associated with TLC (%) ($r = -0.48$, $p = 0.012$) only in the IPF-OSA group. However ET-1 levels were correlated with KCO in both IPF and IPF-OSA groups ($r = -0.54$, $p = 0.006$ and $r = -0.47$, $p = 0.002$, respectively) but with DLCO ($r = -0.5$, $p = 0.001$) only in IPF-OSA group.

Conclusions: Our findings showed negative associations of serum KL-6 and ED-1 with specific lung diffusion parameters only in IPF-OSA subgroup of patients. This evidence could support the hypothesis that specific biomarkers levels probably reflect the additional oxidative stress OSA provides in IPF patients. Further studies are needed to clarify this observation.

Disclosure: Nothing to disclose.

P680 | Hypoglossal nerve stimulation for obstructive sleep apnea

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Objectives/Introduction: Traditionally, obstructive sleep apnea has been defined by anatomical compromise in which soft tissues and craniofacial structures around the pharyngeal airway lead to increased airway collapsibility.[4] Because of protective reflexes, the pharyngeal airway maintains patency during wakefulness, but, during sleep, loss of these reflexes reduces the activity of the pharyngeal dilator muscle, causing collapse of the susceptible airway.[1] The hypoglossal nerve is a motor nerve that controls the pharyngeal dilatator muscle and movements of the tongue

Methods: Mild stimulation of the distal hypoglossal nerve restores the tone of the pharyngeal dilatator muscle. Increase of muscle tone can prevent the tongue and other soft tissues from collapsing and obstructing the airway during sleep. Inspire Upper Airway Stimulation (UAS) is based on unilateral inspiratory stimulation to the medial branch of the hypoglossal nerve. Inspire Upper Airway Stimulation (UAS) is used to treat a subset of patients with moderate to severe Obstructive Sleep Apnea (OSA) (apnea-hypopnea index [AHI] of greater than or equal to 15 and less than or equal to 65).

Results: Inspire UAS is used in adult patients 22 years of age and older who have been confirmed to fail or cannot tolerate positive airway pressure (PAP) treatments (such as continuous positive airway pressure [CPAP] or bi-level positive airway pressure [BPAP] machines) and who do not have a complete concentric collapse at the soft palate level.

Conclusions: <ul type="“disc”"> <li class="“MsoNormal”" style="“color: rgb (51, 51, 51); margin-bottom: 3.75pt; line-height: normal; background-image: initial; background-position: initial; background-size: initial; background-repeat: initial; background-attachment: initial; background-origin: initial; background-clip: initial;”">. Patients with obstructive sleep apnea due primarily to velopharyngeal compromise may have a good response to palatal surgery, whereas those with unstable ventilatory control may improve with agents such as oxygen or acetazolamide, which can stabilize the breathing pattern. In theory, strategies that increase activity in the pharyngeal dilator muscles should be effective for patients who have dysfunction in these muscles.[8]

Disclosure: Nothing to disclose.

P681 | Comparison between auto-trilevel and bilevel positive airway pressure ventilation for treatment of obesity hypoventilation syndrome patients

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Objectives/Introduction: To observe the efficacy of auto-trilevel positive airway pressure (Auto-trilevel PAP) ventilation for obesity hypoventilation syndrome (OHS) by comparison of bilevel positive airway pressure (BiPAP) ventilation.

Methods: Twenty-three patients with both OHS and OSAS were recruited. Three different positive airway pressure (PAP) modes issued by the ventilators were used for 8 hr per night with each mode at each night and two nights' interval without any treatment among different modes. In mode 1 the EPAP issued by BiPAP was titrated as the minimal positive pressure for disappearance of snoring. The same inspiratory positive airway pressure (IPAP) titrated by $PaCO_2$ in mode 1 was used in mode 2 and 3 as well. However, the EPAP issued by BiPAP in mode 2 was 3 cmH_2O higher than that in mode 1. In mode 3 with autotrilevel PAP, the beginning of EPAP was set the same as that in mode 1 while the end of EPAP (EEPAP) was automatically adjusted to elevate based on upper airway patency condition. The following parameters were compared such as nocturnal apnea hypopnea index (AHI), minimal SpO_2 (miniSpO_2), arousal index, morning $PaCO_2$ and daytime ESS.

Results: Compared with before ventilation therapies, there was a significant decrease in nocturnal AHI, arousal index, morning $PaCO_2$ and daytime ESS, but a significant increase in miniSpO_2 and sleep efficiency caused by all three modes of ventilation (all $p < 0.01$). Comparison among three modes demonstrated that with the same IPAP, the mode 3 could result in the lowest arousal index and daytime ESS. Compared with mode 1, in mode 2 there was a statistically lower AHI, higher miniSpO_2 and morning $PaCO_2$ (all $p < 0.05$), but in mode 3 there was a lower AHI, higher miniSpO_2 (all $p < 0.05$), with no significant difference in $PaCO_2$ at the end of therapy ($p > 0.05$). Compared with mode 2, in mode 3 there was a significant lower $PaCO_2$ ($p < 0.05$), but no significant difference in AHI and miniSpO_2 (all $p > 0.05$).

Conclusions: Auto-trilevel PAP ventilation had a higher efficacy in simultaneous removal of apnea hypopnea events and correction of hypercapnia and was superior over BiPAP ventilaiton for treatment of OHS.

Disclosure: Nothing to disclose.

P682 | Snoring causes OSA: sensory nervous lesions in the palate worsen over time in untreated snorers but not in CPAP-treated patients

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Objectives/Introduction: Previous studies have shown that there are signs of both motor and sensory nervous lesions in the upper airway of patients with obstructive apnea (OSA) and, to a lesser extent, of habitual snorers.

Hypothesis: snoring *per se* may damage upper airway neurons over time, thereby causing the progression to manifest sleep apnea. To prove this, non-snoring subjects, untreated snorers and CPAP-treated OSA-patients underwent repeated sensory testing in the upper airway in a long-time study.

Methods: Cold detection threshold (CDT) testing, a routine neurophysiological method to study sensory function, was performed at the soft palate and the lip. 64 subjects were initially tested in 2008 for their ability to perceive the sensation of cold and retested 6 - 7 years later. 20 were non-snoring controls, 24 untreated snorers and 20 had received CPAP. CDT-testing was performed using the method of limits by a Medoc TSA 2001 equipment with an intra-oral thermod.

Results: In untreated snorers AHI increased from average 9–12. Eight previously normal subjects had developed OSA (AHI/ODI >5). CDT:s worsened from 5.0°C to 14.5°C ($p = 0.001$). Three subjects had completely lost their cold sensitivity in the palate, whereas it was normal and unchanged on their lips. In non-snorers there were no significant changes in AHI (mean values 2.0). Cold detection thresholds increased slightly from average 3.1°C to 6.0°C ($p = 0.003$). In the CPAP-treated patients the CDT:s did not significantly change (from 5.1°C 2008 to 7.1°C in 2015).

Conclusions: CDT:s worsened much more in the untreated snorers than in the other two groups ($p = 0.03$). This group therefore risks developing poor sensitivity in the upper airway in a couple of years of habitual snoring. This could contribute to sleep apnea, since also the snorers′respiratory disturbance had increased. In contrast, it seems that efficient treatment of OSA protects the sensory innervation, since the CPAP-treated group maintained their sensitivity to cold.

Disclosure: Nothing to disclose.

P683 | First successful mechanical splint for OSA with an orally administrable pharyngeal stenting device

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Objectives/Introduction: We report the case of obstructive sleep apnea (OSA) in a 19-year old, otherwise healthy and drug-free, male patient with a BMI of 23 kg/m^2, presenting with persistent daytime sleepiness and non-restorative sleep sensations after velo- and uvuloplasty. Clinical evaluation also reported moderate macroglossia and loud snoring at anamnesis. Given persistent daytime symptoms and the patient's prior explicit refusal of CPAP-treatment, mandibular advancement device or additional surgery, an individually tailored prototype of a pharyngeal stenting device was proposed in the framework of a first feasibility trial ('PHASTENTOSA').

Methods: In contrast to former mechanical stenting attempts by means of nasally inserted trumpets, the studied device here comprises a mouth-administered, completely removable functional pharyngeal stent mounted on a simple inferior dental guard. The stent aims at providing a mechanical upper airway splint by limiting retrolingual collapse between the tongue and the posterior pharynx wall. For the study purpose, the patient underwent two consecutive polysomnographic recordings (PSG) in an academic Sleep Unit of a general University Hospital. The clinical assessment was completed with the Pittsburgh Sleep Quality Index (PSQI) and the Epworth Sleepiness Scale (ESS).

Results: Symptom-scales confirmed excessive daytime sleepiness (15/24 on the ESS) and non-restorative sleep sensations with a PSQI level of 7. At baseline, PSG showed a total apnea-hypopnea index (AHI) of 15.5 and of 24.4 per hour of rapid eye movement (REM) sleep, but no nocturnal hypoxemia. During consecutive PSG, with the treatment device in place, residual AHI dropped to 6.7 (56.8% reduction) and to 1.4 per hour of REM sleep (94.3% reduction) respectively. The device was well tolerated and kept in situ during PSG without any interruptions or complications. Sensation at morning arousal was reportedly refreshing. Recorded sleep efficiency under active treatment, with respect to sleep maintenance, was excellent at 96.5%. Sleep architecture, with respect to sleep stage proportions and sleep fragmentation appeared to be numerically similar between both nights.

Conclusions: Hence, our report shows for the first time, the achievability of a successful mechanical splint with an easy-to-administer orally inserted, pharyngeal stenting device, which may represent a novel treatment option for OSA in the future.

Disclosure: Nothing to disclose.

P684 | Is speech frequency hearing loss associated with STOP-BANG score in commercial drivers?

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Objectives/Introduction: Obstructive sleep apnea (OSA) is a common sleep-disordered breathing. OSA and intermittent hypoxia may be a risk factor for hearing loss. The main purpose of this study was to assess the association between speech frequency threshold and STOP-BANG score as a validated questionnaire for screening of OSA in commercial drivers.

Methods: This cross-sectional study was performed on 1,000 commercial drivers. All the participants were asked to fill out the validated Persian version of Epworth sleepiness scale (ESS) and STOP-BANG questionnaire. A blood sample was collected from all drivers. Pure tone audiometry (PTA) was performed by an expert audiologist and hearing threshold levels of all subjects were measured in frequencies of (500–1,000–2,000–3,000 Hz) for each ear in dB.

Results: The mean age of all drivers was 43 ± 9.9 years. The mean ESS and STOP-BANG score of the participants was 3.1 ± 2.8 and 1.8 ± 0.8, respectively. Drivers were classified in high and low risk for OSA according to the STOP-BANG score. There was a significant difference between speech frequency thresholds (500–1,000–2,000–3,000 Hz) in high risk subjects and low risk for OSA (p value <0.001).

Conclusions: Patients who were high risk for OSA may be prone to hearing loss. More investigation is needed.

Disclosure: Nothing to disclose.

P685 | Using prediction formulas for continuous positive airway pressure in obstructive sleep apnea syndrome

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Objectives/Introduction: Continuous positive airway pressure (CPAP) is the most effective therapy for patients with moderate to severe Obstructive Sleep Apnea (OSA). Increased demand for sleep

lab tests (diagnostic Polysomnography (PSG) and CPAP titration) has led to long waiting lists and high cost. Therefore, CPAP prediction formulas derived from anthropometric and PSG recorded parameters are used to determine CPAP pressure. In this study, we aimed to compare the prediction formulas derived CPAP pressure with the pressure obtained from manual titration among patients referred to a sleep clinic.

Methods: In this cross-sectional study, 90 subjects with confirmed OSA who underwent CPAP titration in Baharloo sleep clinic, Tehran, Iran during 2017 were enrolled. All of the participants had Respiratory Disturbance Index (RDI) ≥15/hr in their overnight PSG and underwent manual CPAP titration study. Then, the pressure obtained from manual titration was compared with the calculated pressure using available prediction formulas for each patient. Hoffstein, Lin, Hukins, and Loredo prediction formulas were used.

Results: The mean CPAP pressure resulted from manual titration was greater that pressures calculated by four prediction formulas. The difference between mean CPAP pressure obtained by manual titration and pressures calculated by Hoffstein, Lin and Hukins formulas were statistically significant. However, mean CPAP pressure obtained by manual titration was not statistically different from Loredo formula (11.7 ± 2.6 vs. 11 ± 2.3, respectively; p value = 0.11).

Conclusions: CPAP pressure prediction formula developed by Loredo et al provided the most similar result with CPAP pressures obtained from manual titration. This formula can be used as a guide for the optimum pressure needed during manual titration and for selected patients who are candidates for auto-titration.

Disclosure: Nothing to disclose.

BREATHING DISORDERS 6

P686 | Characterization of patients with OSAS and nocturnal dessaturation

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Objectives/Introduction: Obstructive sleep apnea syndrome (OSAS) is associated with variable degrees of nocturnal dessaturation. Besides the obstructive events of the upper airways there are other factors that may contribute for dessaturation in these patients. The aim is to describe the characteristics of patients with OSAS and nocturnal dessaturation.

Methods: Retrospective analysis of patients diagnosed with OSAS and a percentage of recording time with SpO2 < 90% equal or superior to 30% (T90 ≥ 30%), from 2014 to 2016 at our hospital.

Results: Identified 68 patients: 11 with mild OSAS, 10 with moderate and 47 with severe. The mean age was 66 ± 12 years-old and 63% were male. T90 was not significantly different between the 3 groups of severity (60%, 63% and 56% respectively, p = 0.711). The remaining characteristics were also not significantly different, with the exception of BMI (31, 33 and 36 kg/m^2 for mild, moderate and severe OSAS respectively, p = 0.034). Although not achieving statistically significance there was a tendency in mild OSAS, comparing with moderate and severe, for more non-smokers (73%, 34% and 53%, respectively), more female (64%, 50% and 28%) and higher values of pCO2 (46 mmHg, 43 mmHg and 43 mmHg). The 68 patients had a mean pO2 of 71 mmHg and various comorbidities: hypertension (69%), heart failure (27%), neuromuscular diseases (3%) and COPD (17%), with a tendency for a higher incidence of COPD in mild OSAS (27%, 20% and 14%). CNS depressant drugs were used in 27% of patients. Regarding the pulmonary function testing 50% of patients had normal tests, 16% had obstructive, 15% restrictive and 19% mixed ventilatory patterns.

Conclusions: Most the patients with significantly nocturnal dessaturation had severe OSAS; however, these patients did not have higher T90 compared to mild or moderate OSAS. There was a tendency for higher values of pCO2 in mild OSAS, and in this group may had been included patients with obesity-hypoventilation syndrome, factor that may contribute to nocturnal dessaturation. There was also more COPD in patients with mild disease, factor that may also contribute to dessaturation, which was slightly higher in mild than severe OSAS.

It would be interesting evaluate in which of these patients CPAP treatment would correct nocturnal dessaturation.

Disclosure: Nothing to disclose.

P687 | Rapid Eye Movement-related obstructive sleep apnea: comparison between two definitions

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Objectives/Introduction: Compare the prevalence and clinical characteristics between two different definitions of Rapid Eye Movement related obstructive sleep apnea (REM-related OSA).

Methods: A retrospective review of all patients that performed polysomnography during 2017 in a Terciary Portuguese Hospital was made and were included all patients with apnea-hypopnea index (AHI) ≥5 events/hr.

In this sample, it was applied two different definitions of REM-related OSA and compared their characteristics.

REM-related OSA was defined as:

1. Definition 1: ratio AHI REM/AHI NREM > 2
2. Definition 2: AHI NREM < 5 and AHI REM ≥ 5 and at least 30 min of REM sleep.

Results: Identified 221 patients, mostly male (n = 135; 61.1%), mean age 57 ± 11. Mean AHI was 22.0 ± 18.5 with 101 patients (45.7%) with mild OAS, 70 (31.7%) with moderate OAS and 50 (22.6%) with severe OSA.

When definition 1 was applied it was identified 84 patients with REM-related OSA (38.1%). The REM-related OSA group had a higher percentage of females (47.1% vs. 33.8%; p = 0.049), a lower score in Epworth Sleepiness Scale (9 vs. 6; p = 0.012) and a lower median AHI (11.4 vs. 19.4; p =< 0.001). REM sleep time, percentage of sleep time with SatO2 < 90%, body mass index (BMI), age, symptoms and comorbidities (including cardiovascular and pulmonary diseases, anxiety and depression) were not statistically different.

When definition 2 was applied it was identified 25 patients with REM-related OSA (11.3%). The REM-related OSA group had a higher percentage of females (76% vs. 34.2%; p < 0.001), lower median AHI (5.9 vs. 17.9; p < 0.001), lower percentage of sleep time with SatO2 < 90%, (3.%1 vs. 6%; p = 0.038), higher BMI (33 vs. 28.5; p = 0.012), higher prevalence of depression (32% vs. 13.3%; p = 0.014) and use of two or more antihypertensive drugs (44% vs. 24.5%; p = 0.038). REM sleep time, Epworth Sleepiness Scale score, age, symptoms and comorbidities as pulmonary and cardiovasculary disease and anxiety were not statistically different.

Conclusions: REM related OAS was more prevalent in females and had lower AIH regardless the definition used.

The use of more restrictive definition for REM-related OSA, like definition 2, defines a group with higher BMI and an arterial hypertension more difficult to treat, which can help in the therapeutic decisions.

Disclosure: Nothing to disclose.

P688 | Outcomes in home sleep testing in patients with high pre-test probability for obstructive sleep apnoea

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Objectives/Introduction: Home sleep testing (HST) is a diagnostic method used to diagnose obstructive sleep apnoea (OSA) in patients with high pre-test probability. We aimed to compare two screening questionnaires regarding outcomes measured by positive HST study and diagnostic polysomnography (PSG) in negative HST.

Methods: We performed 338 HST studies from 2016–2017 in patients with high pre-test probability (Berlin questionnaire ≥2 positive categories or STOPBANG ≥5) for OSA, 35 were excluded from analysis due to insufficient data. All patients underwent HST, and those who were negative underwent diagnostic PSG. Study was positive if respiratory event index (REI) or apnoea hypopnea index (AHI) was higher than 15/hr.

Results: 303 patients were included in analysis, 219 (72%) men, age 54 ± 10.3 years, Epworth sleepiness scale 11 ± 7.7, body mass index 34.9 ± 6.5 kg/m^2. 22 (7%) had high pre-test probability only on STOPBANG, 48 (16%) only on Berlin questionnaire, and 233 (77%) on both. 225 (74%) patients had REI ≥15/hr. Of those with REI ≤15/hr, 31 (40%) had AHI ≥15/hr on diagnostic PSG. Patients were more often positive on HST study if both screening questionnaires were positive than if only one was (78% vs. 61%, p = 0.007), but there was no difference in outcomes in diagnostic PSG between these two groups (35% vs. 46% positive, p = 0.41). No difference in outcomes was observed between Berlin and STOPBANG questionnaire if only one was positive (HST positive in 56% and72%, respectively, p = 0.66).

Conclusions: Patients with high pre-test probability for OSA were diagnosed with HST in 74%. In those who were negative, 40% were later positive on diagnostic PSG. The diagnostic yield of HST was higher if both screening questionnaires were positive.

Disclosure: Nothing to disclose.

P689 | SPECT study in different subgoups of sleep related breathing disorders

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Objectives/Introduction: Prospective, nonrandomized, cross sectional study was organized to investigate the impact of different subtypes of sleep related breathing disorders (SRBD) on regional cerebral blood flow and the integrity of the cerebrovascular reserve capacity.

