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Sleep DownUnder 2017
29th ASM of Australasian Sleep Association and the Australasian Sleep Technologists Association
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Oral Abstracts

001

OBJECTIVE BUT NOT SUBJECTIVE SHORT SLEEP DURATION ASSOCIATED WITH INCREASED RISK FOR HYPERTENSION IN INDIVIDUALS WITH OBSTRUCTIVE SLEEP APNEA

R. REN
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Introduction: Short sleep duration and obstructive sleep apnea (OSA) are both associated with an increased risk of hypertension. We aimed to explore whether sleep duration modifies the relationship between OSA and prevalent hypertension, using both objective and subjective measures of total sleep duration.

Methods: A total of 7107 OSA patients and 1118 primary snorers were included in the study. Hypertension was defined based either on direct blood pressure measures or on diagnosis by a physician. Objective sleep duration was detected by polysomnography and subjective sleep duration was detected by questionnaires. Logistic regressions assessed the odds ratios of hypertension among persons with short sleep duration 6-7, 5-6 and < 5 h compared to persons with persons with a sleep duration > 7 h, measured both objectively and subjectively. The odds ratios of hypertension of OSA in different objective sleep duration stratums was assessed by logistic regressions.

Results: OSA combined with objective sleep duration of 5-6 h increased the odds of hypertension by 44% (odds ratio = 1.44, 95% confidence interval=1.14-1.83), whereas OSA combined with objective sleep duration<5 h further increased the odds of hypertension by 76% (odds ratio=1.76, 95% confidence interval =1.31-2.36) compared to individuals with primary snoring. Increased risk for hypertension was independent of major confounding factors frequently associated with OSA or hypertension. Furthermore, OSA was even not associated with hypertension in the extremely short sleep stratum (< 5 h) (odds ratio=1.16, 95% confidence interval=0.67-2.01) compared to those with OSA. However, no significant risk was observed using subjectively determined total sleep duration groups.

Conclusion: Both OSA and hypertension are age-related illnesses. It is important to note that the average age of patients in our study was approximately 10 years younger compared to most of similar observational studies in Caucasian patients. Through this large cross-sectional study, we obtained that short sleep duration is associated with an increased prevalence of hypertension in patients with OSA.

002

A LONGITUDINAL STUDY OF SLEEP-DISORDERED BREATHING FROM 3-YEARS TO DIRECT ACADEMIC PERFORMANCE ASSESSMENTS AT 8-YEARS

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University Of Otago

Introduction: The association between sleep-disordered breathing (SDB) and poorer academic development is an under-studied area of research and little is known about the potential long-term relationship, especially within context of the New Zealand education system. A longitudinal sleep study in our Dunedin community followed children's academic performance from age 3 through to age 8. The study aimed to investigate if children's early SDB status could predict later academic outcomes. A further aim was to see whether an improvement in SDB status across the early childhood years coincided with an improvement in later academic performance in school-aged children.

Methods: All children were assigned a SDB score at each age of assessment (3, 4, 6, 8 years) comprising of a parent reported history of symptoms score and a clinical examination of SDB correlates score (maximum score of 86). The study design included 80 control children without SDB (SDB score <12) and 77 cases (>25). Academic skills were measured in early literacy in the domains of oral reading and listening skills, alongside early numeracy skills. These data were collected using one-to-one assessments from well-established measures and experimental procedures. Statistical analyses involved ordinary least squares regression adjusted for potential demographic covariates.

Results: Thirty-five (49%) cases improved their SDB status (predetermined criteria) from ages 3-8. A child's SDB status at age 3 predicted his/her academic outcomes at age 8 for oral reading skills in words correct, number of total words, and sequence, in listening skills sequence and total listening skills, and in numeracy skills of word problems (all $p < 0.05$). The academic performance (oral reading and lower order numeracy skills) of children at age 8 whose SDB improved from ages 3 – 8, did not differ significantly from the performance of control children who entered the study at age 3 (i.e. without SDB).

Discussion: The findings suggest SDB in pre-school children predicts poorer academic performance at later school age. Regardless of whether SDB improves or not, a long-lasting effect of SDB in relation to poorer listening skills and high-order numeracy skills is indicated, but a good outcome in respect of 'catch up' growth in oral reading skills, suggesting early treatment may benefit academic outcomes.

003

ACCELEROMETRY-DERIVED SLEEP-WAKE TIMING IS ASSOCIATED WITH DIET AND PHYSICAL ACTIVITY IN CHILDREN: THE PEDALS STUDY

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Introduction: A strong, consistent relationship between shortened sleep duration and obesity is apparent in children, although the mechanisms remain unclear. Recently, it has been suggested that

sleep timing behaviour may also be an important predictor of health, independent of total sleep duration. However, limited research exists in this area. The aim of this study was to examine the associations between accelerometry-measured sleep timing behaviour with both diet and physical activity levels in school-aged children.

Methods: This was a cross-sectional study of 9-11 year old children. Sleep and physical activity data were collected using wrist-worn accelerometers for seven days, and food choice using a short food-frequency questionnaire. Participants were classified into one of four sleep timing behaviour categories using the median split for sleep onset (9.37 pm) and sleep offset (6.51am) times. Principal components analysis was used to derive dietary patterns. Differences between sleep timing behaviour categories for weekly consumption frequency of selected food groups, dietary pattern scores and minutes of moderate-to-vigorous physical activity were examined in 439 participants using generalised estimating equations.

Results: Participants slept for an average of 8.6 (SD 0.7) hours per night. Those in the late sleep/late wake category had a lower 'Fruit and Vegetables' pattern score (−0.06 vs 0.19; p = 0.015), a lower consumption frequency of fruit and vegetables (16 vs 19 weekly serves; p = 0.005) and a higher consumption frequency of sweetened beverages (7 vs 5; p = 0.027) than those in the early sleep/early wake category, as well as a higher consumption frequency of sweetened beverages to those in the early sleep/late wake category (7 vs 3; p = 0.005). Additionally, those in the late sleep/early wake category had a lower 'Fruit and Vegetables' pattern score (−0.10 vs 0.19; p = 0.010) than those in the early sleep/early wake category. Those in the late sleep/late wake category accumulated fewer minutes of moderate-to-vigorous physical activity per day compared to those in the early sleep/early wake (70 vs 81; p = 0.002) and late sleep/early wake (70 vs 79; p = 0.016) categories.

Discussion: In conclusion, sleep timing, even after controlling for sleep duration, was associated with both food consumption and physical activity, suggesting that sleep timing is an important factor to consider in addition to total sleep duration for good health.

004

THE IMPACT OF A MEAL, SNACK, OR NOT EATING DURING THE NIGHTSHIFT ON DRIVING PERFORMANCE

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Introduction: We have previously found that eating a large meal during a simulated nightshift significantly impairs driving performance, compared to not eating. It is unknown whether the size of the meal eaten during the night differentially impacts this post-prandial effect on performance. This study investigates the effects of eating a meal, a snack and not eating during a simulated nightshift on driving performance, attention and subjective sleepiness.

Method: 22 healthy non-shiftworking males (n = 13) and females (n = 9) aged 18-39 years participated in a 7-day laboratory study and underwent four simulated nightshifts. Participants were randomly allocated to one of three conditions: meal at night (n = 7; males: females, 4:3), snack at night (n = 7; 4:3) or no eating at night (n = 8; 5:3). During the nightshift at 0030 h, participants either ate a large meal comprising 30% of 24 h energy intake (meal at night condition), a snack comprising 10% of 24 h energy intake (snack at night condition), or did not eat during the nightshift (no eating at night condition). Total 24 h energy intake was constant across conditions. At 2000 h, 2230 h, 0130 h and 0400 h, participants performed a 40-minute driving simulation on the York driving simulator, a 10-minute Psychomotor Vigilance Task and recorded their subjective ratings of sleepiness.

Results: Mixed model analyses were conducted to test for effects of eating condition, drive time and nightshift. A significant three-way interaction was found, such that, at 0400 h across nightshifts, those in the snack at night condition displayed significant increases in time spent driving in the safe zone ($p < 0.05$; percentage of time spent within 10 km/h of the speed limit and 0.8 metres of the centre of the lane), and significant decreases in speed variability ($p < 0.01$), lane variability ($p < 0.05$), lapses ($p < 0.01$; lapse defined as reaction time>355 ms) and subjective sleepiness ($p < 0.01$), compared to the meal at night condition. No significant differences were found between the snack at night and no eating at night conditions.

Discussion: Eating a small snack during a nightshift appears to protect against the negative effects of eating a large meal. For optimal performance, shiftworkers may want to consider the size of the meal they eat at night. This study was conducted in healthy young participants and the impact of eating a large meal at night may be worse in clinical populations, such as those with sleep disorders.

005

THE INFLUENCE OF SPLIT SLEEP-WAKE SCHEDULES AND DAYTIME SLEEP STRATEGIES ON NEUROBEHAVIOURAL PERFORMANCE

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Introduction: Consumer demands for 24-h services have led to an increase in employees engaged in shiftwork. However, since these schedules often restrict sleep to biologically inopportune times, the risk of fatigue-related accidents is a significant concern. As such, two studies were conducted to evaluate alternative sleep-scheduling options that might optimise performance in situations where long nocturnal sleep episodes are not feasible.

Methods: Study 1 considered the effectiveness of short sleep-wake cycles at sustaining performance around the clock. Twenty-nine males participated in a 13-day, 28 h forced desynchrony (FD) protocol in one of two conditions. All obtained the same total time in bed, allocated as one 9.3 h episode per 28 h in the "standard sleep" condition or 4.7 h per 14 h in the "split sleep" condition. Circadian time was estimated from body temperature. Study 2 assessed different daytime sleep strategies between two simulated 12-h night shifts. Twelve males each participated in three conditions, which differed only in the timing of sleep. The strategies included an immediate sleep, a delayed sleep, and two short sleeps. Performance in both studies was assessed regularly in terms of lapses on the PVT.

Results: For the first study, mixed-models ANOVAs revealed no overall difference between consolidated and split schedules [$F(1,30) = 2.20$, $p > .05$]. However, there was a significant interaction between schedules and circadian phase such that fewer response lapses

occurred at night in the split schedule than the consolidated schedule [F(5,795)=3.8, p > .05]. For Study 2, repeated measures ANOVA showed no differences between the three sleep strategies in night-time mean lapse count [F(2,183)=0.79, p > .05].

Discussion: The results from both studies indicate that splitting sleep episodes is not inherently harmful to performance provided the total duration is sufficient. Study 1 suggests split work-rest schedules may be preferable to traditional night shifts for sustaining performance in some industries. Study 2 suggests the timing and arrangement of daytime sleep between long 12 h nights shifts is not critical for nocturnal function.

006

EFFECTS OF 40 MG OF MORPHINE ON PHENOTYPIC CAUSES OF OBSTRUCTIVE SLEEP APNEA

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Introduction: Opioids use is common for pain management. Accidental deaths have increased in recent years. Deaths nearly always occur during sleep. Thus, people with sleep apnoea may be at greater risk. There are 4 key causes of obstructive sleep apnea (OSA). A collapsible upper airway, poor pharyngeal muscle responsiveness asleep, a low respiratory arousal threshold and unstable ventilatory control (high loop gain). Major concerns are that morphine worsens OSA severity via respiratory depression and central reductions in neural drive to the pharyngeal muscles. However, the effects of morphine on key phenotypic causes of OSA have not been investigated. Thus, given the increasing rates of use and potential for harm, this study aimed to evaluate the effects of morphine on the 4 key causes of OSA.

