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EVENING LIGHT-INDUCED CIRCADIAN PHASE SHIFT IN PRESCHOOL-AGED CHILDREN

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Introduction: In adults, exposure to light at night delays the timing of the circadian clock in a dose-dependent manner with intensity. Although children's melatonin levels are highly suppressed by evening bright light, the sensitivity of young children's circadian timing to evening light is unknown. This research aimed to establish an illuminance response curve for phase delay in preschool children as a result of exposure to varying light intensities in the hour before bedtime.

Methods: Healthy children (n=36, 3.0 – 4.9 years, 39% males), participated in a 10-day protocol. For 7 days, children followed a strict parent-selected sleep schedule. On Days 8-10, an in-home dim-light assessment was performed. On Day 8, dim light melatonin onset (DLMO) was measured through saliva samples collected in 20-30-min intervals throughout the evening until 1-h past habitual bedtime. On Day 9, children were exposed to a white light stimulus (semi-randomly assigned from 5lx to 5000lx) for 1-h before their habitual bedtime, and saliva was collected before, during, and after the exposure. On Day 10, children provided saliva samples in the evening for 2.5-h past bedtime for a final DLMO assessment. Phase angle of entrainment (habitual bedtime – DLMObaseline) and circadian phase delay (DLMOfinal – DLMObaseline) were computed.

Results: Final DLMO (Day 10) shifted between -8 and 123 minutes (M = 56.1 +/- 33.6 min; negative value = phase advance, positive value = phase delay) compared with DLMO at baseline (Day 8). Raw phase shift did not demonstrate a dose-dependent relationship with light intensity. Rather, we observed a robust phase delay across all intensities.

Conclusion: These data suggest preschoolers' circadian clocks are immensely sensitive to a large range of light intensities, which may be mechanistically influenced by less mature ophthalmologic features (e.g. clearer lenses, larger pupils). With young children's ever-growing use of light-emitting devices and evening exposure to artificial lighting, as well as the prevalence of behavioral sleep problems, these findings may inform recommendations for parents on the effects of evening light exposure on sleep timing in early childhood.

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THE CIRCADIAN VARIATION OF SLEEP IN POSTMENOPAUSAL WOMEN

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Introduction: During menopause, 40-60% of women report sleep complaints. Despite the fact that menopause is associated with fluctuations in sex hormones that can affect circadian physiology, the role of circadian factors in sleep disturbances after menopause is not well understood. The present study aims to understand the circadian variation of sleep occurring after menopause.

Methods: Eight healthy postmenopausal women (PMW; 54.8±3.4 years, one taking hormones) without sleep complaints were enrolled and compared to previously-collected data from 12 healthy young women (YW; 25.8±3.4 years) in mid-follicular phase. Following an 8-h baseline sleep period aligned to their habitual sleep times, participants underwent a 48-h (PMW) or 72-h (YW) ultradian sleep-wake cycle procedure (USW) with 60-min wake episodes alternating with 60-min nap opportunities. Sleep was recorded with polysomnography. Circadian parameters (amplitude, phase) of core body temperature (CBT) and sleep were assessed and compared using mixed-effects linear models on the first 48 hours of USW. Sleep parameters, including total sleep time (TST), arousals, sleep onset latency (SOL), stages N1, N2, N3, REM, and wake, were compared between groups during baseline and USW.

Results: PMW presented earlier habitual bedtimes (23:07±00:11 vs 00:13±00:12) and rise-times (07:07±00:11 vs 08:13±00:12) compared to YW ($p=0.005$). There were no differences in amplitude, phase, or phase angle of CBT. An advanced acrophase of REM sleep ($p=0.034$) and lower amplitudes of TST, arousals, SOL, N3, and wake, were observed in PMW vs YW ($p\leq0.05$). During baseline, PMW presented more stage N1 ($p=0.030$) and arousals ($p<0.001$) than YW. During USW, group effects were observed, with more stage N1 ($p=0.007$) and N2 ($p=0.0007$) in PMW vs YW. Significant interactions showed greater TST ($p=0.009$), shorter SOL ($p=0.001$), and more arousals ($p=0.027$) in PMW during the habitual day.

Conclusion: The primary finding in this small group of PMW with no sleep complaints was a general increase in light sleep and arousals across circadian phases. No differences in CBT rhythms were observed, whereas small differences in the circadian variation of TST, N3, and REM sleep were observed. Further studies are needed to clarify the role of circadian processes on sleep in PMW.

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THE ASSOCIATION BETWEEN SLEEP SPINDLES AND COGNITIVE FUNCTION IN MIDDLE-AGED AND OLDER MEN: A POPULATION-BASED COHORT STUDY

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Introduction: Sleep spindles are thought to play an important role in learning and memory. The association between sleep spindles and cognitive function and the potential confounding influence of obstructive sleep apnea (OSA) is uncertain. We examined the cross-sectional association between sleep spindles and cognitive function controlled for OSA in a sample of community dwelling middle-aged and older men.

Methods: Participants of the Florey Adelaide Male Ageing Study (n=477) underwent home-based polysomnography. These participants also completed the inspection time (IT) task, trail-making test part A (TMT-A) and part B (TMT-B), and Fuld object memory evaluation (FOME) test. Spindle metrics derived from sleep electroencephalography (n=356) included occurrence (total number) and fast (13-16 Hz) and slow (11-13 Hz) spindle density (number/minute) during N2 and N3 sleep. Linear regression models were adjusted for age, OSA, education, obesity, cardiovascular disease, diabetes, smoking, and alcohol risk.