Methods: Study participants were recruited from cases of consecutive diagnostic polysomnography performed on patients, referred to our laboratory suspected of having SRBD, based on high questionnaires scores. Sixty eligible patients were candidates for further SPECT investigation, in order to create the one by one twenty-person subgroups.

Group 1. IHR. // N:20, male, age:45ys avg.BMI:28 avg.//
Group 2. OSAS(n) // N:20, male, age:40ys avg.BMI:27 avg.//
Group 3. UARS// N:20, male, age:41ys avg.BMI:30 avg.//

Eligible patients (those with history of cerebro-cardio vascular events, with positive head MRI, or taking medicines having influence on regional cerebral blood flow were excluded) the next morning after polysomnography underwent Tc99 m-HMPAO- SPECT study, followed by Acetazolamide challenge. SPECT scans were visually analysed by two independent specialists.

Results: Finally 40 patients /18/IHR-8/OSAS(n)-14/UARS/completed the SPECT study.

Except four cases /2 UARS and 2 IHR/ positive results, extensive areas of hypofixation, were gained. Left and right side were almost equally affected, except for the frontal regions with dominant right sided involvement.

Areas affected by localization were the follows.

In group 1: 5 temporal and 11 fronto-parietal

In group 2: 3 fronto-temporo-parietal and 5 temporo-parietal

In group 3: 3 frontopolar and 9 temporo-parietal

Acetazolamide challenge revealed compromised autoregulatory vasodilation in 14 cases.

In almost all instances the IHR group (12 positive results of 16 patients) was affected.

Conclusions: Il subtypes of SRBD, regardless of the presence of hypoxia or apnea compromised regional cerebral blood flow by SPECT. Contrary, the localization of SPECT hypofixaiton was highly dependent on hypoxia. Majority of cases with normoxemia affected the temporo-parietal lobe, while those with IHR mostly altered the function of the frontal lobe. In fact, our work is the first one to realise that sleep fragmentation or desaturation are not sufficient contributors, but hypoxia is responsible for impaired cerebrovascular reserve capacity, often encountered in SRBD cases.

Disclosure: Nothing to disclose.

P690 | Prevalence of sleep apnea syndrome in patients with stroke history

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Objectives/Introduction: Evaluate the prevalence of SAS in patients with stroke history, the relationship with associated risk factors, as well as a possible relationship between the location of the ischemic stroke and the prevalence of SAS.

Stroke and sleep apnea syndrome (SAS) have both high incidence, with significant impact on the world's population. There are several studies that link the major cardiovascular changes resulting from SAS, including the occurrence of stroke. However, the presence of SAS as a result of stroke is increasingly more frequent, being also important to study the stroke changes that determine the appearance of SAS and affects the recovery of these patients.

Methods: The present retrospective study data was obtained from the analysis of the clinical process of patients who take a polysomnographic in the laboratory, between July 2011 and July 2016, at the Unidade Local de Saúde de Matosinhos - Hospital Pedro Hispano, neurology service. A total of 472 clinical cases were analyzed whence 14 patients had a stroke history.

Results: The study sample was constituted with 13 male (92.9%) and one female patients, with a mean of age 67.8 years. SAS diagnosis was confirmed in 12 patients (85.7%), mostly severe (58.3%) and mild (33.3%). 92.9% of the sample revealed risk factors where patients with severe SAS presented more. Association between smoking habits and SAS severity was significant (p = 0.05). Regarding the occurrence of stroke in SAS patients, it was possible to verify a higher incidence of subcortical strokes (6 patients). It is also important to highlight the 2 cases of brainstem stroke, both associated with severe SAS.

Conclusions: Our results confirmed that SAS is present in the majority of patients with stroke history. It was proved that patients with previous stroke have higher risk of SAS, given the high prevalence relatively to general population. Early identification and treatment are essential in order to prevent the clinical worsening of patients with previous stroke or stroke risk, once the improvement in these patients is demonstrated after therapy.

Disclosure: Nothing to disclose.

P691 | Obstructive sleep apnea yndrome and type II diabetes: effects of non-invasive ventilation in Hemoglobin A1c values

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Objectives/Introduction: The aim of the present study was to evaluate Hba1C index, before and after treatment with NIV, in diabetic patients with obstructive sleep apnea.

Pathologies such as Obstructive Sleep Apnea Syndrome (OSAS) and Type II *Diabetes Melittus* (T2DM) have a very significant prevalence and impact in the population. There are several studies reporting important metabolic changes in patients with OSAS and Diabetes. The relation between NIV treatment and Hemoglobin A1c (HbA1c) values is an important indicator to evaluate the disese.

Methods: This sample was composed by 31 individuals with T2DM and OSAS, who started NIV, and were followed in the Sleep and Ventilation Unit of the Tondela-Viseu Hospital. The value of HbA1c prior of the NIV theraphy was collected and, after about 6 months of NIV therapy we collected the new data, also including NIV data and NIV adherence (Controlled T2DM patients with HbA1c <7%; Uncontrolled T2DM with HbA1c ≥7%; Adherent patient with use average >4 hr/night and >70% of effective therapy days).The used significance level was 5%.

Results: The sample was composed by 31 patients, male majority (58.1%) with an average age of 56.7 ± 12.5 years. It was found that a large part of the sample was obese with a Body Mass Index average of 32.5 ± 5 kg/m^2. The NIV average daily used was 6.14 ± 1.64 hr/night. Automatic Positive Airway Pressure (APAP) was the NIV therapy most used. Concerning HbA1c values, the mean value before therapy introduction was 8.25 ± 1.30% and, after about 6 months of NIV treatment, the mean value decreased to 7.79 ± 1.33%, with a significance level of p = 0.026%. Initially only 19% of patients had T2DM controlled and, after therapy, the number increased to 32%. There was also an improvement in HbA1c values in patients that used Automatic PAP compared to Continuous PAP therapy.

Conclusions: Appropriate therapy of Obstructive Sleep Apnea Syndrome seemed to induce a better control of Diabetes disease, with an improvement of HbA1c values, in patients with Obstructive Sleep Apnea Syndrome and Type II *Diabetes Melittus*.

Disclosure: Nothing to disclose.

P692 | Comparison of sleep instability indices in normal individuals and patients with severe obstructive sleep apnea

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Objectives/Introduction: Obstructive sleep apnea (OSA) is one of the most prevalent diseases with socio-economic significance. One of the major consequences of this sleep disordered breathing is the decrease of sleep quality. Different measures for sleep impairment have been proposed and cyclic alternating pattern (CAP) is probably the most important.

Methods: Fourty consecutive male patients of our sleep laboratory (mean age 47.5 ± 11.0 years) were included in the present study. Each of them underwent a full-night polysomnography study and the recordings were scored by an experienced and certified scorer. CAP parameters were determined according to the established rules. Based on the apnea hypopnea index (AHI), the patients were devided into two groups: severe obstructive sleep apnea (AHI >30.0/hr) and healthy individuals (AHI ≤5.0/hr). Student's *T*-test for independent variables was used for comparison of different CAP indices between the two groups.

Results: Thirty-two patients were with severe OSA (mean AHI = 71.6 ± 23.9/hr) and 8 did not show signs of sleep disordered breathing (mean AHI = 1.85 ± 1.5/hr). CAP ratio, A3 index, A2 and A3 mean durations showed significant differences between the two groups (80.6 vs. 38.3, $p < 0.001$; 54.8/hr vs. 18.9/hr, $p < 0.001$; 12.7 s vs. 7.9 s, $p < 0.005$; 13.7 s vs. 9.7 s, $p < 0.05$ respectively). On the other hand, A1 and A2 index, A1 and mean duration did not show any statistically significant difference.

Conclusions: In OSA patients analysis of CAP ratio, A3 index, A2 mean duration and A3 mean duration may prove useful for evaluation of sleep quality.

Disclosure: Nothing to disclose.

P693 | Persistence of periodic breathing/ Cheyne-Stokes respiration after tilt table test during short term respiratory monitoring in patients with systolic heart failure

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Objectives/Introduction: Periodic breathing (PB: hyperventilation/ hypopneas) and Cheyne-Stokes respiration (CSR: hyperventilation/apneas) are usually considered to occur in lying and sleeping conditions in patients with heart failure (HF). However, recent evidences suggest that both phenomena may spread throughout the 24-hr. The aim of this study is to evaluate whether PB/CSR may be observed in awake and orthostatic conditions in patients with systolic HF.

Methods: A total of 202 chronic systolic HF patients on optimal guideline-recommended treatment (left ventricular ejection fraction of 33 ± 9%; 66 ± 12 years of age; 79% males) underwent beyond echocardiography, pulmonary function test, 24-hr electrocardiographic and respiratory recording and neurohormonal evaluation (natriuretic peptides, plasma norepinephrine, renin activity and aldosterone levels), a short term attended respiratory monitoring (SRM) during tilt table testing (10 min in clinostatism and 5 min in orthostatism).

A short term scoring from 0 to 2 was created, with 0 being normal respiration, 1 being PB/CSR disappearing in orthostatism and 2 being PB/CSR persisting in orthostatism.

Results: The prevalence of scores 0–1–2 were 54%, 34% and 11%, respectively.

The score was predictive of apnea-hypopnea index severity at the 24-hr recording (all $p < 0.001$), both during daytime (from 0 to 2: 7 IR 2–15, 12 IR 6–20, 26 IR 12–33, events/hr), nighttime (20 IR 6–29, 23 IR 16–34, 37 IR 24–48 events/hr) and the 24-hr (13 IR 5–21, 18 IR 11–26, 32 IR 20–36 events/hr).

At univariate, logistic multinomial analysis predictors of persistence of PB/CSR in orthostatism were moderate to severe mitral regurgitation (MR), left atrial volume and baseline atrial fibrillation (AF), while at multivariate analysis only MR (OR 3.55, CI 1.05–12.01, $p = 0.04$) and AF (OR 5.37; CI 11.74–16.61; $p = 0.004$) resulted as independent predictors.

Conclusions: In HF patients, a short term recording performed during tilt testing is able to stratify the severity of PB/CSR both during daytime, nighttime and the 24-hr, with MR and AF being independently associated with persistence of PB/CSR in awake/ orthostatic conditions.

Disclosure: Nothing to disclose.

P694 | Prevalence of signs and symptoms of sleep apnea in Portuguese adult population

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Objectives/Introduction: Our aim was to analyse the prevalence of signs and symptoms of sleep apnea, in the Portuguese population aged over 30 years, having used validated questionnaires.

Despite of the high prevalence of obstructive sleep apnea (OSA) it remains an underdiagnosed clinical condition. The diagnosis involves, in the majority of the cases, a full PSG. However, other screening tools may be used, like questionnaires, to estimate the presence or absence of the pathology.

Methods: An observational and cross-sectional study was made. We used the data collected by Coimbra Health School (surveys that assessed sleep quality indirectly and anthropometric data obtained in different regions of the country). The sample was composed by 2,146 individuals.

In order to estimate OSA prevalence, it was considered that the individual may suffer OSA if the criterion A (BQ-Berlin Questionnaire with an indicative risk score for OSA + ESS-Epworth Sleepiness Scale with provisional score of excessive daytime sleepiness) and/or B (PSQI-Pittsburgh Questionnaire with a score indicative of sleep disorder + ESS with provisional score of excessive daytime sleepiness) occurred.

Results: In our total sample of 2,146 individuals, 45.2% were male and 54.8% were female with a global age average of 48.92 years. The most common signs described were nocturia (63.2%), morning tiredness (59.5%). The presence of both signs was significantly higher in the female group compared to male group ($p < 0.05$). Also snoring (53.4%) and apnea (16.2%) were frequently reported, but without gender differences.

Berlin Questionnaire (BQ) score reported that 31% of the individuals had high risk for OSA ($p < 0.05$). Excessive daytime sleepiness, obtained by Epworth Sleepiness Scale (ESS) score, was observed in 26.1% of the individuals and 8.7% showed a positive result according to the Pittsburgh Sleep Quality Index ($p < 0.05$).

The global prevalence of OSA in Portuguese population, obtained with our methodology, was about 13.42%. By gender, a significant difference ($p < 0.05$) comparing males (17.5%) and females (10%).

Conclusions: The prevalence of OSA in the Portuguese population, obtained in our sample and using the proposed methodology, was estimated 13.42%.

Disclosure: Nothing to disclose.

P695 | Prevalence of sleep apnea syndrome (SAS) in patients with implantable cardiac electronic devices

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Objectives/Introduction: To evaluate the value of electronic cardiac devices in the diagnosis of SAS among patients with DECI.

Methods: We included 29 patients with cardiac electronic devices implanted with sleep apnea/hypopnea event detection algorithm (Kano™ 100DR, Reply™ 200DR from Livanova, Vitalio™, Incepta™ CRTD, Incepta™ CDI and Invive™ from Boston Scientific). Livanova devices have the SAM algorithm (sleep apnea monitoring) validated in the Dream study.

The Boston Scientific devices detect apnea and hypopnea events through ApneaScan™ Patients performed polygraphy with the ApneaLink plus™ equipment by Resmed™

All patients in whom SAS was detected were confirmed by level 1 or 2 polysomnography.

After confirmation of the diagnosis the patients were monitored by the DECI, to evaluate the adherence to the therapy.

Results: 21 men and 8 women, with a mean age of 76.1 years (±9.8). BMI 26.8 kg/m^2 (±4.2). HBPwas the most frequent pathology (74.2%). In the echocardiography 63.3% of the patients had normal left ventricular systolic function. The implanted device was a definitive pacemaker in 23 patients (sinus node dysfunction in 13 patients, and in the remaining eight atrioventricular conduction disorders), all dual-chamber programmed in DDDR mode, cardiac resynchronization system with implantable cardioverter-defibrillator in five patients, and a dual-chamber implantable cardioverter-defibrillator in one patient. In 15 patients the device was Livanova and in 14 Boston Scientific patients.

The agreement between the polysomnography and the Pacemaker was Kappa = 0.54 ($p = 0.001$), 95%. Of the 20 cases with AHI >15/hr, 18 have pacemaker values ≥20/30.

When we correlated the values ofthe device with PGS values, we verified values >15/hr: sensitivity of 90%, specificity of 83%, values predictive positive of 90% and negative of 87.5%, with diagnostic accuracy of 87.5%.

Conclusions: The prevalence of SAS is high in patients with cardiac electronic devices. There are devices with algorithms capable of recording events that should signal patients to perform polysomnograms to confirm the diagnosis. This study demonstrated a significant correlation between the values recorded in the devices and in the polysomnography.

Disclosure: Nothing to disclose.

P696 | Comparison of performance of four adaptive servo ventilation devices in patients with complex sleep apnea

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Objectives/Introduction: Adaptive Servo Ventilation (ASV) increased the risk for mortality in the SERVE-HF trial. The mechanisms for such a finding remain unclear. Conceivably, device algorithms that control respiratory rate and pressure support may have led to high minute ventilation, which, in turn, may have contributed to hypocapnia and life-threatening arrhythmias. Whether such a finding was due to a device algorithm-based effect ("device-effect") or applies to all devices with servo-algorithm ("class-effect") is uncertain. The objective of this study was to compare the performance of various ASV devices on indices of sleep-disordered breathing and minute ventilation.

Methods: We performed a randomized controlled cross-over trial of patients with complex sleep apnea with preserved cardiac contractility who were adherent with ASV therapy. Patients underwent four nights of laboratory-based polysomnography while receiving therapy from a Philips ASV device (System One), updated Philips ASV device (Dreamstation), ResMed S7 VPAP Adapt (used in the SERVE-HF trial), and ResMed S9 VPAP Adapt.

Results: During polysomnography, apnea-hypopnea index was not different across the different devices ($p = 0.9$). Minute ventilation (V_E) was greater during S7 device (9.8 ± 0.4 Lpm) when compared to all other devices for wakefulness state: S9 (4.9 ± 1.0 Lpm), Dream Station (8.4 ± 0.2 Lpm), and System One (8.6 ± 0.3 Lpm; $p < 0.0001$). V_E was greater during S7 therapy when compared to both Philips devices for stage N1 and REM sleep ($p < 0.01$). Respiratory rate was greater during S7 therapy when compared to other devices for all sleep-wakefulness states ($p < 0.0001$). Pressure support level was greater during S7 therapy when compared to all other devices during wakefulness ($p < 0.0001$).

Conclusions: There were significant differences in minute ventilation delivered by various ASV devices. We speculate that the mechanisms underlying the adverse effects of ASV in previous trials could be secondary to excessive ventilation due to device-effect and not due to class-effect.

Disclosure: This work was funded in part by Philips-Respironics.

P698 | Gender differences in obstructive sleep apnea patients

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Objectives/Introduction: The aim of this study is to evaluate if there are any differences between female and male patients with obstructive sleep apnea (OSA) in terms of symptoms, comorbidities and polysomnographic parameters.

Methods: It was included all patients that performed polysomnography during 2017 in a Terciary Portuguese Hospital and had an apnea-hypopnea index (AHI) ≥5 events/hr. Sociodemographic and polysomnographic data, symptoms and comorbidities was retrospective review. A level of significance of 0.05 was assumed.

Results: We included 220 patients, 85 (38.6%) female and 135 (61.4%) male. The median age was 61 in females and 56 in males.

The female patients had, with statistical significance, lower median AHI (11.8 vs. 17.9; $p = 0.002$), with higher prevalence of mild OSA (57.6% vs. 37.8%; $p = 0.004$) and a lower prevalence of severe OSA (15.3% vs. 27.4%; $p = 0.037$). There were no statistically significant differences in sleep efficiency, percentage of time with SatO2 under 90% or snoring episodes.

Female patients had more non-restful sleep (69.2% vs. 37.8%; $p < 0.001$). Snoring, witnessed apnea and sleepiness (according epworth sleepiness scale) were not statistically different. Although there was no statistical difference, in females appeared to be a tendency for a higher frequency of insomnia (29.5% vs. 21.3%; $p = 0.183$) and nocturnal awakenings with sensation of choking (44.3% vs. 32.8%; $p = 0.097$).

Regarding comorbidities, female patients had more arterial hypertension (62.4% vs. 43%; $p = 0.005$), anxiety (11.8% vs. 3.7%; $p = 0.021$) and depression (35.3% vs. 3%; $p < 0.001$).

It was initiated positive airway pressure therapy in 47 (55.3%) females and 72 (53.3%) males.

Conclusions: Female patients appear to have a different clinical spectrum. In terms of symptoms they had a higher prevalence of non-restful sleep, despite having similar sleep efficacy when compare to male patients. Female patients had a lower median AHI, with a higher prevalence of mild OSA. Despite that they had a similar prevalence of initiation positive airway pressure therapy, which may be justified by a higher prevalence of arterial hypertension in females.

Disclosure: Nothing to disclose.

P699 | Montreal cognitive assessment versus mini-mental state examination scales for cognitive impairments in obstructive sleep apnea-hypopnea syndrome patients with and without morning headache

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Objectives/Introduction: Cognitive impairments (CI) and morning headache (MH) frequently occur in obstructive sleep apnea syndrome (OSAS) patients. In the same time, both OSAS and MH are risk factors for developing CI. The aim of the study was to compare which test - Montreal Cognitive Assessment (MoCA) or Mini Mental State Examination (MMSE) - has a higher sensibility for CI in OSAS patients and also to establish the relationship between MH and CI in OSAS patients.

Methods: The sample included 17 patients (11 females, mean age 57.8 years, SD ± 8.6), diagnosed with OSAS (mean AHI 50, SD ± 30) through cardiorespiratory monitoring during sleep (SleepDocPorti "Dr. Fenyves und Gut"). MH was established according to ICHD-3. Cognitive function was assessed with MoCA and MMSE.