Materials and Methods: 21 men with OSA (AHI range=7-67 events/h sleep), were studied on 2 separate nights (1 week wash-out) according to a randomised, double-blind, cross-over design in which patients received 40 mg of MS Contin on one visit and placebo on the other. Brief reductions in CPAP were delivered to induce airflow limitation during non-REM sleep to quantify the 4 traits that cause OSA (i.e. upper airway collapsibility [Pcrit], genioglossus muscle responsiveness [MR], respiratory arousal threshold [AT] and loop gain [LG]) at each visit. Additionally, CO_2 was administered via nasal mask to quantify hypercapnic ventilatory responses during stable non-REM sleep.

Results: Compared to placebo, 40 mg of morphine did not change Pcrit (-0.1 ± 2.4 vs. -0.4 ± 2.2 cmH_2O, $p = 0.58$), genioglossus responsiveness (-2.2 [-5.4 to -0.87] vs. -1.2 [-3.5 to -0.3] microV/cmH_2O epiglottic pressure, $p = 0.22$), or arousal threshold (-16.7 ± 6.8 vs. -15.4 ± 6.0 cmH_2O, $p = 0.41$), but did reduce loop gain (-10.1 ± 2.6 vs. -4.4 ± 2.1 dimensionless, $p = 0.04$). Morphine also reduced ventilatory and genioglossus responses to CO_2.

Conclusions: Concordant with recent clinical findings, 40 mg of morphine does not change Pcrit, MR, or AT in patients with moderately severe OSA. However, in line with blunted chemosensitivity, 40 mg of MS Contin does reduce LG and hypercapnic ventilatory responses. These paradoxical effects may reduce unstable respiratory control in patients with high LG but could decrease breathing and worsen blood gas disturbances in others. Identification of at risk of harm patient's characteristics with opioids remains a priority.

007

PRODROMAL OBESITY HYPOVENTILATION SYNDROME - EARLY DETECTION OF HYPOVENTILATION IN THE VERY OBESE POPULATION

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Introduction: Prodromal obesity hypoventilation syndrome (pOHS) refers to the presence of nocturnal hypoventilation (NH) without awake hypercapnia. This study evaluates the characteristics and prevalence of prodromal OHS in the very obese population and further investigates simple measures to detect hypoventilation prior to the development of awake hypercapnia.

Methods: 89 consecutive patients with a BMI >40 kg/m^2 without known lung (spirometric ratio >0.7) or neuromuscular disease were recruited from local sleep and obesity clinics. Anthropometrics, spirometry, daytime pulse oximetry, supine and upright arterialised capillary blood gases (cABG) and slow vital capacity obtained in random order, as well as in-lab polysomnography and nocturnal transcutaneous carbon dioxide monitoring (TcCO2) were performed on all patients. NH was defined by a rise in TcCO2 levels by 10 mmHg or a TcCO2 > 55 mmHg for > 10 minutes during the sleep study.

Results: Twenty-one patients (24%) were diagnosed with pOHS, 54 patients (61%) with obstructive sleep apnoea (OSA) without hypoventilation, 2 patients (<1%) without sleep disordered breathing and 12 patients (13%) with OHS. In this cohort, no patient had hypoventilation without concurrent obstructive events. The mean BMI, age and gender (%male) of the overall cohort were 54 (range 40-90 kg/m^2), 49 (range: 26-75 years) and 37% respectively. Compared with OSA, patients with hypoventilation (OHS + pOHS) demonstrated significant differences in daytime pulse oximetry (SpO2), slow and forced vital capacities, waist, hip, neck, abdominal sagittal height and body mass index (BMI). The pOHS group however only showed significant differences in neck (pOHS 51 v OSA 47 cm; $p = 0.01$), sagittal height (31 v 28 cm; $p = 0.01$), BMI (57 v 51 kg/m^2; $p = 0.008$) and SpO2 (94 v 96%, $p = 0.007$), compared with OSA. Combining SpO2 and BMI yielded an area under the ROC curve of 0.8. Only patients with hypoventilation, including the pOHS group, showed a rise in cABG carbon dioxide levels (PaCO2) in a supine v upright position (pOHS 44 v 41 mmHg; $p < 0.001$).

Discussion: Prodromal OHS can be recognised early with simple measures in an outpatient setting particularly with BMI and SpO2. A higher supine versus upright PaCO2 is also helpful. Further longitudinal studies in the pOHS cohort and subsequent awake hypercapnia, are needed.

008

AUTOMATIC POSITIVE AIRWAY PRESSURE (APAP) MAY REDUCE WAIT TIMES FOR TREATMENT OF OSA IN PAEDIATRIC PRACTICE

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Introduction: Obstructive sleep apnoea (OSA) in children is associated adverse health outcomes including deficits in cognition, behaviour, growth and cardiovascular function. The most common

cause of OSA in children is adenotonsillar hypertrophy and surgery is 1st line treatment. However, residual OSA is often present despite adenotonsillectomy, particularly in those with comorbid conditions such as obesity or congenital syndromes. For these children CPAP (continuous positive airway pressure) is often utilised. Automatic positive airway pressure (APAP) devices deliver varying pressures according to a patient's needs. Adult studies show equivalence of APAP to CPAP for OSA treatment but also suggest additional benefits such as enabling earlier treatment and improved adherence. Paediatric sleep resources are limited, with significant wait time to access specialist services and initiate definitive treatment. More evidence around the efficacy of APAP in children is needed in order to develop alternative models of care that may facilitate earlier access to treatment for patients.

Methods: A retrospective review of all patients from our centre in whom APAP was used to initiate therapy in our lab was undertaken. Data was collected over a 2-year period.

Results: There were 37 patients (4-17 yrs) in whom APAP was used for titration (14 Female; 23 Males). Patients waited an average of 9.6 weeks from diagnostic study to in-lab titration (0-35.6 weeks). Average OAHI reduced from 31/hr (0.3-126.1 hr) to OAHI 1.36/hr (0-6-6.7) in patients who tolerated therapy (n = 30). Mean maximum TcCO2 reduced from 52.2 mmHg to 48.7 mmHg with APAP. Three patients failed trial due to intolerance of mask; two were never established on CPAP/APAP and one required alternative management for catathrenia. Two patients changed to VPAP due to complex OSA. A further 2 patients required manual titration but both failed to use CPAP/APAP at home.

Discussion: APAP showed a significant improvement in OAHI in all patients who tolerated therapy (81%). With appropriate family education, initiating APAP at home while awaiting a titration study could be a feasible model of care for treatment of OSA with the benefit of treating patients earlier. This approach may also have a cost benefit by leading to fewer lab studies and shorter inpatient stays to initiate treatment.

009

MANDIBULAR ADVANCEMENT APPLIANCES EFFICACY ON SLEEP DISORDERED BREATHING IN CHILDREN: A RANDOMISED CONTROLLED TRIAL

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Aim: The objective of this study was to test the efficacy of mandibular advancement appliances (MAS) for the management of Sleep-Disordered Breathing (SDB) and associated symptoms in children.

Methods: The study was carried out as a single-blind crossover randomised controlled trial (RCT) with administration of both an Active and a Sham MAS. Eighteen children were recruited in the trial and randomly assigned to a treatment sequence, starting with either the Active or the Sham MAS. Participants wore the appliances for three weeks, separated by a two-week washout period. For each participant, home-based polysomnographic data were collected four times before and after each treatment period. The apnoea hypopnea index (AHI) and snoring frequency (snoring time and number of snoring episodes) were assessed as the main outcome variables.

Results: Compared to a Sham MAS, wearing an Active MAS resulted in a significant reduced AHI ($p = 0.002$). The separate assessment of AHI in supine and non-supine sleeping positions revealed that only the former was significantly influenced by treatment, with a reduction of 4.1 events per hour (95% CI = 1.8-6.4; $p < 0.001$). Snoring time was 46.3 minutes shorter with the Twin-Block than with the Sham appliance (95% CI = 14.5-78.1; $p = 0.004$).

Conclusion: Within the limitations of this study, it can be concluded that wearing a mandibular advancement splint over a short period can be beneficial for children affected by SDB.

010

OBSTRUCTIVE SLEEP APNOEA SEVERITY IN CHILDREN IS ASSOCIATED WITH INCREASED CENTRAL AORTIC SYSTOLIC BLOOD PRESSURE

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Background: We have shown that obese children with obstructive sleep apnoea (OSA) do not have elevated peripheral blood pressure (BP) compared with non-obese children with OSA. However, central aortic pressure is a better predictor of cardiovascular outcome compared with peripheral BP. Applanation tonometry (AT) of the radial artery provides a non-invasive estimation of central aortic systolic BP (cSBP), through identification of the second systolic peak on the radial artery pulse waveform. The Augmentation Index (AI), a measure of arterial stiffness, can also be calculated using AT. We aimed to determine the cSBP and AI in overweight/obese children with and without OSA and controls.

Methods: Overweight/obese children aged 8-18y with OSA (n = 17) or without OSA (n = 20) referred for clinical assessment of OSA and healthy weight non-snoring controls recruited from the community (n = 18), had AT prior to overnight polysomnography. The radial artery pulse waveform was calibrated to brachial systolic and diastolic blood pressure measurements assessed by an automated cuff before the tonometry measurement. The late systolic peak was identified from three representative waveforms and the average used to calculate cSBP. AI was calculated as a percentage using: AI = (P2/P1)*100 whereby P1 = height of the early systolic peak pressure and P2 = height of the second systolic peak pressure on the radial artery pulse waveform. Group comparisons of P1, P2, cSBP and AI were made using one-way ANOVA. The association between P1, P2, cSBP and AI, with OSA severity as indicated by the obstructive apnoea hypopnoea index (OAHI), and the BMI Z-score were determined using Pearson Correlations.

Results: There were no differences between groups for P1, P2, cSBP or AI. P1 and P2 were positively correlated with BMI Z-score (P1: $r = 0.4$, $p < 0.003$; P2: $r = 0.3$, $p = 0.03$). cSBP was positively correlated with OAHI ($r = 0.3$, $p = 0.02$). AI was not associated with either OAHI or BMI Z-score.

Conclusion: Our results show that OSA severity rather than BMI-Z-score, is associated with an increase in central aortic systolic blood pressure. As central aortic systolic blood pressure is more predictive of poor cardiovascular outcomes than peripheral blood pressure, this study further highlights the need for early intervention for children with OSA.