Results: In covariate unadjusted analyses, higher spindle occurrence during N2 sleep was associated with better IT, TMT-A, TMT-B, and

FOME performance (all p<0.05). Spindle density (fast and slow) during N2 and N3 sleep (slow spindles only) was associated with better inspection time, TMT-A, and TMT-B performance (all p<0.05). Fast spindle density during N2 sleep was also associated with better FOME performance (B=1.03, 95% CI [0.47, 1.59], p<0.05). In covariate adjusted analyses, higher spindle occurrence during N2 sleep was independently associated with better IT (B=-0.002, 95% CI [-0.004, 0.000], p=0.046), while fast spindle density during N3 sleep was independently associated with worse TMT-B performance (B=0.12, 95% CI [0.03, 0.21], p=0.011).

Conclusion: Specific sleep spindle metrics during N2 and N3 sleep were independently associated with better visual processing speed and worse executive attention, suggesting a differential association between cognitive function and spindles during N2 and N3 sleep. The utility of sleep spindles for predicting cognitive impairment needs investigation in prospective studies.

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THE ROLE OF EDUCATION ON THE ASSOCIATION BETWEEN OSA AND COGNITIVE FUNCTIONS IN MIDDLE-AGE AND OLDER ADULTS

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Introduction: A weak relation between an increase in education and improved health knowledge was observed among those who attended college, but not among those whose highest educational level attainment was high school (Altindag, Cannonier, & Mocan, 2014). Alachantis and colleagues (2005) had applied cognitive reserve theory (Stern, 2002) to help explain why OSA patients with higher intelligence scores perform well on cognitive tasks. The resource substitution theory (RST; Ross & Mirowsky, 2006) posits that higher education compensates for background disadvantages rather than magnifying background advantages. The goals of the current study were to examine the interaction between educational level and obstructive sleep apnea (OSA) on cognitive functions such as verbal fluency, psychomotor vigilance, executive functions, visuospatial ability, and attention span and to determine whether the results would support the RST.

Methods: One hundred and nine participants (47 ApneaLinkTM -screened controls and 62 untreated OSA patients) participated in the study and completed the Wisconsin Card Sorting Test, WAIS-III digit span and block design, semantic and phonemic fluency tests, and a psychomotor vigilance task. Subjective sleep (PSQI and ESS) and health measures (depression, anxiety, mood disturbance, diabetes, hypertension) were assessed. A hierarchical regression was conducted to test for the additional variance explained by the interaction term even after accounting for the covariates.

Results: In semantic fluency and visuospatial ability tasks, patients with higher education performed better than patients with high school or less education. This moderation effect of education was not observed for the control group. A significant interaction effect was not observed for vigilance, phonemic fluency, attention span, or executive functions although education was a significant predictor for all cognitive tasks.

Conclusion: The resource substitution theory was supported as the benefit of education seemed more crucial for OSA patients than for controls, specifically in semantic fluency and visuospatial ability. This benefit of higher education contributing to larger cognitive reserves in patients with OSA helped buffer some cognitive deficits but not for others, but this buffer no longer works when the cognitive demand gets larger.

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UNDERLYING FACTORS CONTRIBUTING TO SLEEP HEALTH AMONG MIDDLE-AGED AND OLDER ADULTS

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Introduction: Although poor sleep is not inherent with aging, an estimated 50-70 million adults in the US have insufficient sleep. Sleep duration is increasingly recognized as incomplete and insufficient. Instead, sleep health (SH), a multidimensional concept describing sleep/wake patterns that promote well-being has been shown to better reflect how sleep impacts the individual. Therefore, focusing on the underlying factors contributing to sleep health may provide the opportunity to develop interventions to improve sleep health in middle-age and older adults.

Methods: Data from the 2014 wave of the Health and Retirement Study (HRS) were used. Sample size was restricted to those who completed an additional questionnaire containing sleep variables. A derivation of the SH composite was constructed using eight selected sleep variables from the HRS data based on the five dimensions of sleep: Satisfaction, Alertness, Timing, Efficiency, and Duration. Total score ranged from 0-100, with higher scores indicating better SH. Weighting variables were based on complex sampling procedures and provided by HRS. Machine learning-based framework was used to identify determinants for predicting SH using twenty-six variables representing individual health and socio-demographics. Penalized linear regression with elastic net penalty was used to study the impact of individual predictors on SH.

Results: Our sample included 5,163 adults with a mean age of 67.8 years (SD=9.9; range 50-98 years). The majority were female (59%), white (78%), and married (61%). SH score ranged from 27-61 (mean=50; SD=6.7). Loneliness (coefficient=-1.92), depressive symptoms (coefficient=-1.28), and physical activity (coefficient=1.31) were identified as the strongest predictors of SH. Self-reported health status (coefficient=-1.11), daily pain (coefficient=-0.65), being middle-aged (coefficient=-0.26), and discrimination (coefficient=-0.23) were also significant predictors in this model.

Conclusion: Our study identified key predictors of SH among middle-aged and older adults using a novel approach of Machine Learning. Improving SH is a concrete target for health promotion through clinical interventions tailored towards increasing physical activity and reducing loneliness and depressive symptoms among middle-aged adults.

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SLEEP, EMOTION, AND PHYSICAL ACTIVITY IN OLDER ADULTS WHO ENGAGE IN RESONANT BREATHING BIOFEEDBACK

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