Results: All patients fulfilled the MMSE (mean score - 26.58 ± SD 3.36 (>25 considered normal) - 2 patients (12%) presented results below 25) and MoCA (mean score - 22.05 ± SD 4.05 (≥26 considered normal) - 14 patients (82%) had a total score below 26 and 3 patients above 26). Afterwards the sample was divided into two

subgroups: with MH (11 patients) and without MH (6 patients) and the mean MoCA total score was compared: for the MH group was 21.36 vs. 23.33 for the group without MH, $p > 0.05$. We also compared the MoCA result by domains: the abstraction ability in OSAS patients with MH was 0.8 vs. 1.6 in those without MH, $p < 0.05$.

Conclusions: In the studied sample the MoCA questionnaire revealed CI in 82% of patients vs. only 12% revealed by MMSE. As a result, we can suppose that MMSE has a lower sensibility for CI disturbances in OSAS patients, and using MMSE for CI assessment in OSAS patients can underestimate this phenomenon.

On the other hand, there is no relationship between MH and CI in OSAS patients - both subgroups with and without MH presented CI, only the abstraction ability being significant diminished in patients with MH.

Disclosure: Nothing to disclose.

P700 | Sleep apnea syndrome screening and diagnosis among public transport (bus) drivers in Hungary

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Objectives/Introduction: Obstructive sleep apnea is the most frequent sleep disordered breathing associated with daytime sleepiness, cognitive impairment and daytime dysfunction.

Methods: The relevant factors of sleep apnea syndrome were compered in bus drivers who underwent polysomnography (Alice 6, Philips, Respironics) test. The objective of the present study was to determine the prevalence of sleep apnea among consecutive bus-drivers (age: 49 ± 9). The survey comprised Epworth Sleepiness Scale (ESS) for daytime sleepiness assessment, body mass index, coffee consumption and smoke habit as well.

Results: Accordig to the polysomnography results 40 (54.1%) bus drivers were diagnosed with sleep apnea (13.5% moderate, 12.2% severe). BMI correlated positively with RDI, AHI, ODI results, but no correlation was found with sleep apnea and ESS.

Conclusions: Moderate and severe OSA is a high risk among bus drivers. The obesity is good marker to identify the potential sleep apnea patients, thus polysomnography procedure is necessary in obes patients.

Disclosure: Nothing to disclose.

P701 | Obstructive sleep apnoea as a risk factor for incident metabolic syndrome: a multicentric prospective epidemiological study

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Objectives/Introduction: Cross-sectional studies have demonstrated that obstructive sleep apnoea (OSA) and metabolic syndrome (MetS) are often associated. We aimed to investigate the effect of OSA on the risk of developing MetS in a general population sample.

Methods: Prospective study combining two population-based samples (Episono in Brazil and HypnoLaus in Switzerland). MetS was assessed according to the Joint Interim Statement. Polysomnography (PSG) was performed at baseline and follow-up in Episono, and at baseline in HypnoLaus. OSA was defined according to apnoea-hypopnoea index as mild (5·0–14·9/hr) and moderate-to-severe (≥15·0/hr).

Results: 1,853 participants (52 ± 13 years, 56% female) without MetS at baseline were included. After a 6-year mean follow-up, 318 (17·2%) developed MetS. Multivariable analysis adjusted for baseline confounders showed that moderate-to-severe OSA was independently associated with incident MetS (OR = 2·33 [1·50–3·61]). Mediation analysis revealed that moderate-to-severe OSA increased the number of MetS components (mainly abdominal obesity and impaired glucose/insulin homeostasis) from baseline to follow-up through partial mediation of time with oxygen saturation (SpO_2) <90%. Subset analysis in Episono confirmed that the increase in the percentage of time with SpO_2 <90% between baseline and follow-up PSG represents a risk factor for MetS (OR = 1·36 [1·04–1·69] for each 10% increase).

Conclusions: Baseline OSA is independently associated with increased risk of developing MetS through mediation of nocturnal hypoxaemia in the general population.

Disclosure: Nothing to disclose.

INSOMNIA 4

P702 | A clinical portrait of patients treated at the Université Laval Sleep Clinic

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Objectives/Introduction: At the Sleep Clinic of Université Laval, established in 2015, we are referred individuals with any sleep disorders associated or not with psychopathologies. Since its opening, more than 240 patients complaining of sleep difficulties have been treated. This study aims to describe a clinical portrait of an ecologically valid population consulting for sleep difficulties.

Methods: Patients self-reported to the Sleep Clinic, or were referred by general practitioner or pulmonologist. After a phone screening interview, patients came to the clinic for a semi-structured clinical interview on sleep and psychopathology. During this evaluation period, patients completed sleep diaries and self-reported questionnaires assessing sleep, sleepiness, anxiety, and depression. The sleep diary was completed throughout psychotherapy. A descriptive analysis of 207 patients' records (57% female, M_{age} = 42.5 years) was performed to assess patients' sleep disorders, mental disorders, medical conditions, and treatment length.Psychologists or doctorate students in psychology conducted therapy sessions. The study was approved by the Université Laval ethical committee.

Results: Results reveal a high level of comorbities with an average of 2.86 diagnoses per patient (SD = 1.64) and more than 4 diagnoses for 27.5% of the patients. More precisely, 141 out of 207 (68.1%) patients presented with at least one other mental comorbidity; 73 (35.3%) with a medical comorbidity; and 67 (32.4%), with another sleep disorder alongside their primary sleep concern. Insomnia was the main sleep disorder (74.4%, 154/207) followed by fatigue (17.4%, 36/207), sleep apnea (10.1%, 21/207), and hypersomnia (0.05%, 10/207). Anxiety (51.7%, 107/207) and depressive (30.9%, 64/207) disorders were the predominant patients' psychopathologies, while fibromyalgia (2.9%, 6/207), hypertension (2.9%, 6/207), and head trauma (2.42%, 5/207) were the main medical conditions. The mean length of treatmentfor sleep disorders was of 9.4 therapy sessions (SD = 8.0).

Conclusions: The clinical portrait illustrates the reality of multiple morbidities, with more than 14 of the sample reporting at least 4 separate diagnoses. Having multiple morbidities may have implications for our clinical decisions such as the use of a more transdiagnostic approach, as opposed to sequential applications of distinct treatments for each disorder. Future research is needed to evaluate such transdiagnostic treatment approaches for the sleep disorder patient with multiple morbidities.

Disclosure: T.A. and S.deB.G. salaries were partially paid by patients' psychotherapy fees while others authors have nothing to disclose.

P703 | Polysomnographical effects of on-line cognitive behavioral therapy for insomnia

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Objectives/Introduction: Insomnia is a serious public health problem worldwide. Cognitive Behavioral Therapy (CBT) is proven effective in treating insomnia. Sleep Restriction (Rest) is a central treatment component in CBT for insomnia (CBT-i), and Sleep Compression (Comp) is sometimes put forward as a less burdening alternative. However, there is a lack of information on their effects on polysomnographic (PSG) measures, and beyond post-treatment assessments such evaluations are virtually non-existing. The primary purpose of the present study was therefore to evaluate the effect of restricting time in bed, and compare the effects of Comp v/s Rest on polysomnographic measures at post treatment and at follow up.

Methods: Twenty six patients (mean age 46.4 ± 14.4 years, 80% women) with Insomnia Disorder were randomly assigned to the sleep restriction group (Rest = 16*n*) or to the sleep compression group (Comp = 10*n*). All participants underwent four polysomnographic ambulatory nights during a period of ten weeks; before the beginning of treatment (pre-treatment), after the first week of treatment (mid-treatment), after five weeks of treatment (post-treatment) and after ten weeks (follow up). The Karolinska Sleep Diary (KSD) was completed on the morning after each PSG night, one day before and two days after.

Results: For PSG measures, all patients (regardless of group) showed a significant increase in SleepEfficiency (Pre = 82.8 ± 9.8%, mid-treat = 89.9 ± 6.8, Post = 89.5 ± 6.8%, $p < 0.01$), shorter TIB (Pre = 469.2 ± 52 min, mid-treat = 393.6 ± 59 min, Post = 404.3 ± 50 min, $p < 0.01$), shorter Wake Time after Sleep Onset (Pre = 64.6 ± 38.9 min, mid-treat = 34 ± 29 min, Post = 34.9 ± 26.6 min, $p < 0.01$), shorter Sleep Onset Latency (Pre = 15.3 ± 16.8 min, mid-treat = 6.4 ± 5.8 min, Post = 8.1 ± 5.8 min, $p < 0.05$), fewer nighttime awakenings/hr (Pre = 5.2 ± 3.7, Post = 3.5 ± 1.8, $p < 0.05$), and higher percentage of REM-sleep (Pre = 21.3 ± 5.5%, mid-treat = 23.59 ± 6.4, Post = 24.5 ± 6.4%, $p < 0.01$). A Statistically significant interaction between group and condition was found only for TIB measurement (F = 3,347, $p < 0.05$) and for REM% (F = 3,072, $p < 0.05$). For KSD, at post-treatment all participants showed a significant increase in feeling well rested in the morning (F = 4,488, $p < 0.05$), and a significant decrease in morning sleepiness (F = 2,881, $p < 0.05$). No interaction between groups and conditions was found.

Conclusions: Five weeks of online CBT-I improves sleep continuity and clinical ratings of sleep quality regardless of the type of sleep reduction strategy, compression or restriction.

Disclosure: Nothing to disclose.

P704 | Cognitive behavior therapy for insomnia - is sleep compression an equally effective and less difficult alternative compared to sleep restriction?

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Objectives/Introduction: One of the main components of Cognitive Behavior Therapy for insomnia (CBT-i) is Sleep Restriction (SR). SR abruptly restricts time in bed to the average time the patient actually slept the previous week, to produce higher sleep efficiency and establish a robust sleeping pattern. However, SR is also related to adverse events such as sleep deprivation and fatigue. Sleep Compression (SC) is a possible alternative treatment component, which decreases time in bed more gradually. By doing so, SC is proposed to produce less adverse effects than SR, but this proposition has not been empirically tested.

The aim of this study is to therefore to compare SC to SR, with the ultimate goal to improve treatment outcome of CBT-i. Focus for the comparison is improvement of insomnia symptoms and participants perceived negative effects of the treatments.

Methods: This is a randomized controlled trial with 5 weeks of Internet delivered treatment with therapist support, followed by a 5 weeks self-care period. Interventions consist of 5 + 5 weeks of SR [SJ1] or SC. Follow-up is conducted at 5 and 10 weeks after treatment start. Participants (n = 188) are adults with insomnia recruited nationally in Sweden. Primary outcome is insomnia severity, measured with the Insomnia Severity Index (ISI). The most important secondary outcome is Adverse Events (AE).

Results: Preliminary data (n = 94) suggests that both treatment groups improve in insomnia severity from pre measurements to follow up (p =< 0.001, η_p^2 = 0.503), but that there is no significant difference between the both groups with regards to improvement in insomnia severity (ISI change score pre-10 weeks: SR = 8 v/s SC = 5.6; p = 0.079), and no significant difference in number of reported adverse events between the groups (SR = 14.1 v/s SC = 12.5; p = 0.377).

Conclusions: Preliminary data from this study suggests that both interventions are equally effective in treating insomnia, and at this point no statistically significant difference can be seen in number of adverse events. This brings up the question of sleep compression could be put forward as a less difficult alternative for treating insomnia.

Disclosure: Nothing to disclose.

P705 | One and ten-year follow-up of insomnia severity after a randomized trial of behavioral self-help treatment for insomnia with or without therapist guidance

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Objectives/Introduction: Cognitive behavioral therapy (CBT) is treatment of choice for insomnia, but availability is scarce. Having CBT for insomnia (CBT-i) delivered as self-help can increase availability at low cost, but evidence for its long-term efficacy is limited. We will present data from one-year and ten-year follow-up of a behavioral self-help treatment - the longest follow-up of CBT-i known to us. We hypothesize that the previously reported positive effects of a cognitive behaviorally based self-help book on insomnia severity in individuals also with co-morbid problems, would prove maintained also at one and ten-year follow-up.

Methods: After a parallel randomized (block randomization, $n \geq 21$) controlled "open label" trial where volunteer, media recruited participants with insomnia (n = 133) were randomized to three groups - bibliotherapy with (n = 44) and without (n = 45) therapist support, and waiting list control (n = 44), with assessments pre- post and three-month follow-up, long-term follow-up assessments were conducted at 1 and 10 years. Intervention was six weeks of bibliotherapeutic self-help, with established cognitive behavioral methods including sleep restriction, stimulus control, and cognitive restructuring. Therapist support was a 15-min structured telephone call scheduled weekly. Main outcome measure at one and ten-year follow-up was the Insomnia Severity Index (ISI).

Results: We have previously reported significant improvements in insomnia severity in both self-help groups from pre to post treatment, and maintainted at three-months (Jernelöv et al 2012*). Follow-up data shows that these improvements were maintained also at one year ($p < 0.001$), with ISI-scores having decreased from pre-treatment, with 6.8 points for the group receiving self-help without suport and 10 points for the group receiving self-help with therapist support (interaction $p < 0.001$). Preliminary data from the first 53 participants at ten-year follow up suggests that treatment gains may be largely maintained, with a mean decrease of 6.2 and 6.3 points respectively ($p < 0.01$).

*Jernelöv, S., et al. (2012). BMC Psychiatry 12(5): 1–13.

Conclusions: These findings suggest that a time-limited behavioral self-help intervention for individuals with insomnia produces long-lasting effects on insomnia severity.

Disclosure: SJ is the author of the commercially available self-help book used in the study.

P706 | Chronotype and psychiatric comorbidity in patients with insomnia referred to sleep disorders center

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Objectives/Introduction: Mental health and chronotype play and importnant role in sleep regulation and should be routinely assessed in patients with sleep disorders. The aim of the study was to (1) assess chronotype, severity of insomnia, level of sleepiness and depressive symptoms among patients referred to our center by primary care physicians due to various sleep disorders, mostly because of insomnia, (2) compare patients with and without comorbid psychiatric condition, (3) compare patients with morning, evening and intermediate chronotype.

Methods: We examined 170 consecutive patients (99 women, mean age 46.5 ± 15.1 years and 74 men, mean age 39.9 ± 16.4 years), who were administered the Morningness - Eveningness Questionnaire (MEQ), Athens Insomnia Scale (AIS), Epworth Sleepiness Scale (ESS) and Beck Depression Inventory (BDI). The group differences were tested for significance using Student's *T*-Test and ANOVA.

Results: There was a significant difference between patients with and without comorbid psychiatric condition in AIS (13.90 ± 3.79 vs. 15.6 ± 5.2; $p < 0.001$) and BDI (12.71 ± 8.53 vs. 27.57 ± 13.59; $p < 0.001$). Additionally, the AIS scores in patients with intermediate (15.2 ± 4.1) and morning (15.1 ± 4.3) chronotype were higher than in patients with evening chronotype (12.7 ± 5.0) ($p < 0.05$), what was primary related to the younger age of patients with lower MEQ scores. After adjusting age factor the effect was no longer observed.

Conclusions: The obtained data confirm higher intensity of sleep difficulties in patients with comorbid psychiatric condition, as well as greater depressive complaints. The outcome of the study showing that morningness might be associated with poor sleep was due to age factor and was not confirmed.

Disclosure: Nothing to disclose.

P707 | Mediating effects of somatic symptoms in the association between sleep disturbance and mental health following Qigong exercise in a RCT

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Objectives/Introduction: Sleep disturbance has a close relationship with mental health and is positively related to greater somatic symptoms. However, the effects of Qigong on somatic symptoms and the role of somatic symptoms in the relationship between sleep quality and metal health following Qigong exercise remain unclear.

Methods: A randomized waitlist-controlled trial was conducted to assess efficacy of Qigong exercise and investigate the mediating effects of somatic symptoms in the relationship between sleep disturbance and mental health among persons with sleep disturbance. 189 participants with sleep disturbance were screened and recruited from the community and randomly assigned to Qigong ($n = 96$) and control ($n = 93$) groups. Intervention was eight 3-hr weekly sessions of Qigong training plus 30-min self-practice at least 3 times per week. Self-reported questionnaires, including Pittsburgh Sleep Quality Index (PSQI) and somatic symptom inventory (SSI) and Hospital Anxiety and Depression (HADS) were assessed at baseline (T0), immediate post-intervention (T1) and 3-month post-intervention (T2).

Results: At baseline, two groups were comparable except for more painful somatic symptoms (SSI-pain: 49.55 vs. 44.02, $p = 0.010$) and depressive symptom (HADS-depression: 7.79 vs. 6.83, $p = 0.036$) in Qigong group. Repeated measure ANCOVA controlling for baseline depressive and painful somatic symptoms showed compared with control group, Qigong exercise significantly improved sleep quality ($F = 5.77$, $p = 0.030$) and reduced somatic symptoms (SSI-painful: $F = 9.31$, $p < 0.001$; SSI-painless: $F = 15.45$, $p < 0.001$), anxiety (HADS-anxiety: $F = 3.89$, $p = 0.002$) and depressive (HADS-depression: $F = 7.35$, $p = 0.001$) symptoms. Significant associations were found between PSQI change score and reduction in anxiety ($r = 0.228$, $p = 0.002$ at T1 and $r = 0.166$, $p = 0.022$ at T2) and depression ($r = 0.254$, $p < 0.001$ and $r = 0.228$, $p = 0.020$) at both T1 and T2 following Qigong exercise using the linear regression; while controlling for painful or painless somatic symptoms, association between PSQI change score and reduction in anxiety and depression were fully mediated by somatic symptoms.

Conclusions: Qigong exercise alleviated sleep disturbance and somatic symptoms, and improved mental health. Significant mediating effect of reduction of somatic symptom in the associations between sleep improvement and mental health following Qigong exercise were found. This study sheds light on possible role of reduction of somatic symptoms in enhancing sleep quality and mental health.

Disclosure: Nothing to disclose.

P708 | Do really chronic sleeping pills users develop tolerance to the drugs?

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Objectives/Introduction: Chronic Insomnia is a common sleep problem with prevalence of 10–30% of total population; It is defined as subjective experience of an inadequate quantity or quality of sleep that has persisted for at least one month. Medical therapy is an acceptable therapy for insomnia, at least for a fixed period. There are inconsistent evidences for the development of tolerance to the sedative effect of benzodiazepines; however, there is almost no evidence in the literature to tolerance for *Z* drugs. The aims of our study were: (1) To Identify and characterize the usage of sleeping drugs among chronic users. (2) To find whether there is an evidence to tolerance among chronic hypnotic users, which expressed by increase in average number of "usage days".

Methods: Retrospective analysis from computerized pharmacy record of "Maccabi health service" with total of 1.2 million patients. The data was collected for all patients above the age of 18 between the years 2011–2015. Occasional users were defined as those who dispensed at least one monthly prescription of sleeping drugs (30 days) while chronic user were defined as those who dispensed at least 9 prescriptions (270 days) per year for at least 2 years.

Results: Only 1% of the adult populations were defined as chronic users. 66% of chronic hypnotics consumers were females, and 34% males. Age was positively associated with higher rate of chronic usage. Benzodiazepines therapy was more prevalent compare to *Z* drugs in the total population while there was no difference in the chronic patients. We observed no change in the total average number of "usage days" between the years 2011–2015 in the chronic patient group. Moreover, only 5% of the occasional users became chronic users every year, while 15% of the chronic users did the opposite and turn to be occasional ones. Of note, 50–58% of the chronic users has actually decreased their "usage days" per year over the long term, while only 36–47% increased.