011

LONGITUDINAL EFFECTS OF PERIODIC BREATHING ON CEREBRAL OXYGENATION IN TERM AND PRETERM BORN INFANTS

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Objectives: Periodic breathing is common in infants, but is thought to be benign. The aim of our study was to assess the incidence and impact of periodic breathing on brain tissue oxygenation index (TOI) in infants born at term and preterm over the first 6 months after term equivalent age.
Study design: 24 preterm infants (born at 27-36 weeks gestational age) and 19 infants born at term were studied with daytime polysomnography in quiet sleep (QS) and active sleep (AS) and in both the prone and supine positions at 2-4 weeks, 2-3 months and 5-6 months post-term corrected age with continuous recording of TOI (NIRO-200 spectrophotometer). Periodic breathing episodes were defined as ≥3 sequential apnoeas each lasting ≥3s. % change in TOI was only calculated during episodes of periodic breathing which were free of movement artifact with the 30 s prior to the episode onset being defined as baseline and the nadir reached during the entire episode.
Results: In preterm infants a total of 164 individual episodes of periodic breathing were recorded in 19 infants at 2-4 weeks, 62 in 12 infants at 2-3 months and 35 in 10 infants at 5-6 months. In term infants a total of 64 individual episodes in 10 infants (1 with 35 episodes), 24 in 6 infants at 2-3 months and 7 in 4 infants at 5-6 months. There were no differences between sleep states or position for any of the variables measured and so data were combined. The amount of time spent in periodic breathing fell with postnatal age in both preterm infants: 6.9 ± 2.4% at Study 1, 3.6 ± 1.8% at Study 2 and 1.3 ± 0.6% at Study 3 and term infants: 2.6 ± 1.8% at Study 1, 0.4 ± 0.2% at Study 2 and 0.3 ± 0.2% at Study 3. Mean duration of episodes was longer in term infants at 2-4 weeks (81 ± 13s vs 54 ± 4s, $p < 0.05$) and at 5-6 months (48 ± 11s vs 31 ± 2s, $p < 0.05$). The nadir in TOI was significantly less in the term infants at 2-3 months (−5.6 ± 0.8% vs −12.3 ± 1.1%, $p < 0.001$) and at 5-6 months (−8.3 ± 1.6% vs −12.7 ± 1.3%, $p = 0.09$).
Conclusions: Periodic breathing was more common in infants born preterm and despite episodes being longer in the term group, falls in cerebral oxygenation were greater in the preterm group. The clinical significance of this on neurodevelopmental outcome is unknown and warrants further investigations.

012

DOES EARLY PARENTAL EDUCATION PREVENT INFANT SLEEP PROBLEMS?

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Introduction: Infant sleep problems are common within the first year of life, with potential long-tern effects. Whether prevention of sleep problems might be more effective than attempts to treat established issues is largely unknown. A large randomised controlled trial (the Prevention of Overweight in Infancy (POI) study), which aimed to prevent excessive weight gain in early childhood, provided an opportunity to determine whether a brief infant sleep education programme reduced the prevalence of parent-reported sleep problems and night wakings and influenced sleep duration in infants. Differences in infant self-settling and safe sleep practices, and parental reports of their own sleep, fatigue and depression symptoms were also determined.
Methods: Within the 4-arm trial 802 families were randomly allocated to one of four groups: usual care (Control); sleep intervention (Sleep); food, activity and breastfeeding intervention (FAB); both interventions (Combination). All groups received standard well-child care. The sleep intervention groups (Sleep and Combination) received an antenatal group education session, emphasising infant self-settling and safe sleeping, and a home visit at three weeks reinforcing the antenatal sleep education. FAB and Combination groups did not receive this information.
Results: No significant intervention effects were found on sleep outcomes with 19.1% of mothers and 16.6% of partners reporting their infant's sleep a problem at 6 months. Actigraphy estimated the number of night wakings to be significantly reduced (8%) and the duration of daytime sleep increased (6 minutes) in those groups receiving the sleep intervention. These small differences are unlikely to be clinically significant and were not observed in 24-hour infant sleep diary data.
Discussion: A strategy delivering infant sleep education antenatally and at three weeks postpartum was not effective in preventing the development of parent-reported infant sleep problems. This may be due to there being limited room for improvement – so a ceiling effect - within a well-educated and well supported population, who receive good standard well child health care.

013

QUALITY OF LIFE AND MOOD IN CHILDREN AND ADOLESCENTS WITH CYSTIC FIBROSIS; ASSOCIATIONS WITH SLEEP QUALITY

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Introduction: Children and adolescents with cystic fibrosis (CF) experience sleep disturbance, elevated symptoms of depression and reduced health-related quality of life (HRQOL). We aimed to investigate the relationship between sleep quality, mood and HRQOL in children with CF and healthy controls.
Methods: Children (7-12 years) and adolescents (13-18 years) with CF, free from pulmonary exacerbation, and healthy controls completed sleep evaluation including 14 days of actigraphy recordings and one night of oximetry. Age appropriate questionnaires assessed mood (Children's Depression Inventory; CDI or Beck's Depression Inventory; BDI), HRQOL (Cystic Fibrosis Questionnaire; CFQ-R or Pediatric Quality of Life Inventory; PedsQL), and daytime sleepiness (Pediatric Daytime Sleepiness Scale; PDSS).
Results: 87 children and adolescents with CF and 55 controls were recruited. Children with CF (7-12 years) had poorer objective sleep quality, more daytime sleepiness and higher CDI total scores,

indicating lower mood, than controls, with a negative correlation between CDI score and sleep efficiency. Children with CF and controls with lower mood were sleepier. Adolescents with CF (13-18 years) demonstrated poorer objective sleep quality and more sleepiness than controls, but no difference in mood scores. Reduced objective sleep quality was significantly correlated with lower CFQ-R scores for physical and emotional functioning, vitality, treatment burden, health perceptions, social, role and respiratory health. There was also a significant association between increased daytime sleepiness and lower CFQ-R scores for vitality and role in adolescents with CF. In both control groups (7-18 years) there was no correlation between sleep quality and mood or HRQOL.

Discussion: In clinically stable children and adolescents with CF, impaired sleep quality and daytime sleepiness is related to lower mood and quality of life in an age-specific manner. Future research should assess the benefits of optimizing sleep in children and adolescents with CF.

014

MELATONIN SUPPRESSION AS A BIOMARKER OF DEPRESSED STATE: A PILOT STUDY

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Patients with major depression almost invariably experience disruptions to their sleep-wake cycle. Often, these are underpinned by disturbances in circadian rhythms. Research has consistently shown abnormal circadian timing and amplitude in patients with depression. However, the mechanism by which these disruptions develop is not known. Sensitivity of the circadian system light is a major mediator of how circadian rhythms synchronise with the external environment, and abnormal sensitivity to light has been cited as a factor in the development of circadian-rhythm sleep disorders such as DSWPD. This study investigated circadian sensitivity to light in un-medicated, unipolar depression patients. Participants included women aged 18-30 with a diagnosis of a major depressive episode within the preceding 2 years as confirmed by the structured clinical interview for the DSM-IV (SCID). Participants had not taken any psychiatric medication within the last 3 months, were not using hormonal contraception and had no serious medical diagnoses. Following 3 weeks of actigraphy & sleep diaries, participants initially completed an assessment of baseline salivary melatonin levels in dim-lighting of <1 lux, followed one week later by an assessment of melatonin levels under normal room lighting (~100 lux). The degree to which melatonin was suppressed (% suppression) was calculated by comparing melatonin concentrations in these two conditions. There was a strong, negative correlation between level of melatonin suppression measured 1 hour past habitual bedtime, and current depression level as measured by the DASS-d at the time of the light exposure. This indicated that patients with higher levels of depression also experienced reduced sensitivity of the circadian system to light. Hyposensitivity of the circadian system to light may lead to the circadian misalignment seen in patients with depression, as typical light cues may not be adequate to entrain an insensitive clock, resulting in an uncoupling of the biological night and the main sleep period. Interventions which increase sensitivity to light may assist in normalising rhythms, and therefore recovery from depressive episodes.

015

PRELIMINARY INVESTIGATION OF THE VARIABILITY IN MELATONIN ONSET IN SELF-REPORTED INTERMEDIATE CHRONOTYPES

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Introduction: Participants recruited for laboratory shiftwork simulation studies are often screened using subjective chronotype scales in order to exclude morning or evening types as a potential confound. This study investigated the range of values of a circadian marker (melatonin onset) of intermediate chronotypes (as defined using a common subjective scale) across a simulated nightshift protocol.

Methods: 12 healthy males (n = 7) and females (n = 5) aged 19-39 years participated in a 7-day simulated shiftwork laboratory study. During screening participants completed the Composite Scale of Morningness and Eveningness (CME) as a subjective indicator of chronotype. Inclusion criteria specified intermediate CME score and habitual bedtimes between 2100 h-0000 h, with 6-9 h of sleep per night, and no habitual naps. Participants also filled out a sleep diary for 7 days prior to entering the sleep laboratory. In the laboratory, participants underwent a baseline sleep opportunity (2200 h-0600 h) followed by a full night awake. Saliva samples were collected hourly from 1700-0000 h under constant light conditions (max 100 lux) to determine melatonin onset (the time saliva concentration exceeded 10pM). Samples were frozen at −20°C until analysis (Direct Saliva Melatonin RIA, Buhlmann, Switzerland).

Results: All participants had intermediate CME scores (mean = 33 ± 5; range = 24-39). Melatonin onset (mean = 2109 h ± 54 min; range = 2034 h-2335 h) and sleep onset varied (mean = 2319 h ± 43 min; range = 2222 h-0034 h), prior to entering the laboratory. Correlations were low between melatonin onset and CME score (r = 0.26), average sleep onset (r = 0.14), earliest sleep onset (r = 0.10), and latest sleep onset (r = 0.14) in the week prior entering the laboratory. However, there was a strong correlation between melatonin onset and the standard deviation of sleep onset in the week before entering the sleep laboratory (r = 0.75).

Discussion: Despite the inclusion of self-reported intermediate chronotypes only, there was a large range in melatonin onset times during the study. Combining subjective chronotype scales with measures of bedtime variability may help in laboratory screening. Further analysis will also investigate how much melatonin onset time shifts in these participants across simulated night work.

016

TELOMERE LENGTH AND SALIVARY DNA METHYLATION AFTER 48 HOURS OF SLEEP DEPRIVATION

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Telomeres are protective structures which cap the ends of chromosomes. Loss of structural integrity, and accelerated telomere shortening, are both associated with biological ageing and increased disease risk. Epigenetic factors, including DNA methylation, are critical for telomere maintenance. Sleep deprivation (SD) and shift work have both been associated with rapid changes in DNA methylation status, resulting in altered expression of CLOCK and other key regulatory genes, such as brain-derived neurotrophic factor (BDNF). To our knowledge the impact of acute SD on telomere length (TL) and DNA methylation status has not previously been reported. In this double-blinded, lab study, participants were assigned to either a caffeine (n = 12, 4F, 22.5 ± 3.3y BMI 21.7 ± 1.5 kg/m2) or placebo condition (n = 12, 5F, 22.5 ± 2.5y, 22.3 ± 2.1 kg/m2). The protocol included one baseline sleep (BL; 22:00 h–08:00 h), 50 h SD and a daytime recovery sleep (REC; 10:00 h–19:00 h). Caffeine (200 mg) or placebo gum was chewed for 5 min at 01:00 h, 03:00 h, 05:00 h and 07:00 h during each night of SD. We examined the impact of 48 h SD, with and without caffeine, on TL and salivary DNA methylation status. Blood and saliva samples were collected after BL (11:00 h day 1) after 48 h SD (08:00 h day 3) and after REC (20:00 h day 3). TL was determined in peripheral blood mononuclear cells (PBMC) by flow cytometry using a telomere-specific FITC-conjugated PNA probe. Global methylation status of salivary DNA was measured using an ELISA assay. TL increased after SD in the caffeine group compared to both BL ($p = 0.04$) and the placebo group ($p = 0.03$), however, it returned to BL levels after REC ($p = 0.10$). Salivary DNA methylation increased after SD in all subjects, and continued to increase even after REC. This effect reached statistical significance in the caffeine group ($p = 0.05$). Previously chronic SD has been associated with shorter telomeres. The current data suggests that acute SD increases TL, specifically when caffeine is administered. This may be due to an acute stress response, stimulating up-regulation of telomere maintenance processes. Rapid changes in DNA methylation with SD have been reported, however, the current observation in salivary DNA is novel. Further investigations are warranted to determine the impact of acute SD, and caffeine, on methylation, telomere length and genome integrity.

017

THE RELATIONSHIP BETWEEN CIRCADIAN PHASE AND MOOD IN UNMEDICATED MAJOR DEPRESSIVE DISORDER: A PRELIMINARY ANALYSIS

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Introduction: Published research on the association between circadian system dysfunction and depression has produced highly variable findings. The earliest studies found the endogenous circadian clock to be advanced relative to sleep time in depression, while as the years progressed, more studies found a circadian phase delay. However, previous research has been compromised by methodological problems, in particular through including participants who were currently or too-recently taking antidepressant medication. Therefore, the current study aims to explore the relationship between circadian phase and mood in a thoroughly-screened, unmedicated sample of women with and without depression. A preliminary analysis of data from the ongoing study is presented.

Method: Women who had experienced a major depressive episode within the past two years and women with no history of mental illness were recruited from the community. They were aged from 18 to 30 years, had no comorbid medical conditions, and were not taking antidepressants or any other medications. A number of other strict exclusion criteria applied. Participants had depression history confirmed or disconfirmed by structured clinical interview (SCID-I/P) and completed several mood and sleep questionnaires. Following three weeks of sleep monitoring with actigraphy and sleep diary, participants had the time of dim light melatonin onset (DLMO) assessed over 7 hours in the laboratory to determine circadian phase.

Results: The depression group scored more poorly than controls on most questionnaires assessing sleep (sleep quality, daytime sleepiness, insomnia symptoms) and mood (depression, anxiety, stress). A larger phase angle between the time of DLMO and mean sleep onset, indicating advanced circadian phase, was associated with more severe mood symptoms, particularly depression. Mean time of sleep onset was not associated with phase angle or depression.

Discussion: This preliminary analysis suggests that advanced circadian phase relative to sleep time is associated with poorer mood. This does not appear to be due to later sleep onset in people who are more depressed. Findings are more consistent with the earliest research in this area, and have implications for treatment of major depressive disorder.

018

EFFECTS OF CHRONIC SHIFT WORK AND OBSTRUCTIVE SLEEP APNEA ON SLEEPINESS, MOOD, VIGILANCE AND NEUROCOGNITION

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Introduction: Obstructive sleep apnea (OSA) and shift work both cause sleep impairment. In OSA, upper airway collapse fragments sleep and often induces intermittent hypoxia. In shift work, sleep quality and quantity is reduced due to a misalignment of sleep periods and circadian rhythms. It is unknown whether poor sleep affects both groups equally or whether the different aetiologies cause distinct patterns of impact. This study compared the effects of chronic shift work and OSA on sleepiness, mood, vigilance and neurocognitive function.

Methods: Participants were 41 untreated OSA patients, 41 shift workers (with a ≥ 24 hour break from last shift) and 40 healthy controls. Participants completed an in laboratory, 3.5 hour, test battery from ~1 pm. The test battery assessed sleepiness (Epworth Sleepiness Scale (ESS), mood (Beck Depression Index (BDI), State

Trait Anxiety Index and Profile of Mood States), vigilance (Psychomotor Vigilance Test (PVT), Oxford Sleep Resistance Test and simulated driving) and neurocognitive function (Digit Span (DS), Logical Memory, and Victoria Stroop Test). Testing was followed by an overnight in laboratory polysomnography.

Results: ESS scores (median, interquartile range) did not differ significantly between the OSA (11, 6.5-14.5) and shift work (7, 5-11.5) groups, but both were significantly elevated ($p < .001$) compared to the control group (4.5, 3-6.0). BDI differed significantly ($p < .05$) between all groups [OSA (12, 8-17.5), shift work (7, 4-15), control (4, 2-8.5)]. PVT lapses were significantly greater ($p < .01$) in the OSA group (3, 2-6) compared to the shift work (2, 0-4) and control groups (1, 0-4), with the latter pair not differing significantly. DS forward scores were significantly greater ($p < .05$) in the OSA group (9, 8-10.5) compared to the shift work (11, 9-12) and control groups (10, 10-13), with the latter pair not differing significantly.

Conclusions: Untreated OSA impaired sleepiness, mood, vigilance and neurocognitive function. While shift work is reported to cause similar acute impairment, this study found that following a 24 hour recovery period, vigilance and neurocognitive function were equivalent to healthy non-shift workers, but subjective sleepiness and mood were elevated. This suggests that not all functions recover equally for shift workers. Future work should determine whether the effects of shift work on subjective sleepiness and mood are recoverable with increased break time (>24 hours) or whether they are chronic in nature.

019

ASSOCIATION OF SLEEP DURATION AND QUALITY WITH PHYSICAL, SOCIAL, AND EMOTIONAL FUNCTIONING OF AUSTRALIAN ADULTS

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Introduction: Epidemiological studies often consider sleep duration and sleep quality separately, although they are interrelated measures of sleep. It is unclear how these two aspects of sleep combine and interact to impact health and functioning. We therefore evaluated the interaction of sleep quantity and quality on physical, emotional, and social functioning in a representative sample of Australian adults.

Methods: We conducted analysis of cross-sectional data from 14,557 participants aged 15 or older in the 2013 wave of the Household, Income and Labour Dynamics in Australia (HILDA) cohort. Physical, emotional, and social functioning was determined using the SF-36. Associations between combined self-reported sleep quality (good/poor) and self-reported sleep duration (short <6 h / mid 6-8 h / long >8 h) and each aspect of functioning was evaluated using logistic regression models. We adjusted for sociodemographic factors, health behaviours, obesity, pain, and mental and physical illnesses as potential confounders.

Results: Poor sleep quality in combination with mid-range, short and long sleep was associated poor physical, emotional and social functioning (ORs ranged from 3.1 to 7.8). Control for pain and comorbid illness greatly attenuated these associations, whilst the contribution from other covariates was limited. After full adjustment for confounding, poor sleep quality remained associated with worse functioning regardless of sleep duration (adjusted ORs 1.4 to 3.8). Those with good sleep quality of short duration had comparable functioning to those with good quality, mid-range sleep durations (adjusted ORs 0.9 to 1.1); while those with poor quality long sleep had the poorest functioning (adjusted ORs 2.3 to 3.8).

Conclusions: Poor sleep quality has robust associations with poor functioning regardless of sleep duration. This suggests sleep quality may be a better predictor of health and functioning than sleep duration and thus should be measured in population-based studies.

020

GREATER SPINDLE DENSITY IN INSOMNIA IS ASSOCIATED WITH SUBJECTIVE MORNING ALERTNESS AND MORE SUSTAINED ATTENTION

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Background: Insomnia is characterised by subjective complaints of reduced sleep quantity and impaired daytime functioning[1]. Sleep spindles are key electroencephalogram (EEG) oscillations that promote sleep stability[2] and sleep-dependant cognitive processing[3]. This research explored the relationship between sleep spindles and subjective measures of sleep quantity, daytime symptoms and tasks of executive functioning in insomnia.

Methods: 93 patients (61 F; mean age 41.3 (SD11.7)) with Insomnia Disorder (DSM-V; ISI 17.3 (4.8)) from a clinical cohort underwent overnight polysomnography. EEG from 10 sites (F3, Fz, F4, C3, Cz, C4, Pz, O1, Oz & O2; (referenced M1 + M2)) were analysed using an automated spindle detection algorithm with a band-passing finite-impulse response filter & Hilbert transformation. Correlations between spindle density (number of spindles per min) during NREM with next morning measures of self-reported sleep quantity (sleep onset latency, wake after sleep onset, total sleep time), daytime insomnia severity scale (DISS) scores, and pre-sleep Tower of London (ToL) & Letter Cancellation Test (LCT) performance measures were examined using Spearman's rank correlation.

Results: Frontal spindle densities (F3 and F4) showed a significant positive association (Rho 0.22; $p = 0.04$) with the alert cognition component of DISS. Increased spindle densities were associated with greater LCT hit rates (Rho = 0.26; $p = 0.03$) and shorter processing speeds (Rho = −0.28; $p = 0.04$). Noassociations were found with subjective measures of sleep quantity or ToL performance.

Discussion: Greater overnight spindle density was related to higher subjective reports of morning alertness and better pre-sleep accuracy and speed performance on the LCT, a task of sustained attention. Although the relationship between spindle activity and neurocognitive performance was relatively weak, it requires further exploration. We are currently examining this relationship in a larger sample of Insomnia patients who completed both pre and post-sleep neurocognitive testing.

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021

TREATING INSOMNIA IN DEPRESSION: INSOMNIA CHARACTERISTICS PREDICT DEPRESSION TRAJECTORIES DURING TREATMENT AND 2-YEAR FOLLOW-UP

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Introduction: We previously reported that cognitive behavioral therapy for insomnia (CBT-I) was efficacious for insomnia among patients with comorbid depression, but did not lead to differential depression outcomes. The current study explored the heterogeneity in depression change trajectories and examined their correlates, particularly those related to insomnia characteristics.
Methods: 148 adults (age M ± SD = 46.6 ± 12.6, 73.0% female) with diagnosed insomnia and major depressive disorder received antidepressant pharmacotherapy, and were randomized to 7-session CBT-I or control conditions over 16 weeks with 2-year follow-up. Depression and insomnia severity were assessed at baseline, bi-weekly during, and every 4 months after treatment. Sleep effort and beliefs about sleep were also assessed.
Results: Growth mixture modeling revealed three trajectories: (1) Partial-Responders (68.9%) had moderate symptom reduction during early treatment (p-value < .001) and maintained mild depression during follow-ups. (2) Initial-Responders (17.6%) had marked symptom reduction during the treatment (p-values < .001) and low depression severity at post-treatment, but increased severity over follow-up (p-value < .001). (3) Optimal-Responders (13.5%) achieved most gains during early treatment (p-value < .001), continued to improve (p-value < .01) and maintained minimal depression during follow-ups. The classes did not differ significantly on baseline measures or treatment received, but differed on insomnia related measures after treatment began (p-values < .05): Optimal-Responders consistently scored the lowest on insomnia severity, sleep effort, endorsement of unhelpful beliefs about sleep.
Conclusions: Three distinct depression symptom trajectories were observed among patients with comorbid insomnia and major depression during acute treatment and long-term follow-up. These trajectories were associated with insomnia-related constructs after commencing treatment. Early changes in insomnia-related constructs may be useful for predicting longer-term outcomes in patients with depression.

022

SLEEP AND CARDIO-METABOLIC RISK IN INDIGENOUS AUSTRALIANS – THE BIRCH STUDY

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Background: Indigenous Australians have 1.3 times higher risk of cardiovascular disease (CVD) compared to non-Indigenous Australians. Poor sleep is associated with increased risk of CVD. To date, there is limited data describing sleep abnormalities and cardio-metabolic risk in this ethnic population. The BIRCH (Better Indigenous Risk stratification for Cardiac Health), is a large multi-site cohort study to better identify CVD risk factors in Indigenous Australians. As part of this study we aimed to investigate sleep quantity and quality in Indigenous Australians and assess cardio-metabolic risk.
Methods: Indigenous Australians aged >18 years were recruited from Aboriginal communities in Alice Springs and Palm Island. Sleep quantity and quality were assessed by subjective (Epworth Sleepiness Scale (ESS)) and objective (3 night actigraphy, Actigraph™) methods. Cardio-metabolic risk factors included glycated haemoglobin (Hb_A1c), total, low density lipoprotein (LDL) and high density lipoprotein (HDL) cholesterol and triglycerides measured in finger-stick whole blood (Alere Afinion™ AS100 Analyser), anthropometric measurements and sitting blood pressure via an automated monitor (Omron™).
Results: Responses from198 participants showed that self-reported sleep duration was 7.6 ± 0.3 hours/night and 34% reported a sleep duration of <7 h/night. Overall, 22% of subjects had an ESS score above 10, indicative of severe daytime sleepiness. Overall, 50 actigraphy assessments were performed with analysable data available for 32 subjects. For actigraphy, 41% had a sleep duration <7 h/night. Sleep disruption was evident with an average of 7 nocturnal awakenings/night and 75% of the group having >3 awakenings/night. Shorter self-reported sleep duration was associated with higher total ($r = -0.22$, $p < 0.05$) and LDL cholesterol ($r = -0.22$, $p < 0.05$) while a higher Sleep Fragmentation Index from actigraphy was negatively correlated with (lower) HDL cholesterol levels ($r = -0.45$, $p < 0.05$).
Conclusion: A large proportion of Aboriginal Australians had well below the recommended sleep duration of 7-9 h/night and significant sleep disruption. Poor sleep quantity and quality may contribute to heightened cardio-metabolic risk in this ethnic group.