Conclusions: Insomnia symptoms can have adverse implications on emotional, mental health and quality of life. Our results suggest that chronic patients did not develop tolerance to sleeping drugs.

Disclosure: Nothing to disclose.

P709 | The relationship between anxiety, chronotype, melatonin onset and sleep on depression symptoms in insomnia

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Objectives/Introduction: Insomnia has been shown to have a bi-directional association with depression. Insomnia patients with evening chronotype are more likely to be depressed. The influence of the circadian system may influence these associations. Therefore, the aim of this study was to investigate subjective (anxiety, chronotype and sleep diary), and objective (polysomnography and melatonin onset) variables in people with insomnia disorder and depression symptoms.

Methods: Participants were recruited from the community and insomnia clinics and were screened at a sleep clinic by a physician for the diagnosis of Insomnia Disorder (DSM-5). Eligible participants completed baseline questionnaires (General Anxiety Disorder (GAD-7); Composite Morningness Questionnaire (CMQ); Depression Anxiety Stress Scale (DASS-21)) and a 14-day sleep diary before two consecutive nights in a sleep laboratory (1st night with a full sleep opportunity and PSG; 2nd night dim light melatonin onset (DLMO) was assessed). Correlations and multiple regression were used to test subjective and objective predictors of depression symptoms in insomnia.

Results: Participants (n = 87; mean age 46.4 [15.0] y; 70% female) were predominately intermediate chronotypes (CMQ: 34.6), with mild anxiety (GAD-7: 6.9), and moderate depression scores (DASS-21: 9.7). Objective and subjective sleep metrics (PSG TST, SOL, WASO: 355.6, 23.0, 75.6 min vs. diary TST, SOL, WASO: 333.1, 47.0, 61.8 min) were not different. DLMO clock time averaged 21:08 (range: 17:45–00:53) with a mean phase angle of 1.64 hr. The correlation between DLMO and chronotype was modest (r = –0.22; p = 0.035), whilst anxiety was shown to be the strongest predictor of depression (r^2 = 0.340; $p < 0.001$).

Conclusions: To the best of our knowledge this is the first study to examine anxiety, chronotype, depression symptoms, objective and subjective sleep, and circadian measures in Insomnia disorder. Anxiety scores were highly predictive of depression. The inclusion of circadian measures did not add to the prediction of depression symptoms in this cross-sectional sample of Insomnia disorder.

Disclosure: Nothing to disclose.

P710 | Insomnia in primary care: a survey conducted on the Italian population older than 50 years. Results from the "Sonno e Salute" study

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Objectives/Introduction: Insomnia affects one-third of the adult population and is associated with poor quality of life and multiple psychiatric and medical conditions, notably depression and cardiovascular disease. We conducted an observational epidemiological survey to assess:

(1) the prevalence of insomnia in an Italian population (aged over 50 years) presenting directly to the general physician (GP);

(2) the association of insomnia with sleepiness and comorbidities and

(3) the pharmacological treatment.

Methods: The study was carried out by GPs. Each GP was asked to enroll the first patient over 50 years old spontaneously presenting for any medical problems for five consecutive days. The Italian version of the Sleep Condition Indicator (SCI) was administered; daytime sleepiness was evaluated by a visual analogic scale (VAS). For every patient, GP collected information regarding comorbidities and pharmacological treatment for insomnia and evaluated the severity of insomnia using the Clinical Global Impression Severity Scale (CGISS).

Results: A total of 748 patients (mean age 65, SD 9.45) were enrolled by 149 GPs. Prevalence of insomnia was 55.3%. Linear regression shows a significant correlation between SCI score and CGISS score ($p < 0.001$) and VAS sleepiness score ($p < 0.001$). The presence of insomnia was found to be associated with the following medical conditions: anxiety and depressive disorders ($p < 0.001$), other psychiatric disorders ($p = 0.05$), cardiovascular disease ($p < 0.001$), chronic pain ($p = 0.002$). A statistical significant correlation was found between SCI score and the use of: benzodiazepines ($p < 0.001$), z-drugs ($p < 0.001$), antidepressants ($p < 0.001$) and melatonin prolonged release ($p < 0.001$).

Conclusions: Insomnia affects half of Italian primary care population over 50 years and is frequently associated with different psychiatric and medical conditions, sleepiness and usage of different drugs.

Disclosure: Lino Nobili has received honoraria from Fidia Farmaceutici (for consulting activities).

P711 | Risk of herpes simplex virus infection among patients with insomnia: a retrospective cohort study

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Objectives/Introduction: This study explored the risk of developing Herpes simplex virus (HSV) infection in patients with insomnia.

Methods: This study applied a population-based retrospective cohort design. A total of 8,425 patients aged ≥20 years who had received a diagnosis of insomnia between 2000 and 2005. They were identified according to the corresponding ICD-9 code (780.52; insomnia, unspecified). The reference cohort comprised 16,850 age- and sex-matched patients. Data from the Taiwan National Health Insurance Research Database were employed from 2000 to 2013.

Results: Patients with insomnia had a higher risk of HSV infection, compared with the reference group (hazard ratio (HR) = 2.19, 95% confidence interval (CI) 1.73–2.79). For individuals divided into three age groups (≤40, 41–65, and >65 years old), the HSV infection risk of the insomnia cohort was significantly greater than that of the reference cohort (HR = 4.08, 95% CI 1.98–8.42; HR = 1.61, 95% CI 1.04–2.48; HR = 2.25, 95% CI 1.64–3.09, respectively). For male or female, the HSV infection risk of the insomnia cohort was significantly greater than that of the reference cohort (HR = 2.31, 95% CI 1.69–3.14; HR = 1.97, 95% CI 1.35–2.88, respectively).

Conclusions: Compared with without insomnia cohort, patients with insomnia had a higher risk of developing HSV infection.

Disclosure: Nothing to disclose.

P712 | A phase 1/2 double-blind, placebo-controlled study of SAGE-217 in an insomnia model

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Objectives/Introduction: SAGE-217 is a novel, orally-bioavailable, positive allosteric modulator (PAM) of synaptic and extrasynaptic $GABA_A$ receptors ($GABA_AR$) being investigated in clinical studies in multiple indications, including sleep disorders. This Phase 1/2, double-blind, placebo-controlled study evaluated the safety and efficacy of 30 mg and 45 mg SAGE-217 doses in a 5-hr phase advance model of insomnia.

Methods: Randomized healthy volunteers (n = 45) received 30 mg SAGE-217, 45 mg SAGE-217, or placebo once each on three separate visits in a double-blind, crossover study using a 5-hr phase advance model of insomnia, with lights-out and polysomnography recording beginning 5 hr prior to habitual bedtimes. Blinded study drug was administered 30 min before lights-out. Participants remained in bed for 8 hr. Treatment periods were followed by 7-day washouts. Sleep Efficiency (SE; percentage of time in bed spent asleep), measured by polysomnography, was the primary endpoint. Secondary endpoints included Wake After Sleep Onset (WASO), and Total Sleep Time (TST). Safety and tolerability were assessed by standard safety parameters, including adverse events (AEs).

Results: SAGE-217 at 30 mg or 45 mg achieved the primary endpoint by significantly improving SE to medians of 85% and 88%, respectively, compared to 73% for placebo (both doses $p < 0.0001$). Median TST increased significantly from 350.0 min in the placebo group to 406.3 and 420.3 min in the SAGE-217 30 mg and 45 mg groups, respectively (both doses $p < 0.0001$). SAGE-217 30 mg and 45 mg groups also showed significant decreases in median WASO compared to placebo (55.0 min for 30 mg; 42.5 min for 45 mg; 113.0 min for placebo; $p < 0.0001$). SAGE-217 was generally well tolerated, with low AE rates across all treatment groups (11.4% 30 mg; 4.8% 45 mg; and 9.8% placebo). No serious AEs were reported. Most common AEs across all periods and groups were headache (4/127, 3.1%) and fatigue (3/127, 2.4%).

Conclusions: In this first randomized, placebo-controlled insomnia model trial of this $GABA_AR$ PAM, SAGE-217 met the primary endpoint of improved sleep efficiency, demonstrated improvements in total sleep time and maintaining sleep, and was generally well tolerated.

Disclosure: This study was funded by Sage Therapeutics, Inc. Amy Bullock, Handan Gunduz-Bruce, Abdul J. Sankoh, Haihong Li, Min Qin, Christopher Silber, Stephen Kanes, Jeffrey Jonas, and James Doherty are employees of Sage Therapeutics with stock/stock options. GKZ has: ownership interest in Clinilabs, Inc., Home Sleep and Respiratory Care, and Nationwide Sleep Testing; consulting fees from Acetlion, Avadel, Eisai, Glaxo Smith Kline, Jazz, Idorsia, and Purdue; honoraria from Guidepoint and Merck; and research support from Actelion, Adare, Alder, Alkermes, Aptalis, Astellas, Astra-Zeneca, Avadel, Balance Therapeutics, Biomarin, CHDI, Corbus, Eisai, Flamel, Flex, Fresca, Idorsia, Janssen, Jazz, Johnson & Johnson, Merck and Co., Neurocrine Biosciences, Novartis, Pfizer, Purdue, Ritter, Sage Therapuetics, Inc., Sen-Jam Pharmaceuticals, Sequential Medicine, Sunovion, and Vanda.

P713 | Physical activity and insomnia: an international perspective

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Objectives/Introduction: Physical activity shows a 'U' shaped relationship with sleep quality, with very low levels, and very high levels associated with increased insomnia risk. Physical inactivity continues to rise internationally, though showing considerable cross-national variability (WHO, 2010). Multi-centre epidemiological comparisons also indicate substantial cross-national variations in insomnia symptoms. The present study was designed to assess the extent to which higher and lower moderate intensity physical activity levels contribute to insomnia risk in 5 countries.

Methods: Sleep, demographic, health and physical activity profiles were obtained from an online survey of 9238 participants (age range 18–75; 76% female) drawn from five countries: South Africa, Australia, China, South Korea and the UK. Those reporting sleep onset or maintenance problems, or unrestorative sleep (all with daytime consequences) on ≥3 nights/week for the previous ≥3 months were categized as insomnia cases. Continuous, moderate intensity physical activity l was divided into 5 categories: <10 min/week; 10–75 min/week; 76–149 min week; 150–300 min/week; and >300 min/week. Risk was assessed in partially adjusted (age, gender) and fully adjusted (+health, sleep medication, smoking status, alcohol consumption, caffeinated consumption, educational level and employment status) logistic regression models.

Results: In partially adjusted models, the lowest level of physical activity was associated with significant insomnia risk (OR = 1.37 (95% CI = 1.05–1.79; $p < 0.05$). In the fully adjusted model, however, only the highest level of physical activity significantly elevated insomnia risk (OR = 1.30 (95% CI = 1.03–2.51; $p < 0.05$). Risk associated with high activity remained after the addition of 'country' to the model (OR = 1.31 (95% CI = 1.02–1.69; $p < 0.05$). The country × physical activity level interaction term was non-significant ($p = 0.266$). Across all models, female gender, low rated health, low education, and older age consistently increased insomnia risk.

Conclusions: Extremes of inactivity/activity are significantly associated with insomnia risk. While low activity appears to be a proxy for poorer health, high activity increases risk independent of health and demographic factors.

Disclosure: The 5-Nation Sleep Survey, from which these data are taken, was supported by Sealy (UK) Ltd. Kevin Morgan was paid as a consultant to this firm in 2016.

P714 | Can flavour influence sleep disturbance? An experimental research with hop

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Objectives/Introduction: To initial experience in using flavoured bed equipment's to influence insomnia. The measured and self-rated sleep quality and efficiency shall be better with this treatment of flavour.

Methods: The study was based on two phases and started with 6 healthy people. The participants were put in a controlled trial in a double cross over design to sleep with a pillow treated with and without a flavour of hop. The application of the equipment's with the treatment hop was double blinded so that the study participants and the assistants of the sleep laboratory didn't know whether they had the treatment or not. The sleep was controlled in an accredited sleep lap standardized and the evaluation was done following the AASM manual. In a second step 3 participants with a diagnosed sleep disorder were recruited from the laboratory. They slept for four nights on a pillow with and without treatment without knowing, when the treatment was, evaluation as named.

Results: After the first trial with healthy participants there were no clear relationship between the treatment and the sleep of the participants. But no participant had any dysfunction or side effect. So the second step started with affected people. In this step all three participants showed a small improvement of the insomnia in the deep sleep phase and also the sleep efficiency and they reported by themself a better sleep. One participant could reduce his medication.

Conclusions: In this research it is showed that the treatment with a hop flavour in a pillow could cause a small positive effect to Insomnia patients. The affected participants were enthusiast but regarding the size of the study participants the reported results are only an indication and further research is needed.

Disclosure: I am Scientist in Public Health and work for the company Lück GmbH & Co KG, Bocholt Germany. This company makes the products. The research and the results are based on the experience of a accredited sleep laboratory in Velen Germany and independent from the company., Aalten 15.04.18

P715 | The comparison research of effects of neurofeedback and cognitive behavior treatment for insomnia patients

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Objectives/Introduction: Insomnia refer to difficulty of in initiating sleep, maintaining it, or a relaxing sleep despite the opportunity to get plenty of sleep. CBT-I is evidence-based therapy for insomnia, proven to be effective in ameliorating insomnia by non-medication that corrects sleep related misbehavior and distorted thinking. However, exisiting treatment is an approach that does not consider the main physiological characteristic of insomnia which is arousal phenomenon. Additionally it has a problem of confirming only the patient's subjective report about the therapeutic effect. Therefore, this study proposes a beta-decrease neurofeedback training for the reduction of hyperactivity which is physiological characteristic of insomnia and confirms whether the new therapeutic approach is as effective as the existing evidence-based therapy.

Methods: 14 participants who showed a score suggestive of insomnia in the sleep disorder test were randomly assigned to the Neurofeedback training group and the CBT-I group and received the corresponding treatment. Resting brain wave were measured for comparing therapeutic effect when before and after treatment.

Results: According to Wilcoxon's signed-ranks test, both groups showed statistically significant change about ISI(NF: 0.005, CBT-I: 0.027), PSQI(NF: 0.017, CBT-I: 0.027), PSAS(NF: 0.008, CBT-I: 0.028) and GSES(NF: 0.005, CBT-I: 0.046). But only the CBT-I group showed significant decline in DBAS (p = 0.028) and the neurofeedback training group significantly decreased beta power related to hyperarousal (beta-3, p = 0.046).

Conclusions: All treatments were effective in improving insomnia, but neurofeedback was more effective on ameliorating hyperarousal symptoms and CBT-I was more effective in decreased dysfunctional thinking about sleep.

Disclosure: Nothing to disclose.

P716 | The effects of neurofeedback in fibromyalgia: a randomized controlled study

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Objectives/Introduction: Poor sleep is reported by nearly 80% to 90% of the individuals with fibromyalgia. poor sleep quality is a risk factor for the development of fibromyalgia; Poor sleep may have a strong dose-dependent association with symptom severity. Previously RCT trails showed that SMR training significantly improves sleep. This randomized controlled study examined whether the improvements of the sleep quality following neurofeedback

(sensorimotor rhythm, SMR) training correlate with the reduction of pain intensity after neurofeedback training in fibromyalgia.

Methods: Participants in the SMR group (n = 60) were trained in 8 weekly laboratory sessions, whereas participants in the control group (CG) were accepted telephone education (n = 20). A total of 600 min SMR enhancement training will be provided to participants during an 8-week training period. During the first 4 weeks, they will be trained 3 sessions per week. For the second 4 weeks, the participants will be trained 2 sessions per week. Sleep quality (Pittsburgh Sleep Quality Index, PSQI), pain (Brief Pain Inventory, BPI) and fibromyalgia symptom severity (Revised Fibromyalgia Impact Questionnaire, FIQR) were assessed before and after training.

Results: The changes in SMRG and CG from pre and post test were analysis. After 8 weeks, the decreased PSQI score (mean change −2.17 vs. −1.28, p = 0.373), decreased BPI (mean change −1.55 vs. −0.07, $p < 0.001$) and FIQR (mean change −15.33 vs. 0.05, p = 0.004) were found. And improved day time dysfunction (PSQI) in SMRG than CG (mean change −0.45 vs. 0.05, p = 0.04).

Conclusions: SMR neurofeedback training in fibromyalgia improved sleep quality, pain and fibromyalgia symptoms.

Disclosure: Nothing to disclose.

P717 | Comparison of sleep related factors in clinic clients with and without sleep difficulty complaints

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Objectives/Introduction: Sleep is affected by multiple factors. However, majority of patients get medical treatments without a comprehensive sleep assessment. This study tries to implement comprehensive sleep assessment scales in a medical center and to explore differences of sleep-related factors between clinic clients with and without sleep difficulty complaints.

Methods: Five dimensions of comprehensive sleep assessment (CSA) scales including personal, physiological, psychological, social, and environmental factors were used to assess clients' status. Clients who visited sleep clinic due to sleep difficulties (n = 32, 16 males and 16 females, ages 43.7 ± 14.2 years) and gender-and age-matched healthy subjects without sleep difficulties (n = 96, 47 males and 49 females, ages 42.0 ± 13.7 years) were randomly recruited at a ratio of 1:3 (with sleep complaints vs. without sleep complaints) to compare their sleep and the CSA factors.

Results: Results show that all clinic clients with sleep complaints did have poor sleep quality (PSQI >5) and mild to moderate daytime sleepiness (ESS >11). Personal factors of long working hours (χ^2 = 10.315, p = 0.001), shift workers (χ^2 = 8.964, p = 0.003), night shift (χ^2 = 9.395, p = 0.004) and perceived stress (χ^2 = 9.503, p = 0.002) were disruptors of sleep quality. Physiological factors from physical examination including breathing by mouth, low soft palate, high narrow palate, Edward Angle, tongue hypertrophy, and occlusion of the worn surface were observed in clinic clients. Psychological factors including higher perceived stress (χ^2 = 32.542, p = 0.000), anxiety and depression (χ^2 = 32.868, p = 0.000); social factors including lack of leisure activities (χ^2 = 39.857, p = 0.000), more drinking habits (χ^2 = 1.798, p = 0.018), irregular amount and frequency in meals (χ^2 = 5.086, p = 0.024), excessive dinner (χ^2 = 21.511, p = 0.000), being incapable of getting up on time due to previous poor night sleep (χ^2 = 4.444, p = 0.035); and environmental factors including light disruption (χ^2 = 7.683, p = 0.006), noise disruption (χ^2 = 5.086, p = 0.024), low or high bedroom temperature (χ^2 = 4.595, p = 0.032) were existed in clients.

Conclusions: Many sleep related factors including personal, physiological, psychological, social, and environmental dimensions existed in sleep complainers. Findings of this study provide important reference for assessing and intervening clinic clients with sleep difficulties.

Disclosure: Nothing to disclose.

P718 | Association of chronotype with sleep and alertness in nurses under fixed shift

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Objectives/Introduction: Shift nurses often suffer from disruption of the circadian rhythm resulting in sleep disorder as well as physiological and psychological health issues. Individual's chronotype may play a role influencing the alertness and fatigue level of a shift worker while taking different shifts.This study focused on the influence of the chronotype on sleep pattern and health in nurses with fixed shifts.

Methods: A purposive sampling method was used to recruit nurses from two medical centers with fixed day (n = 37), evening (n = 37), and night (n = 35) shifts. Data including personal information, chronotype (Morning-Evening Questionnaire), sleep pattern (Actiwatch worn 24 hr a day, together with a sleep diary for 6 days), sleep quality (Pittsburg Sleep Quality Index, PSQI), fatigue (Standard Shiftwork Index Chronic Fatigue Scale, SSICFS), and alertness (Visual Alertness Scale, VAS) were collected in the middle weeks of a monthly shift schedule.