023

SELF-REPORTED SLEEP QUALITY IN A MULTI-ETHNIC ASIAN POPULATION

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Introduction: There has been limited data on sleep disturbances in Singapore, a multi-ethnic Asian population. We aimed to quantify the prevalence of poor sleep quality and examine associations with sociodemographics, lifestyle risk factors and medical comorbidities.
Methods: The Singapore Health 2012 (SH2012) and Singapore Health 2 (SH2) were two population-based studies that comprised interviews by trained personnel on sociodemographics, lifestyle factors and medical history together with health screening for comorbidities such as hypertension and diabetes. A community sample of 4666 people aged 18 to 80 years old from these two cohorts completed the Pittsburgh Sleep Quality Index (PSQI).
Results: The mean age of the sample was 44.7 $\pm$ 15.0 years and 2162 (46.2%) were male. The prevalence of poor sleep quality, defined as a PSQI score $>$ 5, was 27.2%. There was no association between gender and sleep quality. Participants who were of Malay ethnicity, elderly (aged $\geq$65 years), obese (BMI $\geq$27.5 kg/m2), previously married, those with lower household incomes and levels of education, smokers and medical comorbidities were more likely to report poor sleep quality (p-value all $<$ 0.01) On logistic regression analysis, the independent predictors of poor sleep quality were chronic joint pain (odds ratio [OR] 1.96, 95% Confidence Interval [CI]: 1.66-2.31), cancer (OR 1.76, 95% CI: 1.12-2.78), cardiovascular disease (OR 1.63, 95% CI: 1.22-2.19), having a monthly household income $<$$2,000 (OR 1.46 95% CI 1.08-1.54), smoking (OR 1.46, 95% CI: 1.15-1.85) and being of Malay ethnicity (OR 1.28 95% CI: 1.07-1.53).
Discussion: Poor sleep quality is prevalent among Singaporean adults and is associated with sociodemographic factors and presence of medical comorbidities. Considering the impact of poor sleep quality on health, our findings suggest a potentially large burden of health consequences caused by sleep disturbances in the general population.

024

CHRONIC PAIN IN NARCOLEPSY: INVESTIGATION OF DIFFERENCES IN THOSE WITH AND WITHOUT CATAPLEXY

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Chronic pain is more common in people with narcolepsy compared to the general population (Dauvilliers et al., 2011). It is theorised that people with type 1 narcolepsy have a lower pain threshold and this may relate to the neuropeptide hypocretin. Type 1 narcolepsy is associated with low or non-detectable levels of hypocretin, while those without cataplexy (with or without narcolepsy) typically have normal hypocretin levels. The specific role of hypocretin is currently not well understood but it is considered to have a key role in regulating sleep and wakefulness and may also be involved with pain (Chiou et al., 2010), depression and autoimmune diseases. The present study examined whether people with type 1 narcolepsy experienced a different location, type and higher severity of pain than people with type 2 narcolepsy, idiopathic hypersomnia and healthy controls. A total of 508 adult participants were recruited and comprised four groups: participants with type 2 narcolepsy (n = 77), type 1 narcolepsy (n = 131), idiopathic hypersomnia (n = 136) and controls (n = 164). Participants were age matched across the groups. A number of questionnaires assessed location, type and severity of pain. Participants were also asked whether they had recurrent or ongoing pain. Results indicated that people with type 1 narcolepsy were more likely to report that they experienced ongoing or recurrent pain than the other three groups. However, among all participants who reported experiencing pain, there was no significant difference between the groups in the type of pain, severity of pain, or where on the body was the pain felt. Lower back pain was most commonly reported across all four groups. Also, all participant groups described their current pain as discomforting, with only a small number of participants describing it as horrible or excruciating. These findings suggest that the presence or absence of hypocretin may contribute to the likelihood of experiencing pain as people with type 1 narcolepsy reported experiencing pain more often than the other three groups. However, hypocretin does not appear to have an effect on the location, severity and type of pain experienced. Having a clear understanding of what these groups commonly share and the role of hypocretin in narcolepsy could provide knowledge to aid in the development of better treatments for people with narcolepsy and possibly for people without narcolepsy. Ultimately, this could help improve the quality of life for people with and without narcolepsy.

025

USING ELECTRONIC DEVICES IN BED AFTER LIGHTS OUT REDUCES SLEEP DURATION AND QUALITY

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Introduction: The impact of exposure to electronic devices before sleep is well documented in children and adolescents, yet this issue has been somewhat overlooked in the general adult population. The aim of this study was to examine the impact of electronic device use in bed after lights out on sleep duration and quality in an Australian adult population.
Methods: A total of 1210 Australian adults (mean age $\pm$ SD: 53.7 $\pm$ 17.7; age range: 18-101) completed a telephone survey to assess sleep behaviours and electronic device use in bed. Sleep quality and sleep duration on weekdays and weekends were analysed using multivariate ANOVA.
Results: Out of 1210 participants surveyed, 504 reported using an electronic device in bed after lights out. MANOVA analysis confirmed that any device use after lights out was significantly associated with poorer sleep quality, a later sleep time, and reduced sleep duration $F_{(1,496)} = 5.68$, $p < .001$. Frequency of device use was associated

only with reduced sleep duration and later sleep times on week days, $F_{(6,496)} = 2.42$, $p = .025$.

Discussion: These data indicate that the use of electronic device after lights out results in poor sleep habits that may compromise the timing of sleep as well as the duration and quality of sleep. Given the widespread use of electronic devices and their potential impact on sleep, further studies are necessary to determine the reasons why adults continue to use their electronic devices after lights out.

026

QUANTITATIVE ELECTROENCEPHALOGRAM MEASURES IN ADULT MEN DURING SLEEP: RELATIONSHIP WITH THE APNEA HYPOPNEA INDEX

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Introduction: There are a few small studies that have undertaken quantitative EEG (qEEG) power spectral analysis (PSA) among people with OSA during NREM and REM sleep across a range of EEG frequencies (0.5-32 Hz). Population-based studies are scarce. Our aim was to determine the relationship between OSA and EEG power spectra among a large sample of community dwelling men.

Methods: Data were drawn from a randomly-selected cohort of men aged ≥40y at recruitment (2002-5) in Adelaide, South Australia. (MAILES study). Of the 837 men with no prior OSA diagnosis who underwent full in-home polysomnography (Embletta X100; 2010-11), the C3 EEG tracings in n = 737 were subjected to quantitative power spectral analysis. PSA variables were log transformed to normalise the distribution for regression against AHI adjusted for age. EEG slowing was determined by EEG slowing ratio (delta + theta)/(alpha + sigma + beta) and EEG delta/alpha ratio (D/A, global EEG slowing during sleep). Results are expressed as standardised Beta coefficients.

Results: Mean (SD) total and REM sleep time were 375 (57) and 57 (22) minutes respectively. The prevalence of OSA (AHI ≥10/h) was 51.8% (AHI ≥30/h: 11.4%). AHI was associated with total EEG power (0.5-32 Hz) in N1 (0.129, $p < 0.01$) and REM (0.191, $p < 0.01$) sleep. AHI was positively associated with spectral power in all frequency bands ($p < 0.01$) during N1 and REM sleep and with power in the beta frequency during N2 and NREM sleep. AHI was associated with EEG slowing ratio in N1 (0.080, $p = 0.032$), N3 (-0.091), $p = 0.014$] and REM sleep (0.103, $p = 0.03$) and with D/A in REM sleep (0.104, $p = 0.005$). The findings for EEG power during NREM sleep remained unchanged when considering NREM AHI, however EEG slowing in REM sleep was not significantly associated with REM AHI.

Discussion: These findings are consistent with previous smaller studies and suggest that as OSA becomes more severe it is associated with an overall increase in EEG power and greater slowing of EEG activity in REM sleep. Further investigation is required to examine if and how these cortical activity changes in OSA relate to negative mental and cardio-metabolic health outcomes.

027

ASSOCIATION OF DEPRESSION WITH QUANTITATIVE ELECTROENCEPHALOGRAM MEASURES IN ADULT MEN DURING SLEEP

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Introduction: Quantitative EEG (qEEG) abnormalities are present in 80% of patients with psychiatric disorders. Small studies of wake qEEG in patients with depression show variation in findings. Both increase and decrease in slow wave activity has been reported in depressed patients in addition to increased alpha and beta activity. We aimed to determine the relation between sleep qEEG parameters and depression in a large sample of community dwelling men.

Methods: Data were drawn from a randomly-selected cohort of men aged ≥40y at recruitment (2002-5) in Adelaide, South Australia. (MAILES study). Of the 837 men with no prior OSA diagnosis who underwent full in-home polysomnography (Embletta X100; 2010-11), the C3 EEG tracings in n = 635 men with known depression status were subjected to quantitative power spectral analysis. PSA variables were log transformed to normalise the distribution for regression against AHI adjusted for age. EEG slowing was determined by EEG slowing ratio (delta + theta)/(alpha + sigma + beta). Logistic regression determined association of depression (n = 87) with log transformed EEG measures adjusting for age, AHI, BMI, financial stress and marital status. A sensitivity analysis was performed using linear regression of depression scale scores to confirm findings.

Results: The EEG slowing ratio in N3 was negatively associated with depression ($p = 0.009$), with weaker associations also present in N1 ($p = 0.0.5$) and N2 ($p = 0.02$) sleep. No association was detectable in REM ($p = 0.17$) sleep. Across all NREM sleep stages the negative association is of equal magnitude to that observed in SWS ($p = 0.008$), and is primarily due an increases in short wavelength densities ($p = 0.0007$), but also a reduction in long wavelength densities ($p = 0.02$). Linear regression analysis with depression scores as continuous variable confirmed these conclusions.

Discussion: Depression was associated with reduced slow wave activity and increased fast wave activity in community dwelling men with depression/mood disorder. These findings are consistent with those from small studies in pyschiatric clinics. Further work should investigate the relationship between such EEG predictors and the behavioural complaints and outcomes in depression including outcomes to antidepressant treatments.

028

PREVALENCE OF SLEEP-DISORDERED BREATHING AMONG PATIENTS ADMITTED FOR PROLONGED VIDEO-EEG MONITORING

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Introduction: There is emerging evidence that patients with epilepsy have an increased prevalence of sleep-disordered breathing compared to the general population. This potentially contributes to increased sleepiness, poorer seizure control, and cardiovascular-related morbidity and mortality. Chronic sleep-disordered breathing can also cause deficits to memory and global cognitive function. Despite this, there have been few studies examining sleep-disordered breathing in epilepsy.