Results: Result show that the majority of nurses' chronotype were intermediate (60.6%) or evening (32.1%) type. More nurses under night shift slept less than 7 hr than those under day or evening shifts. Nurses with evening type took significantly longer sleep latency than nurses with intermediate or morning type while worked in day shifts (F = 0.187, p = .026). Nurses with evening type had

higher alertness level while worked in evening shifts (F = 1.187, p = 0.055).

Conclusions: Nurses with evening type may be more suitable for evening shifts. Managers can take nurses' chronotype into consideration while arrange their shifts as an option for better performance and sleep quality.

Disclosure: Nothing to disclose.

P719 | The paradoxes of sleep state misperception and of paradoxical insomnia: a search for an evidence-based definition

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Objectives/Introduction: Misperception is definitively the most intriguing yet challenging feature of insomnia. After decades of debate, the scientific sleep community is still critically divided between who considers the underestimation of sleep duration a typical feature of all insomniacs, with some extreme cases being part of a clinical continuum, and who supports the existence of a separate diagnostic category, namely "subjective insomnia", otherwise known as "paradoxical insomnia" (PI). Most of the debate is fuelled by the lack of a consensus on which should be a quantitative definition of sleep state misperception and by the absence of evidence-based strategies to study and define paradoxical insomnia.

Methods: We conducted a systematic review of the literature and extracted 20 different quantitative definitions of PI. We then applied these definitions to two real-world datasets. The first consisted of 200 chronic primary insomnia patients, diagnosed according to DSM-IV-TR criteria, the second of 200 age- and gender matched healthy controls without insomnia. For each dataset, available data from the objective sleep parameters and their subjective estimation were imported and analysed in MATLAB using custom algorithms. Finally, we identified some basic, fundamental features a quantitative definition of PI must respect and applied them to our 20 definitions.

Results: Prevalence of PI according to the 20 selected definitions ranged from 8 to 66% in insomnia patients, and from 0 to 89% in healthy controls. Overlap between definitions ranged from 3 to 84%. We ranked classworthy the available definitions. Only three fulfilled our new proposed quantitative criteria for PI, and several open issues remains, like whether there is a minimum number of hours an insomnia patient should sleep in order to be defined as paradoxical, and whether SOL can be used in the definition of paradoxical insomnia together with TST.

Conclusions: Given the high heterogeneity of quantitative definitions of paradoxical insomnia, the scarce literature on the topic is of little use. We suggest to adopt only the definitions that survived a rigorous methodological evaluation and use them when studying the phenomenon until a consensus is reached. A research agenda is proposed at the end of the paper.

Disclosure: Nothing to disclose.

PARASOMNIAS

P720 | Screening for idiopathic REM sleep behavior disorder: usefulness of actigraphy

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Objectives/Instruction: To evaluate the utility of multimodal low-cost approaches including actigraphy, a wrist-worn device monitoring rest/activity cycles, in identifying patients with idiopathic REM sleep behavior disorder (iRBD).

Methods: Seventy patients diagnosed with sleep disorders causing different motor manifestations during sleep (iRBD, sleep apnea, restless legs syndrome) and 20 subjects without any relevant motor manifestation during sleep, underwent video-polysomnography (vPSG) and two-week actigraphy, completed six validated RBD screening questionnaires, and sleep apps use was assessed. Actigraphy was analyzed automatically, and visually by seven blinded sleep medicine experts who rated as "no", "possible" and "probable" RBD.

Results: Quantitative actigraphy analysis distinguished patients from controls, but not between patients with different types of motor activity during sleep. Visual actigraphy rating by blinded experts in sleep medicine using pattern recognition identified vPSG confirmed iRBD with 85–95% sensitivity, 79–91% specificity, 81–91% accuracy, 57.7 ± 11.3% positive predictive value, 95.1 ± 3.3% negative predictive value, 6.8 ± 2.2 positive likelihood ratio, 0.14 ± 0.05 negative likelihood ratio and 0.874–0.933 AUC. AUC of the best performing questionnaire was 0.868. Few patients used sleep apps, therefore their potential utility in the evaluated patients' groups is limited.

Conclusions: Visual analysis of actigraphy using pattern recognition can identify subjects with iRBD, is able to distinguish iRBD from other motor activity during sleep, even when patients are not aware of the disease in contrast to questionnaires. Therefore, actigraphy can be a reliable screening instrument for RBD potentially useful in

the general population. Therefore, actigraphy can be a reliable screening instrument for RBD potentially useful in the general population.

Disclosure: This study was supported by the FWF Austrian Science Fund, project number I 2120-B27. Ambra Stefani and Marc Guaita report support from the Austrian Science Fund, project number I 2120-B27.

P721 | Altered heartbeat-evoked potential amplitude in nightmare disorder

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Objectives/Instruction: The pathophysiology of nightmare disorder is not well known. According to some studies, nightmares reflect an increased emotional arousal during sleep. At the same time, the brain response to the heartbeat or heartbeat-evoked potential (HEP), which relates to interoceptive processing, is increased when intrinsic levels of arousal are elevated, such as in high emotional arousal, stress and insomnia. Here we asked whether HEP during sleep might differ in nightmare patients as compared to healthy volunteers.

Methods: We measured HEP amplitude across wakefulness, NREM and REM sleep in 11 patients with nightmare disorder and 11 healthy controls using 21-channel EEG.

Results: We found that nightmare patients had altered HEP amplitude compared to healthy controls in a frontal cluster (cluster-level $p = 0.032$, corrected for multiple comparisons in space and time). This HEP effect was specific for REM sleep. In the nightmare group, there was also a negative correlation between HEP amplitude in the frontal cluster and the Beck depression scale ($r = -0.68$, $p = 0.02$).

Conclusions: These findings support higher emotional arousal and interoceptive processing during REM sleep of nightmare patients, which may favor the emergence of emotional dreams.

Disclosure: Nothing to disclose.

P722 | Imagery rescripting and imaginal exposure for nightmares: efficacy and mechanisms of change

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Objectives/Instruction: Nightmares can be effectively treated with cognitive-behavioral therapies. It remains elusive which therapeutic elements are responsible for the beneficial effects on nightmare symptoms. Imagery rescripting (IR) and imaginal exposure (IE) are commonly identified as active treatment components of nightmare therapies. With this randomized controlled trial, we compared IR and IE as individual treatments to a wait-list (WL) condition to determine whether these particular therapeutic elements ameliorate nightmare symptoms and whether mastery and tolerability mediated the effects.

Methods: In this trial we randomized 104 patients with a primary DSM-5 diagnosis of nightmare disorder into an IR, IE, or wait-list control group. In the intervention conditions all participants received three weekly 60 min individual treatment sessions. The treatment conditions only consisted of IR or IE and did not both comprise of treatment elements such as extensive psycho-education, relaxation and safe-place exercises, or nightmare journals. Nightmare distress was assessed with the Nightmare Distress and Impact Questionnaire (NDIQ; range 0–36). Mediators were assessed weekly with VAS scales. Tolerability (0–100): "*I think that I can tolerate the emotions elicited by my nightmares.*" Mastery (0–100): "*I think that I am in control of the content of my nightmares.*"

Results: Results showed that compared to WL, both interventions effectively reduced nightmare frequency, $d_{ir\text{-}wl} = 74$; $d_{ie\text{-}wl} = 0.70$ and distress $d_{ir\text{-}wl} = 0.98$; $d_{ie\text{-}wl} = 1.35$ in a sample that predominantly consisted of idiopathic nightmare sufferers. The effects of IR and IE were comparable to those observed for other psychological nightmare treatments. Initial effects at post-treatment were sustained at 3- and 6-months follow-up. Distress was mediated by mastery in the rescripting condition (but not by tolerability). Distress was mediated by tolerability in the exposure condition (but not by mastery).

Conclusions: IR and IE both seem to be efficacious treatment components of nightmare therapies. Additional research is needed to directly compare IR and IE among both idiographic and posttraumatic nightmare sufferers with respect to treatment expectancy, acceptability, and effectiveness. Even though IR and IE for nightmares seem to produce similar therapeutic effects, the results of this study suggest that IR and IE tap into different underlying processes.

Disclosure: Nothing to disclose.

P723 | Validation of the Dutch translation of the Paris Arousal Disorder Severity Scale in a one-year and one-month version

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Objectives/Instruction: The Paris Arousal Disorders Severity Scale (PADSS) was developed to evaluate clinical symptoms and

severity of sleep walking and sleep terrors. The original PADSS is used as a screening tool to assess nighttime behavior, its frequency and consequences over the past year. However, to monitor treatment effects, evaluation over a shorter time frame would be preferable. The aim of this study was to test the psychometric properties of the Dutch version of the PADSS and to develop and validate a one month version.

Methods: The Dutch PADSS was obtained by forward-backward translation of the original French questionnaire. A second version was created evaluating symptoms over the past month, instead of the past year. Both versions were completed by patients with sleep walking and/or sleep terrors; and healthy control subjects.

Results: The PADSS was completed by 46 consecutive patients (age 27.0 ± 6.0 years) with sleep walking/sleep terrors and 34 healthy controls (age 27.7 ± 5.6 years). The PADSS showed a good internal consistency in both the one-year version (Cronbach's alpha = 0.727) and the one-month version (Cronbach's alpha = 0.790). Factor analysis using a 2-factor model, yielded factors representing wandering and violence, comparable to the French version. Patients had higher scores than healthy controls on both the one-year version (16.4 ± 4.6 vs. 1.6 ± 3.4, $p < 0.001$ and the one-month version (14.5 ± 5.1 vs. 2.0 ± 3.5, $p < 0.001$). Dutch patients had lower (total) scores on the PADSS one-year version than the previously published French cohort (16.4 ± 4.6 vs. 19.4 ± 6.3, $t = 2.797$, $p < 0.01$). A lower cut-off score to discriminate between patients and healthy controls yielded better results The best Dutch cut-off score was 11.5 (sensitivity 81.8%, specificity 97.1%, ROC-AUC 0.988), whereas the optimal cut-off in the French cohort was 13.5.

Conclusions: Both versions of the Dutch-PADSS are scales with good internal consistency. Although a lower cutoff score was preferred, the PADSS one-year version can be used as a screening tool for non-REM parasomnias. The PADSS one-month version could be used to evaluate current symptoms and potentially to monitor treatment effects. Therefore, its responsiveness to changes should be validated next.

Disclosure: Nothing to disclose.

P724 | Idiopathic REM sleep behavior disorder - symptoms of prodromal synucleinopathy and their relation to the degeneration of nigrostriatal pathway

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Objectives/Instruction: Idiopathic REM sleep behavior disorder (iRBD) is considered as the prodromal synucleinopathy. It is frequently associated with several motor and non-motor symptoms such as hyposmia, constipation, and orthostasis along with gradual loss of dopaminergic neurons in substantia nigra. Our aim was to compare prevalence and severity of degenerative symptoms in iRBD and control group. Additionally, we investigated whether these symptoms are associated with the degree of nigrostriatal degeneration.

Methods: 75 RBD (5f, mean age 67.5 ± SD = 6.2 years) and 41 control subjects (4f, mean age 65.3 ± 8.4) years) were examined using Movement Disorders Society-Unified Parkinson's Disease Rating Scale (MDS-UPDRS-III), Montreal Cognitive Assessment (MoCA), University of Pennsylvania Smell Identification Test (UPSIT), Scales for Outcomes in PD-Autonomic (SCOPA-AUT), and orthostatic test. In 62 iRBD patients, 123I-Ioflupane (DaTscan) SPECT was performed, putaminal indices were calculated using the BASGAN_V2 software and subsequently classified as normal, borderline, or abnormal.

Results: iRBD patients had significantly more severe mean scores in MDS-UPDRS-III ($p = 0.01$), MoCA ($p = 0.001$), UPSIT ($p = 0.0001$), and SCOPA-AUT ($p = 0001$) compared to controls. Orthostatic test was positive in 33% iRBD patients vs. 0% controls ($p = 0.05$). iRBD patients with abnormal DaTscan had significantly higher MDS-UPDRS-III ($p = 0.01$) and lower UPSIT ($p = 0.03$) scores compared to patients with borderline/normal DaTscan result while no differences were found for age, symptom duration, MoCA, and SCOPA-AUT scores.

Conclusions: iRBD is associated with autonomic dysfunction, hyposmia,cognitive decline, and motor impairment suggesting synucleinopathy. Minor motor symptoms and hyposmia along with abnormal DaTscan are likely markers of imminent conversion to manifest neurodegeneration.

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P725 | Influence of NREM parasomnia on daytime functioning, sleep quality, psychological health and quality of life in patients and bed partners

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Objectives/Introduction: Complaints of tiredness and poor sleep quality are frequently reported in patients with NREM parasomnia. Despite this, formal assessments of these functions in patients have been limited and bed partners have never been included in analyses. The aim of this study was to determine daytime functioning, sleep

quality, psychological health and quality of life (QoL) in adults with NREM parasomnia and their bed partners.

Methods: 32 patients (14 male, mean age 41) diagnosed with NREM parasomnia (sleepwalking, night terrors or sexsomnia) and 14 bed partners (6 male, mean age 35.75) were included in the study. All participants completed questionnaires assessing daytime somnolence, insomnia, sleep quality, depression and anxiety symptoms and QoL. Patients completed an additional questionnaire assessing NREM parasomnia characteristics.

Results: Questionnaire scores revealed patients (n = 32) to have poor sleep quality (cut- off score >5; mean score 7.66) and insomnia symptoms (cut-off score >7; mean score 10.56), which was also found in bed partners (n = 14; mean score 5.71 and 7.71, respectively). Daytime somnolence was in normal range for both groups. Anxiety scores were significantly greater than the standard cut-off (>45) for patients (mean score 77.53) and bed partners (mean score 67.86), and depression scores were on the borderline (>10) for patients (mean score 10.34). QoL scores were compared to healthy control data (Lopez et al, 2013, n = 100), which indicated both groups had reduced QoL (mean cut-off score 87.13; patient mean scores 73.84; bed partners mean score 78.87). Statistical analysis revealed significant associations between effects of episodes and decreased sleep quality in patients ($p < 0.05$), and greater frequency of episodes with insomnia ($p < 0.005$). Furthermore, increased severity of episodes was significantly associated with poorer sleep quality in bed partners ($p > 0.001$), insomnia ($p < 0.05$) and reduced QoL ($p < 0.05$).

Conclusions: Our study confirms that adult NREM parasomnia is a condition that negatively affects sleep quality, anxiety and QoL in patients and for the first time also shows an impact on their bed partners. Additionally, increased frequency of episodes is potentially damaging to sleep quality in patients and overall QoL for their bed partners.

Disclosure: Nothing to disclose.

P726 | Impaired visuo-spatial abilities in REM sleep behaviour disorder are detected by the qualitative scoring of the Mini-Mental State Examination Pentagon Test

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Objectives/Instruction: Rapid Eye Movement (REM) sleep Behavior Disorder (RBD) is a REM sleep parasomnia characterised by the loss of REM physiological atonia that enables patients to act out their dreams. RBD is frequently associated with the development of neurodegeneration and cognitive impairments, in particular in the visuo-spatial domain. However, due to the possible subtle nature of these deficits, they might go unnoticed at the standard neuropsychological assessment. In the light of these evidences, the aim of this study was to compare the performance of RBD patients and Healthy Controls (HC) at the Qualitative Scoring of the Mini-Mental State Examination Pentagon Test (QSPT), also exploring the relationship with polysomnographic (PSG) parameters.

Methods: 90 RBD patients (68.82 ± 7.11) and 110 HC (62.68 ± 7.39) were retrospectively evaluated. RBD was diagnosed accordingly to current criteria. Both RBD patients and HC underwent a comprehensive neuropsychological evaluation, comprising the Mini-Mental State Examination (MMSE). Two independent raters, blind to the status of the subjects (RBD or HC), performed the QSPT. Comparisons between RBD and HC regarding the overall score of QSPT as well as all the subscales of the test were investigated. Defining a cut-off as two deviation standard below the mean score of HC (cut-off: 10) we determined the frequency of RBD patients and HC with impaired performance, and compared patients' PSG features.

Results: RBD performed significantly worse in comparison to HC in the QSPT total score (RBD 11.12 ± 1.92; HC 12.07 ± 0.89, p = 0.032) controlling for age and educational level. 16 out of 90 (15%) RBD patients and 2 out of 110 (1%) HC exhibited a total score <10 ($\chi^2_{(1)} = 15.39$, $p < 0.001$). RBD patients who performed below the cut-off showed lower percentage of REM sleep ($p < 0.014$) and slow wave sleep ($p < 0.020$).

Conclusions: We found a worse performance at the Mini-mental pentagon test from a qualitative prospective in RBD patients compared to HC. This finding is in line with the notion that RBD patients show a visuo-spatial impairment and suggests that QSPT may be a useful tool in the early detection of this aspect.

Disclosure: Nothing to disclose.

P727 | A visual search task reveals an impaired visual processing in RBD patients

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Objectives/Instruction: Cognitive impairments, in particular related to visuo-spatial abilities, are recognized as a frequent daytime concern in Rapid Eye Movement (REM) sleep Behavior Disorder (RBD), a REM parasomnia frequently associated with the development of alpha-synucleinopathies over time. Despite this evidence, the effect of RBD on visual processing has been poorly investigated. The aim of this study is to assess the basic mechanisms of stimulus analysis in RBD patients by means of a visual search paradigm.

Methods: 18 RBD patients (mean age: 68.38 ± 8.18, 15 males) and 12 age-matched healthy controls (HC) were enrolled in the study. After a nocturnal video-polysomnographic recording patients performed a visual search task in which they had to detect the presence/absence of a target (letter T) embedded in the 50% of trials into a set of distractors (letters Os, Xs, or Ls). Target's salience and distractors' numerosity were manipulated as independent variables, whereas accuracy and reaction times (RT) were recorded as dependent variables.

Results: Confirming the classical effects of a visual search task, RT increased with the number of distractors ($p < 0.001$), the absence of the target ($p < 0.001$) and decreased with the salience of the target ($p < 0.001$). Slower RT were generally observed in patients with RBD in comparison to HC ($p < 0.05$). However, considering RT of stimuli with target present in comparison to RT of stimuli without the target, the two groups showed a significant difference only in the condition of target absent ($p < 0.05$).

Conclusions: RBD patients exhibit an overall impairment in visual processing highlighted by the more demanding conditions of the task. This main deficit is magnified in the analysis of patterns without the target, which require an exhaustive analysis of the entire stimulus. These results are in line with previous literature that reported visuo-spatial impairments in RBD.

Disclosure: Nothing to disclose.

P728 | Disease duration rather than aging is a key predicting factor for covert progress of neurodegeneration in patients with rapid eye movement sleep behavior disorder

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Objectives/Introduction: Although progression to severe neurodegenerative diseases is the prominent problem in rapid eye movement sleep behavior disorder (RBD) patients, predictive factors for such progress are yet to be determined, especially in patients without clear motor symptom or cognitive decline. RBD patients are reported to have high converting rate to neurodegenerative diseases as a function of RBD disease duration. But simple effect of aging is not negligible. We investigated influence of aging and disease duration against cognitive decline and dopaminergic denervation.

Methods: Medical records of RBD patients, who visited the Sleep Clinic in Shiga University of Medical Science during April 1, 2016 to April 1, 2018, were reviewed and 21 patient records fulfilling following assessments were included in this study.

For cognitive assessment, MoCA-J was used to better detect slight cognitive decline such that cannot be measured by conventional dementia scale.

Dopaminergic denervation was semi-quantified by DAT ^{123}I-FP-CIT SPECT, followed by calculation of specific ^{123}I-FP-CIT tracer binding ratio (SBR) by DAT VIEW software (Nihon Medi-Physics, Tokyo, Japan).

A stepwise multiple regression analysis was conducted with MoCA-J score, and SBR as dependent variables, and age, sex, disease duration, BMI, years of education were used as independent variables.

Results: All patients were male, with a mean (SD) age of 73.2 (5.9) years, disease duration of 9.4 (5.4) years, BMI of 24.4 (2.9) kg/m^2, and education of 13.2 (2.9) years. MoCA-J score was 23.7 (3.2), and SBR was 4.00 (1.29).

Multiple regression analysis equation: MoCA-J score = 26.962 - 0.352 * disease duration ($R^2 = 0.356$, $F = 10, 488$, $p = 0.04$).

However, no significant relation was found between SBR and independent variables.

Conclusions: Disease duration significantly correlated with the score of MoCA-J but did not correlate DAT uptake; age did not correlate with either MoCA-J or DAT uptake.

This research suggested two possibilities. First, disease duration of RBD may be more closely related to the progression of neurodegenerative diseases rather than aging. Second, MoCA-J can capture the sign of neurodegeneration earlier than DAT-SPECT.

Disclosure: This study protocol was approved by the ethics committee of the Shiga University of Medical Science. There are no conflicts of interest. This study was supported by JSPS KAKENHI Grant Numbers 17H00872, 16K20817.

P729 | The utility of polysomnography in NREM parasomnias: a large cohort retrospective study

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Objectives/Introduction: Although video polysomnography (vPSG) is not routinely indicated for the evaluation of typical cases of non-REM (NREM) parasomnias, it can aid diagnosis of unusual cases, other sleep disorders, complicated cases with REM behavior disorder (RBD), and in differentiating parasomnias from epilepsy. In this study we aimed to assess the utility of vPSG in consecutive patients with a clinical diagnosis of NREM-parasomnias covering the whole phenotypic spectrum.

Methods: 512 patients with a final diagnosis of NREM parasomnias who had undergone vPSG were retrospectively identified. Potential priming factors for parasomnias events were extracted

from medical records. vPSGs were analysed for features of NREM parasomnias and for the presence of other sleep disorders.

Results: 206 (40.0%) patients were diagnosed with sleepwalking, 72 (14.1%) with sleep terrors, 39 (7.6%) with confusional arousals, 15 (2.9%) with sexsomnia, 7 (1.4%) with sleep-related eating disorder, 122 (23.8%) with mixed phenotype and 51 (10.0%) with parasomnia overlap disorder (POD). Priming factors were identified in 35.9% of patients; the most common were stress (52%) sleep deprivation (29.3%), and insomnia (13%). The vPSG supported the diagnosis of NREM parasomnias in 64.4% of the patients, and of POD in 9.8%. In 28.9% of the patients, obstructive sleep apnea (OSA) or/and periodic limb movements during sleep (PLMS) were identified: 22% of patients had OSA (AHI: 18.6 ± 15.5 events/hr), and 11% PLMS (PLMI: 33.2 ± 23.6 events/hr), but no significant differences were found between parasomnias phenotypes. Age >50 years, obesity, male sex, and subjective daytime sleepiness were identified as independent predictors of concomitant OSA and/or PLMS.

Conclusions: vPSG has a high diagnostic yield in patients with NREM parasomnias and should be routinely performed when there is diagnostic doubt. A high index of suspicion for OSA and PLMS is also recommended, particularly in older, overweight, male patients.

Disclosure: Nothing to disclose.

P730 | Treatment approach in patients with NREM parasomnias: a large cohort retrospective study of 512 patients

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Objectives/Introduction: Non-REM parasomnias are not uncommon conditions in the general population. Current treatment options are based on small case series and reports. In this study we aimed to present the clinical experience from a large cohort of patients.

Methods: 512 patients with Non-REM parasomnia or parasomnia overlap disorder (POD), who had undergone a video polysomnography and were exposed to treatment with adequate follow up (FU) time of at least 6 months, were retrospectively identified over a period of 7.5 years (between June 2008 and December 2015). Treatment outcome was assessed based on patients' reports, and treatment approach on a locally accepted hierarchy of interventions.

Results: The age of the patients ranged from 19 to 88 years old with a mean of 39.3 ± 12.1 years, 265 were males (51.8%), and the median FU time was 8.0 months (interquartile range 7.0–11.0) of FU time. 40% of the patients were diagnosed with sleepwalking, 23.8% with mixed-phenotype and 10% with POD. 97.2% ultimately reported adequate control of their symptoms. 60.1% were treated with pharmacotherapy and 32.0% without, consistent across all phenotypes ($p = 0.09$). Benzodiazepines were the commonest drugs prescribed (47.1%, $p < 0.05$). Ultimately 37.7% of our patients were receiving a benzodiazepine (clonazepam, 95.8%) as part of their successful treatment, 11.7% an antidepressant (fluoxetine, 31.6%), 9.2% a z-drug (zopiclone, 100%), and 10.7% melatonin. 13.2%, 12.1% and 5.8% of our patients reported good control of their symptoms with sleep hygiene, management of sleep-disordered breathing, and psychological interventions (cognitive behavioral therapy (CBT) or mindfulness-based stress reduction (MBSR)), as monotherapy respectively.

Conclusions: The treatment approach to effective treatment of the patients with Non-REM parasomnias or POD offering first sleep hygiene advice, next treatment of concurrent sleep disorders and management of other priming factors like stress and anxiety, and lastly pharmacotherapy for Non-REM parasomnia is supported by our results. Non pharmacological interventions were effective in one third of our patients, and CBT/MBSR and melatonin appeared promising new treatments.

Disclosure: Nothing to disclose.

P731 | The "RBD Rating Scale" (RBD-RS): description and validation of a new instrument to measure manifestation and change of RBD symptoms over time

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Objectives/Introduction: The intake of melatonin not only has slowly evolving acute effects on symptoms of REM sleep behavior disorder (RBD), but - in contrast to clonazepam - also a remitting influence after discontinuation. Until now, just one polysomnographic (PSG) based instrument to assess the severity of RBD at the time of diagnosis exists (RBDSS; Sixel-Döring et al., 2011). In order to document the initial state before the beginning of treatment and also specific symptom changes in the course of the disease, an external evaluation form has been developed.

Methods: The "RBD Rating Scale" (RBD-RS) is completed by a clinician based on interviews with patients and their bed partners with regard to the last 6 months.

Severity of RBD symptoms is evaluated on two dimensions: On the first scale ("frequency")the occurrence of symptoms can be estimated from never (=0), less than monthly (=1), monthly (=2), 1–2 times a week (=3), 3–5 times a week (=4) and daily (=5).The second scale ("expression") describes the form of the most severe manifestation of RBD symptoms from no movement (=0), to speech or slight distal movements (=1), screaming or complex, non-aggressive movements (=2), complex movements with risk of injury (=3) and leaving

the bed (=4). Both ratings are summarized to a total score (with a range from 0 to 9).

Results: In a cohort of iRBD patients (*N* = 100) who were all treated with melatonin, clinicians filled out the RBD-RS at baseline (PSG) and at every check up in further treatment (at least once, at most three times a year). Within a validation study, in particular the test-retest- and interrater reliability, objectivity and external validity of this newly developed instrument are to be tested, by evaluating videometric data of RBD patients in PSG at baseline, focusing on frequency and expression of symptoms.

Conclusions: The RBD-RS is expected to prove an easy-to-use instrument to document RBD symptom changes over time. It should do so in an objective, reliable, valid and economical way via clinical interview, adding to existing instruments that need PSG based evaluation of RBD symptoms severity.

Disclosure: Nothing to disclose.

P732 | Somnambulism and environmental factors

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Objectives/Introduction: Activity of humans, like that of other living organisms, exhibits a circadian rhythm, generated by endogenous biological clock. Periodic variations in ambient light intensity is the most important external cue (zeitgeber) that synchronizes rhythmical functions with the environmental conditions. Growing usage of the mobile devices (cell phones, tablets), laptops and/or watching TV around bedtime may increase an exposure to the blue component of visible light spectrum and contribute to the sleep disorders. In the Sleep Disorder Center of the Institute of Psychiatry and Neurology in Warsaw, Poland, only 3 adult patients were diagnosed with somnambulism between 2000 and 2012 while between 2013 and 2017 the number of such adults increased to 52. It is worth to emphasize that while somnambulism i.e. sleepwalking episodesaffects up to 15% of children, in most cases it recedes around puberty.

Hypothesis: Refraining from using devices emitting blue light will help to recede or significantly reduce the severity of sleepwalking episodes.

Methods: All patients were asked not to watch TV and to stop using mobile devices and/or laptops minimum 1 hr prior to entrance to bed. After six weeks of treatment the patients who did not report the improvement were additionally prescribed with low dose of SSRI (escitalopram, paroxetine).

Results: Change in the pre-bedtime behavior eliminated episodes of somnambulism in 21 of 48 patients (44%) while 19 other (40%) achieved a marked improvement after the introduction of antidepressant pharmacotherapy. The therapy was not effective in two patients (4%) and 6 persons did not attend the follow-up visit.

Conclusions: The growing number of episodes of somnambulism in adults may originate from an excessive exposure to the blue light around bedtime. Successful treatment comprises the change in sleep hygiene supplemented in some cases with an antidepressant given in a low dose.

Disclosure: Nothing to disclose.

P733 | Effects of melatonin in idiopathic REM-sleep behavior disorder develop over time and are outlasting

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Objectives/Introduction: Idiopathic REM sleep behaviour disorder (iRBD) is considered to represent a prodromal state in developing clinical synucleinopathy (e. g. Parkinson's Disease). The two treatments of choice - clonazepam and melatonin - differ with respect to side effects and treatment response timing. Even though melatonin is considered to have considerably lower side effects, clonazepam is much more often used, most likely because of its very rapid acute effect. Effects of melatonin in RBD develop gradually over weeks, but persist even after treatment discontinuation. Here we report on a large group of iRBD patients treated with melatonin over varying times.

Methods: 100 consecutive iRBD patients (mean age at RBD-diagnosis: 69.37 ± 7.53; mean age at first RBD-symptoms: 64.04 ± 8.63; 82 males; diagnosed by three night video polysomnography) were treated with 2 mg slow-release melatonin. Patients were instructed to administer melatonin, A: 30 min prior to habitual bedtime, and B: always at the same clock-time ± 30 min. Melatonin treatment duration differed: Group 1 (*n* = 79): continuously ongoing; Group 2 (*n* = 21): stopped until six months after treatment initiation. Severity of RBD symptoms was repeatedly determined by two dimensions (RBD-rating scale; see presentation this conference): frequency (range 0–5), expression (range 0–4).

Results: 95/100 of iRBD patients reported an improvement of symptoms during melatonin treatment. All five non-responders were later determined non-compliant to instruction B. RBD-ratings of patients Group 1 improved from baseline 8.0 ± 1.10 to 4.31 ± 1.74 after four weeks, to 4.45 ± 1.37 after eight weeks, to 4.36 ± 2.61 after 12 months, to 3.77 ± 2.11 after 24 months and to 3.33 ± 2.11 after 36 months. RBD-ratings of patients Group 2 improved to 2.92 ± 2.19 5.01 years after discontinuation of melatonin.

Conclusions: To the best of our knowledge, this sample is the largest group of iRBD patients ever reported to be treated with melatonin. Our observations underline that melatonin is effective and safe in RBD. Effects develop gradually, remain stable during years of

treatment and outlast discontinuation after at least six months of treatment. The horizon for effective RBD treatment may be to prevent conversion to full blown synucleinopathy. Future follow-up of our patients will have to evaluate that aspect.

Disclosure: Nothing to disclose.

P734 | A simplified efficient scoring method to quantify REM sleep without atonia

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Objectives/Introduction: REM sleep without atonia (RSWA) is a hallmark of REM sleep behaviour disorder (RBD) and one of the required diagnostic criteria. Current methods to quantify RSWA may include the EMG of several muscles, as well as evaluation of phasic -, tonic -, and "any" muscle activity, are however laborious and time consuming. Our goal was to develop a scoring method to quantify RSWA (manually or automatically) in a simple, straightforward and time-efficient way, based on chin EMG only, that nevertheless provides a reliable estimate about the extent of muscle activation during REM sleep.

Methods: Our definition of muscle activation during REM sleep was adapted from the original description given by Lapierre and Montplaisir (1992), later adapted and validated by Consens et al (2005). We define muscle activation in a REM-episode as muscle activity longer than 1 s, with amplitude of more than 4 times the lowest background EMG activity of that REM-episode. Interruptions with less activity up to 1 s are included. Lowest background EMG activity is visually evaluated for each REM episode. The exact duration of the muscle activation is calculated, without dividing the EMG signal in mini epochs, and expressed as percentage of time spent in REM sleep. Muscle activity of 20 RBD patients was visually scored for RSWA and compared with 20 healthy controls and 20 PLMS patients matched for age and gender.

Results: With our scoring method, we could differentiate well between RBD and non-RBD subjects. Best Cut-off value showed high sensitivity (90.0%) and specificity (92.5%). ROC analysis demonstrated AUC values of 0.96 ($p < 0.05$). In the non-RBD groups, as expected, no significant differences could be demonstrated.

Conclusions: AUC values are in line with published results from the SINBAR group. The results indicate that our scoring method is a reliable and efficient tool for detecting RSWA in RBD patients. The method represents an attractive alternative to the laborious gold standard, especially in situations when RSWA needs to be repeatedly quantified, e.g. within the framework of a progressing neurodegeneration.

Disclosure: Nothing to disclose.

P735 | Sleep stage and time of occurrence of minor and major motor episodes differentiate disorders of arousal from Sleep-Related Hypermotor Epilepsy

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Objectives/Introduction: Differential diagnosis between Sleep-Related Hypermotor Epilepsy (SHE) and Disorder of Arousal (DOA) can be challenging. Generally DOA arise more frequently from deep NREM sleep, in the first third of the night while sleep-related seizures occur mostly during light NREM sleep anytime during the sleep period. However, systematic studies analyzing and comparing these aspects in parasomnic and epileptic patients are scanty and their results are discordant. Aim of this study is to evaluate the stage and the relative time of occurrence of minor and major DOA and epileptic events.

Methods: Video-polysomnography recordings of 89 patients with a definite diagnosis of DOA (59) or SHE (30) were retrospectively selected and reviewed by experts to define major or minor events. For every major or minor event, we analyzed the stage and the relative time of occurrence. The "event distribution index" was defined on the basis of the occurrence of the event during the first vs. the second part of sleep period time. A group analysis was performed between subjects with DOA or SHE in order to identify candidate predictors. The discriminative performance of each continuous discrete predictors was quantified (AUC or specificity/sensitivity).

Results: Significantly less total events were observed in patients with DOA (3.2 ± 2.4) than in patients with SHE (6.9 ± 8.3; $p = 0.03$). Episodes occurred mostly during N3 and N2 in DOA and SHE patients respectively. Indeed, the occurrence of at least one major event outside N3 was highly suggestive for SHE ($p = 2$*e-13; accuracy = 0.898, sensitivity = 0.793, specificity = 0.949). The occurrence of at least one minor event during N3 was highly suggestive for DOA ($p = 4$*e-5; accuracy = 0.73, sensitivity = 0.733, specificity = 0.723). The "event distribution index" was statistically higher in DOA for total events ($p = 0.012$) and for major events ($p = 0.0026$).

Conclusions: Our work confirms that the stage and the relative time of occurrence of minor and major complex motor manifestation during sleep represent a useful tool to discriminate DOA from SHE episodes.

Disclosure: Nothing to disclose.

P736 | REM sleep behavior disorder and other sleep disturbances in dementia with Lewy bodies

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Objectives/Introduction: Sleep disturbances may occur in patients with dementia with Lewy bodies (DLB), especially REM sleep behavior disorder (RBD). A correct identification of sleep disorders in DLB is important to increase diagnostic accuracy and implement appropriate treatment.

Methods: We evaluated the frequency and characteristics of RBD and other sleep disturbances in a series of consecutive patients with DLB through a clinical interview, validated sleep questionnaires and video-polysomnography (V-PSG).

Results: Thirty-five patients, 65.7% men, mean age 77.7 ± 6.1 years were included. Poor sleep quality (67.9%), snoring (60%) and abnormal movements/behaviors during sleep (60%) were the most common sleep-related complaints. V-PSG showed posterior background awake with EEG frequencies slower than 8 Hz in 11 patients (34.3%). Abnormal sleep architecture was found in 24 (75.0%) patients, including absence of sleep spindles or K complexes (12.9%), slow frequency spindles (25.8%) or posterior delta slowing in REM sleep (16.1%). Ten (31.2%) patients showed abnormal behaviors during arousals. Nineteen out of 35 (54.2%) patients had a suggestive history of RBD. In 26 in whom REM sleep was recorded, RBD was diagnosed in 13 (50.0%), 11 out of 15 with a suggestive clinical history (4 false positives) and 2 out of 11 with a negative history (two false negatives). Three of the four false positives had other sleep abnormalities causing behaviors mimicking RBD (obstructive sleep apnea in one, periodic leg movement disorder in one and complex visual and auditory hallucinations in one). Posterior background EEG frequency awake was negatively correlated with the percentage of "any" EMG activity during REM sleep in the mentalis ($p = 0.004$). Wake/sleep architecture abnormalities -other than lack of REM sleep atonia- were more frequent in patients with RBD ($p = 0.02$).

Conclusions: Wake/sleep abnormalities are common in DLB and impair wakefulness, NREM, REM sleep and arousals from sleep. This complexity hinders the correct identification of RBD, which occurs in half the patients. The correlation between posterior EEG background activity awake and abnormal EMG activity in REM sleep suggests that both findings have a subcortical origin.

Disclosure: Nothing to disclose.

P737 | Nightmares and stress: a longitudinal study

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Objectives/Introduction: In nightmare etiology, trait and state factors play important roles. However, the interaction of state and trait factors has never been studied in a longitudinal design.

Methods: The present sample included 406 pregnant women who were followed-up about six months after giving birth ($N = 375$) and four years later ($N = 302$). A nightmare frequency scale and several stress-related questionnaires were presented at the three measurement points.

Results: The nightmare frequencies decreased slightly over this time period ($p < 0.0001$ but were very stable (correlation: $r = 531$, $p < 0.0001$, $N = 279$). In line with previous findings, current stressors were associated with nightmare frequency in the cross-sectional analysis ($p < 0.0001$; $N = 394$ (t1) to $N = 294$ (t4)) but longitudinal analyses also indicated that previously measured nightmare frequency showed even stronger effects ($p < 0.0001$, $N = 267–339$).

Conclusions: Since the nightmare frequencies were very stable, it would be very desirable to carry out intervention studies treating nightmares as early as possible - even in childhood - and investigate how the nightmare frequencies are affected in the following years.

Disclosure: Nothing to disclose.

P738 | Do patients affected by isolated REM sleep behavior disorder present a specific brain [18F]FDG PET pattern?

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Objectives/Introduction: REM behavior disorders (RBD) is a sleep parasomnia, characterized by the pathological lack of atonia during REM sleep associated with enacting dreams. Several longitudinal studies revealed that patients affected by isolated RBD (iRBD) trend to convert to α-synucleinopathies at follow-up.