Methods: A cross-sectional study examining the prevalence of sleep-disordered breathing in patients admitted for prolonged video-EEG monitoring between February 2012 and March 2017 was conducted. Only patients with a diagnosis of epilepsy or psychogenic non-epileptic seizures (PNES) were enrolled in this study. Patients who had previously received a diagnosis of obstructive sleep apnea (OSA) or who were already on treatment were excluded from this study. Patients underwent routine diagnostic polysomnography and neurocognitive testing, and completed screening instruments of quality of life, perceived sleep quality and daytime somnolence during their monitoring period. Studies were staged and scored in accordance with the current American Academy of Sleep Medicine guidelines.

Results: A total of 240 patients who received a diagnosis of epilepsy (n = 168), PNES (n = 53), or both (n = 19) were assessed. The prevalence of sleep-disordered breathing was high in this cohort, with 141 of the 240 patients (58.8%) meeting the diagnostic criteria for mild OSA. Of the 141 patients, 57 (23.8%) had moderate-severe diagnosis of OSA. Patients with PNES had the highest prevalence of moderate-severe sleep disordered breathing (26.9%), followed by those with epilepsy (24.4%) and those with both disorders (10.5%). There were no significant differences in measures of cognition and quality of life across the groups.

Discussion: This study reports a high prevalence of OSA in a population with undiagnosed sleep-disordered breathing. Routine polysomnography is an effective diagnostic tool in patients admitted for video-EEG monitoring. Further studies examining treatment and seizure frequency are required. Studies examining the prevalence and severity of OSA and associated hypoxemia, as well as other cardiovascular comorbidities are warranted.

029

SLEEP ARCHITECTURE IN HEALTHY YOUNG ADULTS

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Introduction: *Sleep architecture* is a term that describes the structural organisation of sleep stages over the course of a single night's sleep. Characteristic changes in sleep architecture are observed with aging and in a range of disorders. However there is very little data that describes the sleep architecture of healthy young adults.

Aims: To establish comprehensive normative values of sleep architecture for healthy young adults using current scoring guidelines.

Methods: Single night in-laboratory PSG was conducted in 22 year-old participants of the Western Australian Pregnancy Cohort (Raine) Study cohort. Studies were scored according to AASM 2012 guidelines. Studies were excluded from the current analysis if AHI > 5 event.hr^{-1}, RDI > 5 events.hr^{-1}, or the documented use of medications known to affect sleep, regular shift work, excess alcohol consumption, or depression or current pregnancy.

Results: 950 individuals underwent a PSG, 240 individuals were excluded. PSG data from 755 participants were analysed by gender. The mean (±SD) age and BMI of the group was 22 ± 0.6 years and BMI 24.9 ± 5 kg.m^2. Compared to males, females had increased total sleep time (TST), sleep efficiency (SE), sleep latency (SL), and decreased wake time after sleep onset (WASO) and time spent in stage N1 sleep. All other measures of sleep architecture were similar between males and females.

females	*Males n = 345*	*Females n = 410*
TST (mins)	375.0 ± 57.7	386.1 ± 51.0*
SE (%)	86.3 ± 9.7	88 ± 8.1*
Sleep Latency (mins)	14.6 ± 16.9	18.4 ± 16.4*
REM Latency (mins)	121.0 ± 57.6	118.2 ± 55.8
WASO (mins)	44.7 ± 36.8	34.9 ± 28.1*
Wake (mins)	59.3 ± 43.4	53.3 ± 34.9
N1 (%)	9.5 ± 4.1	8.3 ± 4.0*
N2 (%)	47.0 ± 7.7	45.9 ± 8.0
N3 (%)	25.9 ± 7.8	27.2 ± 8.4
REM (%)	17.6 ± 6.1	18.6 ± 5.9

*$p < 0.05$ males vs

Conclusion: Young adult women generally have improved polysomnographic features of sleep quality compared to young men, but take longer to fall asleep in the sleep laboratory.

030

AUTOMATED ECG-BASED APNOEA CLASSIFICATION USING HEART RATE VARIABILITY, ECG DERIVED RESPIRATION AND CARDIOPULMONARY COUPLING PARAMETERS

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Introduction: Previous studies have considered using the heart rate variability (HRV) and ECG derived respiration (EDR) as inputs for an ECG based apnoea detection system and accuracies over 85% have been achieved for detecting epochs containing obstructive sleep apnoea (OSA) events. The physiological influences on the heart rate and respiration are not independent. Cardiopulmonary coupling (CPC) measures the coordination between cardiac and respiratory systems as determined from the ECG and has proven to be a useful feature for identifying sleep stages. We investigated supplementing the HRV and EDR with CPC information, and investigated the impact on classifying one-minute epochs for the presence or absence of OSA events. Machine learning methods were used to develop fully automated analysis algorithms

Methods: We used the 35 ECG recordings extracted from scored overnight polysomnography recordings with an average recording time of 8 hours. Scoring of the PSGS included respiratory and sleep stage events. By processing the ECG with signal processing algorithms, the HRV, the EDR (using QRS area method) and the CPC information was determined. Key measurements from the HRV, EDR and CPC were then used as inputs to an artificial neural network classifier which was trained with the back-propagation algorithm. Unbiased performance was assessed with leave-one-record-out cross-validation.

Results: The best classification performance was achieved using the CPC features in conjunction with the time-domain based HRV parameters. The cross-validated results on the 17,045 epochs of the dataset for determining the presence or absence of OSA, were an accuracy of 89.8%, a specificity of 92.9%, a sensitivity of 84.7%, and a kappa value of 0.78.

Discussion: The CPC information captured valuable sleep stage information that assisted the performance of fully automatic algorithms for detecting OSA events from the ECG.

031

ACCURACY OF WRIST ACTIGRAPHY IMPROVED BY NEW TRI-AXIAL SCORING ALGORITHM

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Introduction: Actigraphy is a valid, accurate, reliable and comfortable measure of sleep Accelerometer-derived movement data is transformed to indicate a state of sleep or wake. The most widely used algorithms, Sadeh and Cole-Kripke, were developed from devices that measured one axis of movement. Despite contemporary devices recording three axes of movement, scoring algorithms still analyse data from one axis only. Using additional axes of data may increase accuracy, particularly for subtle movements during wake.

Aim: Increase the accuracy of actigraphy by developing and validating a tri-axial actigraphy scoring algorithm.

Methods: 435 healthy young adults (219 female, 216 male, age 22 $\pm$ 0.2) attended the UWA Centre for Sleep Science for overnight PSG with simultaneous wrist actigraphy. PSG were scored according to AASM 2012 criteria. Algorithm development and statistical analyses were performed in R. Participants were randomly assigned to development (n = 217) and validation (n = 218) cohorts. Discriminant analysis identified development cohort actigraphy measures that most accurately predicted PSG-defined sleep and wake, constants, and overall threshold for algorithm to score sleep or wake. The validation cohort actigraphy data was scored using the new algorithm and also by the Sadeh algorithm. Actigraphy scoring was compared epoch-by-epoch to PSG to obtain sensitivity, specificity and accuracy for both the new algorithm and the Sadeh algorithm.

Results: Sensitivity, specificity and accuracy of the new algorithm were 89%, 62% and 85%, respectively; and for the Sadeh algorithm were 87%, 49% and 80%, respectively. Compared to the Sadeh algorithm, specificity was significantly increased ($p < 0.05$) while accuracy and sensitivity were not different.

Discussion: The improved wake detection of this new algorithm is likely due to the improved capacity of a tri-axial wrist accelerometer, relative to a single axis device, to detect subtle movement.

032

EFFECT OF OBSTRUCTIVE SLEEP APNEA TREATMENT ON RENAL FUNCTION IN PATIENTS WITH CARDIOVASCULAR DISEASE

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Introduction: Obstructive sleep apnea (OSA) is associated with impaired renal function, but uncertainty exists over whether treatment of OSA can influence renal outcomes. Most previous data comes from observational studies on individuals with existing chronic kidney disease, with very little evidence from randomised controlled interventions. The potential effects of continuous positive airway pressure (CPAP) on renal function in subjects with co-existing OSA and cardiovascular disease, but generally adequate kidney function, were investigated in a substudy of the international Sleep Apnea and cardioVascular Endpoints (SAVE) trial.

Methods: The SAVE trial that randomized 2717 patients with moderate-severe OSA and established coronary or cerebrovascular disease to receive CPAP plus usual care, or usual care alone. 200 participants in Australia and New Zealand also provided consent for this substudy of kidney function and had blood and urine collected. Renal function and adverse renal events were compared between CPAP treated (n = 102) and usual care (n = 98) groups. Glomerular filtration rate was estimated at randomization and the end of follow-up; urinary albumin:creatinine ratio was measured at study exit.

Results: In substudy participants (mean age 64 years; median 4% oxygen desaturation index, 20 events per hour, mean estimated glomerular filtration rate at baseline 82 mL/min/1.73 m^2), the median (IQR) rate of change in estimated glomerular filtration rate (mL/min/1.73 m^2/year) was -1.64 (-3.45 to -0.740) in the CPAP group and -2.30 (-4.53 to -0.71) in the usual care group ($P = 0.21$) after a

median period of 4.4 years. There were no between-group differences in end-of-study urinary albumin:creatinine ratio, or the occurrence of serious renal or urinary adverse events during the trial. Level of CPAP adherence did not influence the findings.

Discussion: CPAP treatment of OSA in patients with cardiovascular disease does not alter renal function, nor the occurrence of renal adverse events. While most participants began the trial with normal kidney function, this declined over the course of the study in both CPAP and usual care groups.

033

INDIVIDUAL VERSUS GROUP CPAP CLINICS: EFFICACY IN A SEVERE OSA POPULATION

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Introduction: Public health resourcing for treating OSA in New Zealand is under high pressure due to increasing demand. Changing from the traditional paradigm of an individual clinic (1:1 clinician/patient) to a group clinic (2:8 clinician/patient) could improve health delivery. The purpose of this study was to compare the clinical and resourcing outcomes of an individual CPAP trial versus group CPAP trials.

Methods: Newly diagnosed patients with severe OSA were offered a trial of CPAP either in an individual clinic (n = 161) or a group clinic (n = 161). The individual clinic patients had two sessions including setup and review, while the group clinic patients had three sessions (1 hour per session) which included education, setup and review. Compliance was reviewed at 180 days. Outcome measures included clinician time, patient wait time, CPAP compliance, CPAP failure rate and patient satisfaction.

Results: The minimum face to face clinician time for the individual clinics was calculated at 75 minutes per patient, while the group clinics were 45 minutes per patient. Wait times were significantly ($p < 0.001$) shorter in group clinics versus individual clinics (median 69 vs 276 days). There was no difference in CPAP compliance between clinics (median days used: individual 90%/group 91%, median hours on days used: individual 6.24/group 6.00). The CPAP return rate was greater in the individual (27%) versus the group (13%).

Discussion: Group CPAP clinics provide a cost effective solution for the treatment of OSA. Group clinics increase capacity thereby reducing patient wait time. There appears to be no clinical compromise in group clinics with CPAP compliance being equal with individual clinics. The lower return rate in the group clinics may be related to patient peer support. Group CPAP clinics are an effective alternative to the traditional individual CPAP clinics.