This study aimed at evaluating brain glucose metabolism, measured by [18F]FDG-PET, in patients affected by iRBD compared to Parkinson's Disease (PD), Lewy Body Dementia (LBD), Alzheimer's Disease (AD) and elderly controls (EC).

Methods: Differences in brain [18F]FDG uptake were analyzed using statistical parametric mapping (SPM8) implemented in Matlab

R2012b. The following voxel-based comparisons were performed using a 'two-sample t test' design model: iRBD vs. PD; iRBD vs. LBD; iRBD vs. AD; iRBD vs. EC.

Results: 54 iRBD, 28 PD, 10 LBD, 55 AD, and 35 EC were included in this study. iRBD patients showed brain glucose hypometabolism in the precuneus, middle temporal gyrus, parietal and occipital lobes compared to EC ($p < 0.05$). Considering the other comparisons, iRBD patients mainly showed: cerebral glucose hypometabolism in frontal areas compared to AD patients ($p < 0.05$); temporal glucose hypometabolism compared to LBD ($p < 0.05$); and frontal, cerebellar, and brainstem brain glucose hypometabolism compared to PD patients ($p < 0.05$).

Conclusions: This study documented the alteration of brain [18F] FDG uptake in iRBD patients, as expected in a preclinical neurodegenerative process. Moreover, iRBD patients showed a distinctive pattern of cerebral [18F]FDG uptake, which is different from AD, LBD or PD. These findings further support the hypothesis that iRBD may represent a preclinical stage of neurodegeneration in which biomarkers changes already occur.

Disclosure: Nothing to disclose.

MOVEMENT DISORDERS

P739 | REM sleep-related neck myoclonus, physiological phenomenon or parasomnia?

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Objectives/Instruction: Neck myoclonus during sleep (NM) is characterized by sudden flexion or version of the head that occurs typically during rapid eye movement (REM), with unknown etiopathogenic mechanisms. We report here a series of five non-medicated patients with a primary clinical complaint of abnormal motor behaviors during sleep potentially related to excessive NM. We also identified 25 other patients with incidental findings of excessive NM.

Methods: From 2014 à 2017, 30 unmedicated patients (20 males, median age 27 years range 16–51) with excessive NM (defined by a REM NM index above the 95th percentile of the normative values obtained in a previous study, i.e. 14.3/hr) took part of the study. We described the clinical and polysomnographic characteristics of these subjects and compared them to those of 30 healthy controls (17 males, 30 years range 20–30) and 23 patients with REM sleep Behaviour disorder - RBD (20 males, 69 range 44–80).

Results: The median NM index was 41.4/hr of REM sleep (from 20.3 to 134.5/hr), and 0.8/hr (from 0.0 to 23.8/hr) of non-REM sleep. Patients with clinical complaint of NM had a higher REM NM index than patients with incidental findings of NM (80.3/hr, range 56.9–134.5 vs. 39.0/hr, range 20.3–86.5). The test-retest variability of the REM NM index was low in 8 patients having at least two recordings (from 0.3 to 23.4%). Compared to controls, patients with NM displayed higher levels of subjective and objective sleepiness and REM sleep deregulation, without difference for phasic or tonic muscular activities during REM sleep. There was no difference for REM NM index in patients with RBD and controls.

Conclusions: Excessive NM is rarely associated with clinical complaints of nighttime movements and sleep fragmentation, and could be related to functional impairment. The absence of association between NM index and REM sleep without atonia indexes may suggest that NM results from a unique pathophysiological mechanism responsible for REM sleep deregulation, rather than a variant of RBD.

Disclosure: Nothing to disclose.

P740 | The Grand Total EEG score changes with the course of idiopathic REM sleep behavior disorder

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Objectives/Instruction: Idiopathic REM sleep behavior disorder (iRBD) is well known as a prodromal symptom of dementia with Lewy bodies (DLB). Recently, it was reported that the Grand Total EEG (GTE) score had a sensitivity of 79% and a specificity of 76% in differentiating patients with DLB from those with Alzheimer's disease (AD) when using cut-off score of 6.5 by H. Lee, et al (2015). There have been no studies that investigated how GTE score changed with the course of iRBD. We, therefore, studied the GTE scores of iRBD patients with long follow-up.

Methods: The study is retrospective assessment of daytime EEG of iRBD patients ($N = 17$) with follow-up durations of longer than 24 months (range 24–120 months) at one urban sleep center in Osaka, Japan from December 2006 to December 2016. GTE score was calculated according to the EEG assessments by G.Roks, et al (2008).

Results: The mean age of first visit to our hospital was 69.6 ± 6.1 years old, and estimated age of iRBD on set was 62.9 ± 6.4 years old. The mean duration of iRBD at first visit was 6.7 ± 6.8 years. Two (11.8%) out of 17 patients were female. The last GTE scores of 12 (70.6%) out of 17 patients were higher

than or equal to the first GTE scores (at first visit GTE: 4.0 ± 2.2, range 1–8, at last visit GTE score: 6.9 ± 2.2, range 3–10).

Conclusions: The GTE score tends to be higher as iRBD progresses. There is, however, great individual difference. Some patients showed no change in GTE scores despite long intervals, while others abrupt increase in their scores. Long term follow-up is warranted whether GTE score could be helpful to expect the future possibility to develop full-blown DLB.

Disclosure: Nothing to disclose.

P741 | Periodic limb movements during sleep in stroke/transient ischemic attack: prevalence, course and cardiovascular burden

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Objectives/Instruction: To define prevalence, time course and associated factors of periodic limb movements during sleep (PLMS) in patients with ischemic stroke or transient ischemic attack (TIA).

Methods: Patients enrolled in the prospective SAS-CARE study underwent a double polysomnographic investigation in the acute and chronic phases after stroke/TIA, together with a MRI brain scan and a 24-hr blood pressure evaluation. The prevalence of PLMS in patients was compared with that in a matched sample of randomly selected healthy controls from the HypnoLaus cohort. One-hundred-and-sixty-nine recordings were performed in the acute phase and 191 after 3 months (210 recordings were obtained from the same 105 patients in both phases), and were compared to those of 162 controls.

Results: The mean number of PLMS per hour, as well as the percentage of participants with a PLMS index >10 and >15/hr, were similar between patients and controls. PLMS remained stable from the acute to the chronic phase after stroke. Factors positively associated with PLMS were: age, BMI, history of hypertension. Blood pressure over 24 hr and the burden of cerebro-vascular damage was similar between the PLMS and non-PLMS groups.

Conclusions: PLMS are equally frequent in patients with stroke/TIA and the general population. The absence of higher blood pressure values and of a greater vascular brain damage found in patients with PLMS compared to non-PLMS patients might be due to a larger use of antihypertensive medication among patients with PLMS, which corresponds to a higher prevalence of previous diagnosis of hypertension in patients with PLMS.

Disclosure: Nothing to disclose.

P742 | Restless legs syndrome is associated with arterial stiffness and clinical outcomes in acute stroke patients

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Objectives/Instruction: Restless legs syndrome (RLS) has been associated with vascular diseases, including cardiovascular and cerebrovascular diseases. However, the exact relationship between those diseases and RLS has to be yet clarified. This study investigated the clinical significance of RLS and the factors related to this disorder in patients with acute ischemic stroke patients.

Methods: The presence of RLS was assessed based on the four essential criteria of the International Restless Legs Syndrome Study Group in 2003 in patients with acute ischemic stroke. Their clinical and laboratory characteristics, small vessel disease (SVD) burden on brain magnetic resonance imaging (MRI), and arterial stiffness, as determined by brachial arterial pulse wave velocity (baPWV), were recorded.

Results: Stroke severity using the National Institute of Health Stroke Scale (NIHSS) and the clinical outcomes using modified Raking Scale (mRS) were measured. Of 296 patients with acute ischemic stroke, 16 (5.4%) were diagnosed with RLS. All clinical and laboratory findings were not different between patients with and without RLS. Logistic regression analysis showed that a 1 m/s increase in baPWV was associated with the presence of RLS. The diagnosis of RLS was associated with poor clinical outcome, as were age and NIHSS at admission.

Conclusions: RLS is associated with baPWV and predicts poor clinical outcome in patients with acute ischemic stroke. Additional studies are needed to evaluate whether management of RLS improves outcomes in patients with ischemic stroke.

Disclosure: Nothing to disclose.

P743 | Correlations of use of antidepressants, hypnotics and anti-histaminics with occurrence of clinically significant periodic limb movement in polysomnographically assessed abnormal fatigue and insomnia

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Objectives/Instruction: Periodic Limb Movements during Sleep (PLMS) are characterized by rhythmic extensions of the big toe and dorsiflexions of the ankle with occasional flexions of the knee and hip. PLMS may lead to microarousals and sleep fragmentation and consequently to complaints including non-restorative sleep, fatigue and excessive daytime sleepiness. PLMS are commonly observed on polysomnography (PSG) in patients with restless legs syndrome (RLS) but also occur in subjects without RLS. In a recent review article, Kolla et al. (2018) suggest that some antidepressants may be associated with slightly higher rates of RLS and/or PLMS. The aim of the present study is to further investigate correlations between the use of antidepressants, hypnotics and anti-histaminics and PLMs.

Methods: A retrospective study was undertaken on patients referred to a tertiary care diagnostic center for abnormal fatigue or insomnia and assessed by PSG between January and December 2016. Demographics, objective sleep variables, use of medication, caffeine, alcohol and nicotine were registered. Descriptive statistics were computed and correlations were calculated using the method of Spearman.

Results: Out of 832 included subjects (mean age 41.6 years, SD 12.9, 70.6% female), 204 (24.5%) showed PLMS of clinical significance (defined as an arousal index of >30/hr in the absence of other significant primary sleep disorder). Within this group, PLMS were significantly correlated (p = 0.05) with selective serotonin reuptake inhibitors (SSRI; N = 107, r = 0.159), in particular escitalopram (N = 53, r = 0.147), serotonin-norepinephrine reuptake inhibitor (SNRI; N = 120, r = 0.083) and non-sedating antihistaminics (N = 66, r = 0.076). PLMS were not significantly correlated (p = 0.05) with hypnotics (benzodiazepines: N = 120, r = –0.069; Z-drugs: N = 37, r = –0.017), use of caffeine (r = 0.039), alcohol (r = 0.044) and nicotine (r = –0.001).

Conclusions: In the present study, the use of SSRIs, SNRIs and non-sedating anti-histaminics were significantly correlated with PLMS of clinical significance, as registered by PSG. Within the group of SSRIs, this was most evident for escitalopram. However, classically presumed risk factors such as alcohol, caffeine and nicotine use were not associated with an increased risk for PLMS.

Disclosure: Nothing to disclose.

P744 | 3D detection of leg movements associated with arousals

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Objectives/Introduction: Periodic leg movements during sleep (PLMS) are currently diagnosed based on electromyography (EMG) of the tibialis anterior muscles. We used automatic 3D video analysis to detect leg movements and compared the results to conventional polysomnographic recordings.

Methods: Using a novel 3D near-infrared sensor, our video analysis software measures the height profile of the body at high spatial and temporal resolution. Motor events are characterized by changes in this profile. Using a region of interest including the legs, the software assigns these events to the limbs and computes selected features in the spatial, temporal and frequency domain. Time synchronized video-PSG and 3D-video sleep data of 71 patients presenting with nocturnal leg movements were recorded in a multi-centric clinical study in Austria. Polysomnographic (PSG) recordings were annotated by visual inspection by two experienced somnologists using the WASM 2016 standards. Results were compared to leg movements automatically detected in 3D.

Results: 5,652 candidate leg movements (CLM) were detected by 3D, of which 1,988 (35.2%) were not detected by EMG. Of those not detected by EMG, 476 (23.9%) were associated with an arousal. 3,745 CLM were detected by both methods, with 888 (23.7%) being associated with an arousal. EMG detected 4133 CLM, of which 388 (9.38%) were not detected by 3D. 388 (17.8%) of those not detected by 3D were associated with arousals.

Conclusions: CLM derived from EMG can indicate either actual movements or muscle contractions without visible movements. On the other hand, movements not caused by the tibialis anterior muscles are missed in the standard PSG recordings but are clearly visible in 3D. Thus, 3D video somnography provides additional and more complete diagnostic data than conventional EMG in such cases. The fraction of movements initiated by tibialis and by other muscles varied substantially between patients. Therefore, CLM detection with tibialis anterior muscle EMG clearly depends on movement patterns. Intriguingly, CLM detected by 3D and EMG showed comparable rates of associated arousals. Moreover, the contactless approach of the 3D technology provides substantial advantages by avoiding electrode contact problems, enabling undisturbed sleep and facilitating the procedure of electrode handling.

Disclosure: This study was sponsored in parts by the Austrian Research Promotion Agency, FFG project no. 860159.

P745 | Soluble transferrin receptor blood test as a measure of iron status in the study of restless legs syndrome in blood donors

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Objectives/Introduction: Ferritin is the accepted measurement to study the iron status of patients with RLS. However, as an acute phase reactant is highly variable. Transferrin receptor maintains cellular iron homeostasis. Soluble Transferrin Receptor (sTfR) may be a better indicator of iron status. Our aim was to compare the sensitivity of serum ferritin and sTfR in the study of systemic iron status, in a population of blood donors, and the relationship between sTfR and the presence of RLS symptoms.

Methods: We recruited 129 participants (45.7% women, 54.3% men), mean age 43.8 years ± 10.9. Before blood donation, written inform consent was obtained. Serum ferritin levels and sTfRt were determined from blood tests. Four screening questions, based on International Restless Legs Syndrome Study Group (IRLSSG) diagnostic criteria, were used to asses RLS symptoms: (1) unpleasant sensations in the legs during rest; (2) an urge to move the legs; (3) worsening in the evening or night; (4) the unpleasant sensations prevent from sleeping. We define iron deficiency as ferritin <50 mcg/dl, or sTfR > 1.86.

Results: Ferritin mean value was 48.69 mcg/dl ± 44.32 among women, and 131.81 mcg/dl ± 97.99 among men, which was statistically significant ($p = 0.00$), whereas the mean sTfR value was 3.22 ± 1.01 among women, and 3.03 ± SD 0.89 among men, without statistical significance ($p = 0.22$). The 55.8% of the sample showed ferritin <50 mcg/dl, and 93% showed sTfR > 1.86, reflecting an iron deficiency. Twenty three participants (17.8%) out of 129, had at least one positive answer for the RLS screening questions [3 (1.7%) 1 positive answer, 8 (4.5%) 2 positive answers, 11 (6.2%) 3 positive answers, 1 (0.6%) 4 positive answers]. We did not find any relation between blood donation and RLS symptoms ($p = 0.5$), neither ferritin ($p = 0.6$) nor sTfR ($p = 0.4$) levels and RLS.

Conclusions:

1. Soluble Transferrin Receptor blood test was more sensitive than ferritin to detect iron deficiency in our sample.
2. sTfR measurements were not influenced by gender.
3. No significant association was found between blood donation and the presence of RLS symptoms, neither ferritin nor sTfR and RLS symptoms.

Disclosure: Nothing to disclose.

P746 | Comparing objective and subjective measurements of excessive daytime sleepiness in patients with significant periodic limb movements of sleep (PLMS)

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Objectives/Introduction: The purpose of this clinical series of 10 patients with hypersomnia is to assess the possible clinical association between the rate of periodic limb movements of sleep (PLMS) and the severity of daytime sleepiness.

Methods: In order to test this hypothesis, we compared objective sleepiness, assessed by the multiple sleep latency test (MSLT) and subjective sleep propensity by the Epworth sleepiness scale (ESS) in a clinical retrospective series of 10 patients with a significant PLMS index (>15 PLM/hr), comparing the group with higher PLM index (>25 PLM/hr) with the group with a lower one rate (15–25 PLM/h). The MSLT was preceded by a nocturnal polysomnography (PSG) with an apnea-hypopnea index (AHI) <5/hr in all cases (subjects with previous diagnose of obstructive sleep apnea syndrome (OSAS) used CPAP with their usual pressure). Parameters were obtained from a diagnostic nocturnal PSG-MSLT reports recorded in drug-free patients, documenting MSLT in minutes (min) and number of sleep onset REM periods (SOREMPs). We made the analyses through Sigma-plot 10.0 with Anova Test (parametric).

Results: Ages of the 10 subjects ranged from 42 to 71 years (56.4 ± 10), and 6 were male and 4 female. 8 subjects (80%) were previously diagnosed with OSAS with good adherence to treatment in absence of significant apneas (with CPAP), and 2 (20%) were previously diagnosed with intermittent restless legs syndrome (RLS) with symptoms controlled under treatment. Patients with the highest PLMS index (PLMS > 25/hr, $n = 4$, 40%) had a mean sleep latency of 2.98 min with a mean of 0.66 SOREMPs on MSLT, and a mean ESS score of 19, whereas those with lower PLMS index (PLMS 15–25/hr, $n = 6$, 60%) had a mean sleep latency of 4.57 min with 0.16 SOREMPs on MSLT, and a mean ESS score of 16.

Conclusions: In this study, we find a link between PLMS and increased subjective sleepiness by ESS ($p = 0.033$), but no for objective sleepiness by MSLT ($p = 0.375$). This data points to the importance of routine scoring and consideration of PLMS during the preceding nocturnal PSG, in the evaluation of MSLT results, in patients with otherwise unexplained excessive daytime sleepiness.

Disclosure: Nothing to disclose.

P747 | The role of vitamin D supplementation in Willis/Ekbom, Restless Leg Syndrome (WES/RLS). A new therapeutic option to improve symptoms and augmentation

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Objectives/Introduction: Vitamin D deficiency has been noticed to correlate with the occurrence and severity of RLS/WED both in children and in adults.

Methods: We enrolled all new adult RLS patients referred to our Sleep Centre in the last 3 years. All selected patients had a clinical evaluation including anthropometric values (Body mass index, BMI), iron and vitamin D assessment, RLS severity score, neuropsychological assessment, comorbidity, therapy, augmentation. Patients were all re-assessed after a 6 months interval for reassessment of symptoms and therapy.

Results: Twenty-six consecutive RLS patients (mean age 59.03 ± 8.6, range 45–79 years), (5M, 21 F), mean BMI 30.43 ± 5.3, mean IRLS-RS 19.6 ± 6.4, mean ESS 8.7 ± 5.2 were enrolled. Neuropsychological assessment showed mean scores on BDI and HAM-A compatible with mild depressive anxiety syndrome (mean BDI and HAM-A scores 16.3 and 21.9, respectively). PSQI showed a poor sleep quality (Mean score 10.1 ± 4.3). Comorbidities were: hypertension in 50%, diabetes in 19.2%, osteoporosis in 11.5%, sleep apnea in 53.8%, migraine in 11.5%, thyroid disease in 30.8%. At first visit, twelve patients were already on Dopa-agonists (four of which also on pregabalin). Mean vitamin D value was 26.3 ng/ml. Vitamin D supplementation were prescribed in all patients with insufficient values with improvement of RLS symptoms after 6 months of therapy (IRLS-RS score 6.7 ± 6.1, $p = 0.0002$). Augmentation was reported by eight patients with lower vitamin D values than patients without augmentation (16.04 ng/ml versus 24.8 ng/ml, with statistical significance $p = 0.001$). Augmentation symptoms improved after supplementation of vitamin D. No results were found for ESS, BDI and HAM-A scores. Multivariate regression analysis showed an inverse correlation between vitamin D and IRLS-RS score, BDI score and PSQI ($r = 0.8$, IC 5%).

Conclusions: Vitamin D deficit plays a role on the expression of symptoms severity in RLS; higher D3 values by adequate supplementation may improve symptoms and reduce augmentation.

Disclosure: Nothing to disclose.

P748 | Autonomic nervous system dysfunction during the suggested immobilization test in restless legs syndrome

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Objectives/Introduction: To investigate the relationships between cardiovascular autonomic function and sensory discomfort/periodic limb movements (PLM) through a continuous beat-to-beat blood pressure monitoring (CBPM) during the suggested immobilization test (SIT) in patients with restless legs syndrome (RLS).

Methods: Thirty-two patients with drug-free primary RLS (10 men, median age 62.0 years) and 17 controls (3 men, median age 60.4 years) underwent the one hour SIT during waketime, starting at 8:00 pm, with a concomitant CBPM (Nexfin™). All subjects reported the degree of sensory discomfort through a Visual Analogue Scale (VAS) administered every 10 min. PLM were recorded on surface limb electromyography. The presence of sensory symptoms during the SIT (S-SIT+) was defined by a score ≥4/10 at the VAS (last tertile of the distribution). A positive motor SIT (M-SIT+) was defined by PLM ≥15/hr (last tertile of the distribution). Mixed models regression were performed to study the evolution of CBPM measures. The *p*-value was set at $p < 0.05$.

Results: Seventeen patients (53.1%) had S-SIT+; none of the controls reported S-SIT+. Changes on systolic blood pressure (BP) were found in all groups ($p < 0.0001$); the S-SIT+ group had the higher systolic BP. No significant changes were found on diastolic blood pressure (DBP) ($p = 0.09$) and heart rate (HR) ($p = 0.78$), but interaction between groups and periods revealed that both DBP and HR were higher in patients with S-SIT+. Seventeen patients (53.1%) had M-SIT+, and all the controls M-SIT−. No between-group and along the SIT changes were found on DBP ($p = 0.08$) and HR ($p = 0.78$); SBP increased during the SIT ($p < 0.0001$), without any difference between groups. Combining sensory and motor SIT components, patients were classified in four groups: S-SIT−/M-SIT− ($n = 8$); S-SIT+/M-SIT− ($n = 7$); S-SIT−/M-SIT+ ($n = 7$); S-SIT+/M-SIT+ ($n = 10$). Both SBP and DBP increased in S-SIT+/M-SIT− group ($p < 0.0001$) and in S-SIT+/M-SIT+ group ($p = 0.0008$; $p = 0.01$). HR remained stable in all groups.

Conclusions: Patients with RLS presenting sensory discomfort during the SIT, with or without PLM, displayed a concomitant increasing of systolic and diastolic BP. These results highlighted the links between the sensory symptoms and the cardiovascular autonomic nervous system dysfunction during waketime in patients with RLS, suggesting an increased long-term risk of cardiovascular diseases.

Disclosure: Nothing to disclose.

P749 | Frequent association of central nervous system disorders in patients with periodic limb movements during rapid eye movement sleep

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Objectives/Introduction: Periodic limb movements (PLM) occur mostly during non-rapid eye movement sleep and rarely during rapid eye movement (REM) sleep. Few studies have shown that in patients with neurological disorders, namely REM sleep behaviour disorder (RBD), narcolepsy, Parkinson Disease and spinal cord injury, PLM may occur in REM sleep. Given the active inhibition of somatic motoneurons during REM, the appearance of PLM in REM sleep (PLM-REM) could indicate overt or subclinical injury of central nervous system (CNS) in this pathway. The aim of this work is to assess neurological comorbidities associated with PLM-REM.

Methods: Retrospective study, from a University-hospital neurological department. Inclusion criteria were: (1) age >=18 years; (2) PLM-REM >4 and PLM-REM index >=5/hr; (3) REM sleep time >=10 min and (4) clinical follow-up >=1 year. Demographic, clinical (including neurological comorbidities and concomitant medication use) and polysomnographic characteristics were analysed. Follow-up data on the *novo* neurological diagnosis was obtained from clinical files. Idiopathic PLM-REM was defined when PLM-REM index >=5/hr and there was no known neurological or iatrogenic association.

Results: 102 patients were included (64.7% males). Mean age was 58.2 ± 16.6 years. Twenty-five out of 102 patients had only PLM during REM sleep, 37 patients had PLM-REM more than twice than PLM in non-REM sleep. Most patients (82.3%) had PLM sleep index >=5/hr and only 8.8% patients had restless leg syndrome. The median PLM index was 15.1/hour in sleep and 16.1/hr during REM sleep. Comorbidities occurred in 59 patients [29.4% RBD, 4.9% narcolepsy, 41.2% CNS disorders (including 30.4% neurodegenerative disorders)]. Thirty-four patients were on antidepressants, neuroleptics and/or antiepileptic drugs. Thirty-two patients showed idiopathic PLM-REM. From the 43 patients without previous neurological disorders (including RBD) there were 3 patients (7.0%) with newly diagnosed CNS disorders (median follow-up period was 36 months).

Conclusions: This study confirms PLM-REM occurs more frequently in patients with other CNS disorders but may also be described as idiopathic. Despite the low frequency of de *novo* neurological diagnosis on follow-up, that may be chance related, our results raise the possibility that idiopathic PLM-REM may be a preclinical biomarker of CNS disorders. Further long term prospective and case-control studies are recommended to confirm these findings.

Disclosure: Nothing to disclose.

P750 | Restless leg syndrome effect on heart rate variability, is it real?

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Objectives/Introduction: There are conflicting data about the impact of restless leg syndrome on heart rate variability and autonomic function. Some studies suggested that RLS affects the HRV which may directly lead to the higher prevalence of cardiovascular disease. Other studies found that primary restless legs syndrome (RLS) was not associated with new-onset cardiovascular disease (CVD) or coronary artery disease (CAD). We aimed to assess the change of the HRV parameters in the patients who develop restless leg syndrome in 5 years follow up.

Methods: National sleep research resource database contains data of the sleep heart health study dataset. It contains the baseline measures including overnight polysomnography and follow up of the patients after 5 years. All the patients, who had two polysomnography, at the base line and on the follow up and developed the symptoms consistent with restless leg syndrome were included in the analysis. Patients were excluded if they already had RLS at the baseline or had any factor known to affect the HRV such as D.M, hypertension, myocardial infarction, drugs or sleep apnea. HRV analysis was done in patients who fulfilled the selection criteria.

Results: Of the 5804 subjects included in the study and after applying the exclusion criteria, we ended with 11 patients with newly developed RLS and age and gender 25 matched subjects who did not have RLS. No significant difference regarding the parameters of age, BMI and ESS. In the normal sujects group, there was no significant difference regarding the HRV parameters values except for the NNRR variable with *p*-value of 0.006. In the RLS group, a significant difference in the pNN20, 30, 40 with *p*-value less than 0.05 as well as a significant difference regarding the NNRR parameter of *p*-value of 0.026.

Conclusions: It can be concluded that RLS development may really affect the HRV. A study with larger number of patients is needed to confirm this finding.

Disclosure: Nothing to disclose.

P751 | On the restless legs syndrome and insomnia symptoms in Georgian pregnant women - preliminary findings

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Objectives/Introduction: Restless legs syndrome (RLS) is a common sleep disorder that increases in prevalence during pregnancy. It

is estimated to affect approximately 25% of all pregnancies with a peak in the third trimester. However, less attention has been focused on the RLS diagnostic testing or therapy in Georgia; accordingly, the relationship of RLS to history of pregnancy remains unexplored. The current study was aimed to identify RLS and insomnia symptoms in the Georgian pregnant women.

Methods: A total of 43 pregnant women (age range: 21–38, pregnancy: second and third trimester) selected from two Tbilisi ambulatory care centers participated in the study and answered four questions to detect RLS as proposed by the International Restless Legs Syndrome Study Group (IRLSSG). Subjects who answered positively the four questions were asked to complete two questionnaires: Sleep Impairment Index and Epworth Sleepiness Scale.

Results: A total of 9 subjects (20.9%) met the four criteria for RLS (33.3% with symptoms once/month, 22.2% with symptoms ≥3 times/month, 33.3% with symptoms ≥3 times/week, and 11.1% with symptoms once/year). Of these, 4 subjects (44.4%) were in the second trimester (age: 24–37) and 5 subjects (55.6%) were in the third trimester (age: 24–34). Family history was positive in 5 participants (55.6%). 4 subjects (44.4%) reported the onset of symptoms of RLS at the given pregnancy. 5 women (55.6%) had experienced symptoms of RLS more early than the onset of pregnancy; however, no one has been applied to doctor before to tell this problem. Of the 9 pregnant subjects having RLS, main insomnia symptoms were detected in 6 subjects (66.7%); of these, four women had sleep onset insomnia and two subjects had excessive daytime sleepiness.

Conclusions: Although the pathophysiology of RLS in pregnancy is still under investigation in the general population, the findings point out the relationship of RLS to sleep deterioration and history of pregnancy. The results show: (a) pregnancy affects the development of RLS and (b) sleep difficulties are common in pregnant women who experience the symptoms of RLS. It is needed to implement Clinical guidelines for the diagnosis and treatment of RLS in Georgian Healthcare Settings.

Disclosure: Nothing to disclose.

P752 | Head jerk during REM sleep: healthy motor event or movement disorder?

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Objectives/Introduction: Head jerks are defined by sudden movements of the head with the intense turning to one side. Although these head jerks are considered to affect the quality of sleep, previous studies showed that these phenomena were often recognized in healthy subjects. We investigated the head jerks in sleep disorders, and reevaluated the quality of sleep.

Methods: We obtained video-polysomnography (v-PSG) data from 185 patients with sleep disorders in our hospital from January 2016 to March 2018. REM sleep behavioral disorder and epilepsy were excluded from the study. They underwent PSG for consecutive two nights. The sleep stages were visually scored by 20-s epochs according to the criteria of Rechtschaffen and Kales, and the respiratory and motor events were scored according to AASM criteria. The movement-induced artifacts defined as head jerks were short-lived phenomena on PSG (EEG, EOG and chin-EMG) with the duration of 0.2 to 0.4 s. On video recordings, these head jerks exhibited a brief version of the head to one side or ventral flexion.

Results: Thirty-eight patients (20.5%) showed at least one head jerk during REM sleep. Eight patients (4.3%) showed head jerks during REM sleep in every four sleep cycles. They consisted of 5 women and 3 men aged from 15 to 33 years. We calculated total number of events of head jerk per hour of REM sleep as event index. Such event indices in eight patients were 3.8–50.2 (23.4 ± 14.4, mean ± SD). More than 50% of events were followed by arousals. Epileptic discharge related to head jerk was not recognized in all patients.

Conclusions: Frauscher et al. reported that neck myoclonus was observed in 35% of healthy subjects with variable frequency, suggesting that it constitutes physiologic phenomena. In our study, younger patients tended to show head jerks, which were accompanied by frequent arousals. These arousals induced the fragmentation of REM sleep, and are considered to be responsible for sleep impairment. An establishment of guideline will be necessary to evaluate this movement disorder like the treatment of periodic limb movement disorder.

Disclosure: Nothing to disclose.

P753 | Rocking bed therapy for sleep related rhythmic movement disorder: movement preference and acceptability in six children

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Objectives/Introduction: Sleep related rhythmic movement disorder (RMD) is characterized by episodes of rhythmic movement involving large muscle groups that occur related to sleep onset and during sleep. Clinical consequences include injury and impaired daytime functioning. Rhythmic sensory stimulation is known to be soothing. Furthermore, it might be able to substitute the sensory experience of RMD episodes. The Somnomat is an automated bed, designed to provide rocking movements in two directions with frequencies up to 2.0 Hz. We hypothesize that the bed movement

frequency preferred by subjects resembles their habitual movement frequency.

Methods: During an afternoon protocol, children with RMD (n = 6; 4 male) aged 5 to 14 years (M: 9.0y, SD: 4.1y) were presented with different movement frequencies up to 2.0 Hz. After the bed rocked for one minute, participants were asked to indicate if the bed should move faster or slower to promote sleep. Additionally, the level of comfort and sleepiness were assessed using a five-point visual rating scale. Habitual movement frequency was determined, for the five subjects with symptoms in the lab, as the average movement frequency of three RMD episodes scored manually based on video recorded.

Results: The average habitual movement frequency was 0.97 Hz (SD: 0.31 Hz). Three participants preferred stimulation at 0.25 Hz, which was slower than typical rhythmic movements. The other three participants chose frequencies within the range characteristic of rhythmic movement disorder (0.5, 1.0 and 2.0 Hz). Levels of comfort and sleepiness at the preferred frequency were 4.33 (SD: 0.82) and 4.00 (SD: 0.89) out of 5 respectively, with 5 indicating optimal comfort and maximal sleepiness. All participants indicated liking the movement and were willing to try out the bed overnight. Parents reported having no safety concerns.

Conclusions: Three participants chose faster movement frequencies resembling their habitual movements. The other three participants chose the slowest frequency provided, which in previous studies was reported to be most comfortable and sleep-inducing in healthy adults. As a next step, the effect of rocking bed therapy on symptoms will be determined by comparing a night without movement with a night where the bed moves using the subjects preferred frequency.

Disclosure: Nothing to disclose.

P754 | Multisensor data fusion algorithm for sleep quality estimation using multiple measurements

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Objectives/Introduction: Sleep monitoring represents an interest field in medical word. We spend a part of our life in bed, then an analyzing of our sleep represents a part of our medical consultation. Therefore, the supervision of the evolution of our sleep quality is primordial thing. A lot of systems have been implemented, tested and commercialized. Each system has a specified properties and characteristics. In our living lab, We study the correlation between the sleep quality and balance stability measured at wake up. In this study we use the withing system which is based on movement counted when the person was in the bed at night in order to measure sleep quality and for the balance stability is measured by scale which uses the movement counted when the person is on the scale. The balance stability is used to enhance the sleep quality score therefore the data fusion algorithms are tested on recorded database. The database is recorded by students in internship and phd students. In this work, the data base is described, the correlation study is presented and the fusion data algorithms are detailed. Estimation methods of the weight for each modality (scale and withing system) are prospected.

Methods: Scores fusion algorithm which represents a third layer of data fusion algorithm.

Results: The correlation between measurment of balance stability and sleep qulaity has been verified (98% of test step).

Conclusions: The multimodal fusion data algorithm is able to enhance the estimation of sleep quality.

Disclosure: Nothing to disclose.

P755 | A randomized controlled trial of botulinum toxin for treating sleep bruxism: a polysomnographic evaluation

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Objectives/Introduction: To investigate the effects of botulinum toxin type A (BoNT-A) injection on sleep bruxism(SB) episodes during sleep in SB patients who did not respond to oral splint treatment.

Methods: Twenty three subjects with a clinical diagnosis of SB completed this study. Twelve subjects received bilateral BoNT-A injections (25 U per muscle) into the masseter muscles (experimental group), and the other 11 received bilateral saline injections into the masseter muscles (control group). Videopolysomnographic (vPSG) recordings were made before, at 4 weeks and at 12 weeks after injection. SB episodes and Rhythmic masticatory muscle activity (RMMA) were scored and analyzed for several parameters (e.g., frequency of episodes, bursts per episode, episode duration). The peak amplitude of electromyographic (EMG) activity in the two muscles was also measured.

Results: In BoNT group, the injection reduced the frequency of SB episode, number of bursts, or duration for RMMA episodes. It differed significantly before and 4, 12 weeks after the injection ($p < 0.001$, repeated measure ANOVA). At 4 weeks after injection, the greatest changes occurred. However there was no significant differences between before and at any time period in saline injection group.

Conclusions: BoNT-A injection is an effective strategy for controlling SB for at 4 weeks and at 12 weeks after injection. It reduces the frequency of SB episode, number of bursts, or duration for RMMA episodes. Future investigations on the efficacy in larger samples over a longer follow-up period are needed.

Disclosure: Nothing to disclose.

P756 | Prevalence of restless legs syndrome (RLS) in the general population

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Objectives/Introduction: Estimated prevalence of RLS varies with the method applied. Our aim was to compare prevalence with ICSD-3 and IRLSSG criteria in the elderly adult general population.

Methods: We invited 1,200 subjects selected at random from the population in Nord-Trøndelag, Norway, participating in the large epidemiological HUNT-4 study. *N* = 232 subjects (152 women and 80 men) mean age 58.4 (range 22–89 years). Subjects completed the Cambridge-Hopkins questionnaire (CHq) and were later interviewed face-to-face by a medical doctor for the final RLS diagnosis.

Results: Thirty-two subjects (14%) were diagnosed with RLS with ICSD-3 criteria. Sixty-two subjects had RLS according to IRLSSG, 31 (13%) of whom had chronic and 31 (13%) had intermittent forms. With the two initial screening questions in CHq (leg symptoms relieved by movement), only one false negative subject was observed. However, the number of false positives (*n* = 85) was very high.

Conclusions: The prevalence of RLS depends critically on the criteria as the IRLSSG-based estimate was twice the ICSD- 3 estimate. Simple questions can be used as screening, because the number of false negatives was very low, but the number of false positives was very high. RLS-population prevalence estimated by one or two simple questions may accordingly not be valid.

Disclosure: Nothing to disclose.

P757 | Asymmetry of periodic leg movements in sleep (PLMS) in Parkinson's disease

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Objectives/Introduction: To study whether periodic limb movements in sleep (PLMS) appear asymmetric in Parkinson's disease (PD) compared to Restless-legs-Syndrome (RLS) and obstructive sleep apnoea (OSA) and whether asymmetry of PLMS corresponds to asymmetry of motor symptoms in PD. PLMS were first described in the 1960s by Lugaresi and colleagues. PLMS are repetitive movements occurring during sleep. The pathophysiology of PLMS is still unclear. PLMS are often associated with RLS but also occur in other conditions like sleep disordered breathing (e.g., OSA), spinal cord lesions and also PD. PLMS were already described as sometimes alternating between sides, but in PD, where asymmetry of motor symptoms as well as pathology is a hallmark, no detailed data exist on asymmetry of PLMS.

Methods: Cross-sectional, monocentric, retrospective analysis of polysomnography recordings using slightly modified American Academy of Sleep Medicine (AASM) criteria for PLMS. Exclusion criteria for control groups comprised all other general or neurological diseases that may cause periodic leg movements in sleep (e.g., spinal cord lesions).

Results: Until now, we included 29 patients with idiopathic PD (mean age 69.9 ± 6.9 years) and sex- and age-matched controls with OSA (*n* = 27, age 70.6 ± 6.6 years) and RLS (*n* = 11, age 67.9 ± 8.1 years; Kruskal-Wallis-test, $p = 0.600$). Of all patients we analyzed two or more PSG recordings. Overall PLM-Index (PLM-I) was significantly higher in OSA compared to PD (65.8 ± 61.8 vs. 15.7 ± 26.3; $p = 0.005$) and also RLS compared to PD (40.3 ± 33.1 vs. 15.7 ± 26.3; $p = 0.009$). PLMS were asymmetrical regardless disease entities or PAP treatment when we analyzed more affected vs. less affected side (PLMS-I: PD 9.4 ± 16.4 vs. 4.6 ± 10.7, $p = 0.001$; OSA 23.0 ± 23.3 vs. 15.1 ± 19.8; $p < 0.0001$; RLS 17.9 ± 13.8 vs. 9.5 ± 8.7, $p = 0.004$). We did not find any correlations between the asymmetry of PLMS with handedness or dominant side of PD motor symptoms.

Conclusions: Periodic leg movements in sleep (PLMS) show asymmetry in patients with PD, RLS and OSA. There is no association between the occurrence of asymmetric PLMS and the asymmetry of motor symptoms in PD. This seems to underline that motor symptoms of PD and PLMS have a different pathophysiological background. Further studies are needed to elucidate whether PLMS are asymmetrical in general.

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