034

PREDICTING RESPONSE TO OXYGEN THERAPY IN OBSTRUCTIVE SLEEP APNEA PATIENTS USING VENTILATORY CHEMOREFLEX TEST DURING WAKEFULNESS

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Introduction: There is no satisfactory treatment for obstructive sleep apnea (OSA); existing treatment options are either poorly tolerated or only partially alleviate abnormalities. Supplemental low-flow oxygen therapy has been shown to reduce hypoxemia and is relatively well tolerated by OSA patients. However, use is limited because the literature suggests that oxygen therapy may benefit only certain subsets of OSA patients. Recent experimental studies suggested that overnight physiological traits could be used to predict individual OSA response to non-CPAP therapy. In this project, we evaluated a potentially more clinically viable test- a 10-min awake ventilatory chemoreflex test in predicting individual OSA response to 2-months oxygen therapy.

Methods: OSA patients with apnea hypopnea index (AHI)>15/hr and who have refused or are intolerant to CPAP therapy were recruited. In the baseline visit, they were evaluated with awake ventilatory chemoreflexes (Modified Duffin Method) in the afternoon prior to the overnight PSG. Then they were provided a home oxygen concentrator and used oxygen treatment at a flow rate of 3 L/min via a nasal cannula. After two months, patients were assessed with a second in-lab overnight PSG.

Results: Twenty OSA patients completed the study with an average age of 57.8 year, BMI of 31 kg/m^2 and baseline AHI of 32.6/hr. As primary outcome of interest, change of AHI significantly correlated with baseline ventilatory response threshold (VRT) ($r = -0.48$, $p = 0.04$) and chemosensitivity ($r = 0.50$, $p = 0.03$) after 2 months O2 treatment. In predicting a fall in AHI after O2 therapy (change in AHI < 0), the area under the receiver operating characteristic curve (AUC) is 0.79 and 0.89 for VRT and chemosensitivity respectively. Importantly, when these two variables are combined in a logistic regression model, the prediction effect becomes stronger with a sensitivity of 0.92, specificity of 0.83 and AUC of 0.97. Based on data from 68 patients in three of our OSA studies, 25% of patients with OSA would be predicted to respond to oxygen (95% CI 16-37%).

Discussion: Our awake ventilatory chemoreflex test could be considered as a clinical tool to predict individual OSA response to oxygen therapy. It provides a potential for a novel personalised medicine approach in selecting suitable OSA patients for targeted treatment.

035

EFFECT OF BARIATRIC SURGERY ON OBSTRUCTIVE SLEEP APNOEA: A SYSTEMATIC REVIEW

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Background and Aim: Obesity is a strong risk factor for obstructive sleep apnoea (OSA) and bariatric surgery is an effective method to reduce and maintain long term weight loss. However, very few patients are cured of OSA following bariatric surgery despite significant reductions in OSA severity and its resolution cannot be predicted by their starting weight or post-intervention weight loss. Hence, we performed a systematic review to look at the effect of bariatric surgery on OSA and to determine if there were any clinical predictors of treatment success.

Methods: Our study protocol has been registered on PROSPERO *(ID=CRD42017062359).* Relevant studies were identified by searches of *Medline, Embase, PubMed, Cochrane Library* and *Medline (In-Process & Other Non-Indexed Citations)* on 8/4/2017. Studies included reported pre and post-surgery sleep study data

(apnoea-hypopnoea index (AHI) or equivalent), body mass index (BMI) and timing of post-surgery sleep studies. Studies that enrolled patients with obesity hypoventilation syndrome (OHS) were excluded. Other data extracted included patient characteristics, type of bariatric surgery performed, sleep study type and scoring criteria used, study design and quality, and relevant sleep quality questionnaires.

Results: A total of 3017 references were retrieved, with 24 studies included in the final analysis. Only two were randomised controlled trials, and 2/22 observational studies had a comparative arm (lifestyle intervention; continuous positive airway pressure). A total of 1101 patients had completed pre and post-surgery sleep studies, with sample size of the individual studies ranging from n = 8 to n = 205. 80% of studies conducted a level 1 sleep study. All studies showed a significant reduction in BMI and AHI post-surgery, however, 14 studies reported an overall post-surgery AHI >10 indicating the presence of residual OSA. A mixture of sleep scoring criteria were used and 29% of studies failed to specify which criteria were used. Time between pre and post-surgery sleep studies ranged from 90 days to 7 years.

Discussion: Further quantitative analysis will be performed after accounting for the heterogeneity in the data and potential influence of use of different American Academy of Sleep Medicine (AASM) scoring criteria.

036

PHENOTYPING USING POLYSOMNOGRAPHY TO SELECT OBSTRUCTIVE SLEEP APNOEA PATIENTS FOR MANDIBLE ADVANCEMENT DEVICE THERAPY

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Introduction: Mandibular advancement devices (MAD) for obstructive sleep apnoea (OSA) are highly effective in some patients but are less effective in others. Detailed physiological studies have identified pharyngeal collapsibility and loop gain as predictors of the response to therapy. However, there is currently no clinical means to identify which patients are most suitable for this intervention.

Methods: Here we employed a novel tool to estimate the phenotypic traits causing OSA from baseline polysomnography, including: 1. loop gain (ventilatory drive response to apnoea/hypopnoea), 2. arousal threshold (ventilatory drive triggering arousal), 3. pharyngeal collapsibility (ventilation assessed during sleep at eupneic ventilatory drive [$V_{PASSIVE}$] and at elevated ventilatory drive when pharyngeal muscles are active [V_{ACTIVE}]). We tested whether these traits could predict the responses to 1 month of MAD therapy (reduction in apnoea-hypopnoea index [AHI] versus baseline). Phenotypic measurements were limited to non-REM sleep.

Results: Diagnostic studies from N = 64 patients have been assessed to date (baseline AHI >20 events/hr). Univariate analysis showed that responders to MAD therapy (treatment AHI <10 events/hr) had lower loop gain compared to non-responders ($p = 0.03$), and also tended to have milder collapsibility (higher $V_{PASSIVE}$ and V_{ACTIVE}; $p = 0.08$ and 0.07 respectively). Multivariate analysis (non-linear "support vector machine") identified two key predictors of response to MAD therapy: V_{ACTIVE} and baseline AHI. The subgroup of "predicted responders" exhibited a 73 ± 4% reduction in AHI versus 46 ± 8% in the subgroup of "predicted non-responders" ($p = 0.01$, mean ±SEM, leave-one-out cross validation). An "inverted U" shaped curve illustrated that patients with more severe collapsibility and higher baseline AHI responded sub-optimally, as did patients with milder collapsibility and lower baseline AHI (who notably had lower arousal thresholds, 109 ± 2 vs. 131 ± $5\%_{EUPNEA}$, $p < 0.001$).

Conclusions: Quantifying pharyngeal collapsibility using routine diagnostic polysomnography may help identify which patients are most suitable for MAD therapy.

037

COMT GENOTYPE DOES NOT PREDICT RESPONSE TO ARMODAFINIL. A SUB-STUDY FROM A RANDOMISED, CONTROLLED TRIAL

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There are different inter-individual effects between patients who take wakefulness promoters modafinil and armodafinil. Catechol-O-methyltransferase (COMT) Val158Met genotype may predict these differences in response to modafinil/armodafinil. Previous research has shown that COMT genotype may be a determinant of response to modafinil/armodafinil in patients with narcolepsy and may be associated with different waking quantitative electroencephalography (EEG) profiles and performance in healthy individuals exposed to sleep deprivation.(1) We aimed to determine the effect of COMT genotype on response to armodafinil in patients with obstructive sleep apnea (OSA) and daytime sleepiness.

Aim: To identify if COMT Val158Met genotype modifies driving simulator performance in response to armodafinil. The hypothesis is that val/val types will have superior response to armodafinil compared with met/met types and val/met types.

Methods: All patients were enrolled in a six month randomised controlled trial of armodafinil vs placebo while undergoing a diet and exercise program. Patients were eligible if they had OSA, daytime sleepiness, obesity and intolerance of standard OSA treatment. Those patients who consented to this sub-study had an extra vial of blood taken during a blood draw for the main study. Genomic DNA was extracted from buffy coat and DNA fragments containing the Val158Met polymorphism were amplified and then digested with NlaIII to obtain the bands that discern between the different genotypes.

Results: COMT genotype was measured in 83 consenting patients; 28 (33.7%) were characterised as val/val, 35 (42.2%) were characterised as val/met (heterozygous) and 20 (24.1%) were characterised as met/met subtypes. COMT genotype did not affect the response to armodafinil on the primary outcome of driving simulator performance at six months (all $p < 0.4$). At three months there was a trend for

better improvement in steering deviation in the met/met group but this was not significant (vs. val/val 18.1 cm better 95% CI −0.6 to 37.9, p = 0.057; & vs. met/val 12.3 cm better, 95% CI −4.2 to 28.9, p = 0.145).

Discussion: There was no evidence of a drug-gene interaction in our trial. Further research is required into the inter-individual differences in performance of patients with OSA including differences in quantitative EEG.

1. Dauvilliers et al, Catechol-O-methyltransferase, dopamine, and sleep-wake regulation. Sleep Medicine Reviews 2015. 22: 47-53

038

MECHANISMS AND RESEARCH PRIORITIES TO ADVANCE STRATEGIES THAT TARGET THE UPPER AIRWAY MUSCLES TO TREAT OSA

D. ECKERT

The session will begin with Dr Wellman providing a brief overview of the role of impaired upper airway muscle function as a therapeutic target to treat OSA and he will present new data on pharmacological approaches to increase upper airway muscle activity, reduce airway collapsibility and their potential role in treating OSA. Dr Lorenzi-Filho will then talk about the findings from his RCTs to train the upper airway muscles to treat OSA and reduce snoring. Dr Eastwood will cover the role of hypoglossal nerve stimulation to treat OSA. Finally, a summary of proposed underlying mechanisms, unanswered questions, and avenues for future research to advance this line of work will be covered (Eckert).

OSA is a common disorder with serious consequences. However, approximately half of all patients with OSA cannot tolerate CPAP therapy. Therefore, new treatment strategies are critically needed. This session will cover new and emerging approaches to improve upper airway muscle function to treat OSA from internationally recognized leaders in the field. There have recently been several major advances in this area. Thus, this topic will be of interest to a substantial proportion of the membership/attendees.

039

INFANT SLEEP: INTERVENTIONS FOR OBESITY PREVENTION AND PROBLEMATIC SLEEP, AND SAFE SLEEP PRACTICES

B. GALLAND

A/Prof Galland will briefly introduce the topic of infant sleep and development background the importance of the infant interventions and practices to follow. The first presentation delivered by A/Prof Taylor will summarise what we currently know about sleep and obesity in children, and then cover the results of traditional early life obesity prevention strategies (nutrition and activity). Newer initiatives that focus on sleep to reduce excessive weight gain in infants and toddlers will then be introduced, together with the findings from two randomised controlled trials conducted in New Zealand and in the US. The second presentation delivered by A/Prof Galland will focus on interventions to address sleep problems in infancy, covering those targeted to prevent a sleep problem before it develops, and those targeted to treat a sleep problem once it has become established. The presentation will also cover some of the challenges in measuring sleep in infancy and around self-settling practices believed to drive good self-regulatory behaviour from an early age. The third presentation from Prof Horne will background the risk of Sudden Unexpected Death in Infancy (SUDI) for pre-term infants in the home environment. She will then cover some of the conflicting evidence surrounding improved respiratory function in preterm infants sleeping prone over the short term, and highlight the gap in studies showing long-term benefits. Data from a longitudinal study will be presented documenting unstable respiratory patterns and adverse effects of prone sleeping on cerebral oxygenation, cardiovascular and cerebrovascular control in ex pre-term babies across the first 6 months of post-term corrected age, highlighting the potential risk for SUDI. The importance of parents receiving safe sleeping messages for their preterm infants will be highlighted. The fourth presentation delivered by A/Prof Baddock will summarise research addressing the benefits and risks associated with infant-parent bedsharing and discuss interventions (wahakura – flax bassinet and pēpi-pod – plastic bassinet) that potentially provide safer, culturally appropriate, alternatives for families at high risk of SUDI who wish to bedshare. The importance of education along with the provision of the device will also be explored.

Parents of newborns are faced with sometimes-conflicting advice about best practices for their infant's nutrition and sleep requirements to kick-start healthy development. This is particularly important in the current era where in NZ and Australia, up to 1/3 of children will be overweight or obese by the time they reach age two. Despite health services providing much advice on feeding, sleep advice tends to be a secondary focus, yet up to 30% of infants' sleep will become a problem for their parents over the first six months of life with the potential to adversely affect babies sleep and development, and parents' sleep, wellbeing and parenting. Furthermore, for parents of newborns at high risk of sudden unexpected death in infancy (due to prenatal and/or postnatal risk factors), correct evidence-based advice on safe sleeping can be critical for survival. It is therefore vitally important that health professionals working with families of newborns are equipped with up-to-date knowledge to provide that appropriate advice. Attendees at this symposium will hear from research experts at the forefront of their fields in delivering the evidence-based research surrounding strategies for the prevention of obesity in infancy, infant sleep interventions, and safe sleeping practices.

040

ORAL APPLIANCES FOR OBSTRUCTIVE SLEEP APNOEA

R. SHEA
Adelaide Institute of Sleep Health

1 lecture by Fernanda Almeida for 60 mins on the different types of oral appliances and their effectiveness. There are a large number of different types of appliances with a range of effectiveness and this lectutre will give a clearer understanding of the differences including "over the counter" oral appliances.

1 lecture of 30 minutes on the connection between edentulous patients and OSA. There has been a range of research indicating that the wearing of full dentures while sleeping may make a difference with OSA. Lecturer unknown at present but can certainly be done by Fernanda Almeida or Rob Shea.

The range of oral appliances is perplexing to many people and this lecture will make the evidence much clearer in the differences between oral appliances.

The other aspect is of interest to advising patients if they should sleep with or without dentures to reduce the OSA.

041

PATHOPHYSIOLOGY, PERFORMANCE AND PHENOTYPING: 3 NEW PS OF OBJECTIVE INSOMNIA MEASUREMENT

C. GORDON

Insomnia is a sleep disorder based on subjective measures. Over the last decade there has been an increase in research examining the objective nature of the condition, in particular related to pathogenesis, phenotypic expression, physiological changes in cardiovascular and neuro-anatomical and metabolism processes, and neurocognition. This extensive body of work has frequently demonstrated disconnection between subjective insomnia symptoms and objectives measures. Further, between-subject comparisons often reveal contradictory findings. Clearly not all cognitive-behavioural and physiological disturbances are going to be congruent in an insomnia population which suggests that insomnia heterogeneity may be largely responsible. As such, phenotypic classifications beyond symptom classifiers have been suggested. This proposed symposium will explore how these insomnia phenotypes arose and the resultant pathophysiological and performance differentiation aligns.

This symposium will synthesise a large body of evidence related to insomnia phenotyping, pathophysiology and neurocognitive performance. There are a number of reasons that this session has been proposed. First, there is much confusion about the exact nature of insomnia phenotypes and we suggest that an epidemiological approach has limited interpretative capability. Second, evidence suggests that insomnia patients have a higher risk of developing morbidity and indeed mortality, yet, plausible biological evidence to support this is mostly unsubstantiated. Third, untangling the putative biologically severe short sleeping insomnia phenotype evidentiary basis will demonstrate that much of the evidence is indeed not strong. Fourth, we suggest that biomarkers of insomnia severity need to be established beyond subjective reporting. The methods for this approach will be discussed. Finally, neurocognitive changes in insomnia patients are evident, yet there does not appear to be consistent patterns in these data. We will explore this issue and suggest whether brain biomarkers (EEG, magnetic resonance spectroscopy or fMRI) could provide insights into these discrepancies.

042

KEY SLEEP DISORDERS – HOW COMMON ARE THEY AND WHY DO THEY OCCUR?

D. BRUCK

(1) Epidemiology of sleep complaints in the community: the 2016 SHF Survey Similarly to other international studies, the results from this national survey of Australian adults shows that sleep problems, related to lifestyle and behavioural choices, produce a considerable burden on health, social life and workplace functioning. Much of this is due to competing demands on people's time with a quarter of all adults reporting their usual routine does not allow sufficient sleep. Lifestyle choices affecting sleep habits, such as working or using the internet just before bed, are also associated with adverse effects on sleep and daytime and work performance. Although limited by self-reported data, short sleep and disrupted sleep timing such as social jetlag have consistently been associated with considerable cardio-metabolic morbidity and increased mortality. The population burden of sleep problems in the community associated with lifestyle choices of sleep habits and duration rivals that of clinical disorders.

(2) **Epidemiology of Obstructive Sleep Apnea (OSA) and related respiratory sleep disorders** OSA is one of the commonest clinical sleep disorders, with 13% of men and 6% of women having it to at least moderate degree, based on an apnea hypopnea index (AHI) of 15 events/hr or greater. Age, gender, body mass index and (to a lesser extent) ethnicity influence its prevalence, which has increased in recent years with population ageing and increasing obesity. Common comorbidities include hypertension, vascular disease, metabolic dysfunction and depression. While cognitive dysfunction is a common sequela of untreated OSA and responsible for the increased accident risk and productivity losses associated with the condition, its presence and severity are inconsistently related to AHI. The reasons for this inconsistency are incompletely understood, and deserve closer examination given the importance of the relationship both economically and in terms of well-being. The economic impacts of untreated OSA are substantial, making its identification and treatment highly cost effective, a simple truth that requires wider appreciation by health planners.

(3) Epidemiology of Narcolepsy, Restless Legs Syndrome and REM Sleep Behaviour Disorder (RMD) Different neurological sleep disorders have different challenges when it comes to studying their epidemiology. The prevalence of narcolepsy in the general population has been estimated around 0.5 – 2 per 1000 inhabitants, with the number of undiagnosed patients heavily outnumbering diagnosed patients and long diagnostic delays. Poor differential diagnosis is a possible confound in older prevalence estimates. Previous studies indicated RLS prevalence rates of 10-15%, with female gender, pregnancy and co-morbid diseases increasing risk. RLS diagnosis can be confounded by 'mimics' and their active exclusion is now an obligatory diagnostic requirement. Only moderate to severe RLS requires treatment.

Epidemiological studies of RBD are limited by the fact that a definite diagnosis requires polysomnography. General population prevalence is estimated to be up to 2% (7 + % in the elderly). Prevalence studies of probable idiopathic RBD often use validated questionnaires, but these have many difficulties; false-negatives, false-positives, low reproducibility, etc. Current RBD research is centered on its ability to indicate an early stage of neurodegenerative disease and the development of population-based screening tools.

Epidemiology is a fast-changing field with new diagnostic and methodological challenges continually emerging and it is thus important that a key conference like Sleep DownUnder regularly includes a comprehensive forum that presents the latest sleep research on these issues. It is also critical, from an advocacy point of view, that sleep professionals are up-to-date with the latest prevalence findings and ideas about what the possible implications of different sleep disorders/problems may be for the community, workplace, health budget and overall economy.

The format, of three presentations by national and international sleep experts covering different sleep problems, will provide sufficient time after each presentation for some questions and discussion.

043

HEALTH IMPACTS OF IRREGULAR WORK HOURS: THE ROLE OF SLEEP AND CIRCADIAN DISRUPTION

S. FERGUSON

The symposium will present an overview of the current state of knowledge in relation to the impact of shiftwork and night work on health markers, with an emphasis on the role of sleep and circadian disruption. Presenters will also discuss current studies and new findings from studies investigating the mechanisms underpinning negative health outcomes, as well as point to potential interventions or harm mitigation strategies for shiftworkers.

Melinda Jackson (RMIT) will provide an overview of the health impacts of shiftwork and irregular hours, highlighting recent state-of-the-art reviews in the field.

Jill Dorrian (UniSA) will present findings from work examining the timing of meals during night shifts and the impacts on metabolic function.

Charli Sargent (CQUniversity) will present work from sleep restriction studies aimed at determining the impact of 'sleep dose' on metabolic function an inflammatory markers.

Leilah Grant (Monash) will present group and inter-individual differences in linear and circadian profiles of metabolomic markers.

Amy Reynolds (CQUniversity) will present preliminary findings on changes to gastrointestinal microbiota and metabolomics markers following sleep restriction.

The field of health monitoring, specifically the use of health biomarkers and precision medicine, is growing quickly. The applications to shiftwork and night work, but also more broadly to sleep health in the general community, are significant. As more is learnt about the role of sleep and circadian biology in the development of chronic non-communicable disease, it is important that the sleep community remains up to date with innovations in monitoring, diagnosis and intervention.

044

MINDFULNESS – WHAT IS IT AND HOW TO USE IT TO TREAT SLEEP DISORDERS?

H. MEAKLIM

Mindfulness has become an increasingly popular intervention and practice in western medicine and psychology over the past few decades. In the last few years, research has focused on how mindfulness might be used as an intervention in insomnia treatment. This session with cover the definition of Mindfulness and what this 'third wave therapy' actually is. It will then discuss how Mindfulness may influence arousal and some of the potential mechanisms for treating sleep disorders. (Dr Tony Fernando)

It will discuss current research in the area of mindfulness and sleep drawing on local and international research. (Dr Allie Peters)

There will also be an experiential component to this session, so that audience members can experience a mindfulness meditation exercise. (Dr Giselle Withers)

Attendees at this session will walk away from this session with a good overview of how Mindfulness can be applied to sleep disorder treatment.

This session will make Mindfulness accessible to the sleep community. A symposia will allow a group of interested individuals to get an overview of what Mindfulness is, how it is helpful for treating insomnia and make a decision about whether they might suggest it as a treatment option to insomnia patients. In addition, with the conference being in Auckland, this is a great opportunity to involve a local psychiatrist with expertise in insomnia and mindfulness (Tony Fernando).

045

NON-INVASIVE VENTILATION ASYNCHRONY IN A SIMULATED LUNG MODEL – PATIENT FACTORS AND EFFECT ON VENTILATION

T. EDWARDS, B. DUCE AND C. HUKINS
Princess Alexandra Hospital

Background: Ventilator asynchrony including failure to trigger and biphasic inspiratory waveforms, (otherwise known as double triggering), have been demonstrated to occur in patients receiving non-invasive ventilation. Using a simulated lung model our laboratory has previously explored device factors causing ventilator asynchrony. This study aims to build on this previous work to identify and explore further patient variables implicated in ventilator asynchrony.

Methods: The IngMar ASL5000 Lung Model was connected to a physiological upper airway manikin via a Medium ResMed Quattro Mask. Two devices were tested – The ResMed S9 VPAP STA and a Philips Respironics Omnilab device. Non-invasive ventilation with pressures of 15/5 cm H_2O and rise time of 0.1s were used in our model. The variables analysed included respiratory rate, respiratory effort, lung compliance (simulating restrictive lung disease) and lung resistance (simulating obstructive lung disease). The primary outcome measures were percentage of breaths where failure to trigger or double triggering was noted. Secondary outcome measures included work of breathing, minute ventilation, degree of overshoot and peak inspiratory flow.

Progress to date: Analysis has been completed using the ResMed S9 VPAP device. Double triggering occurred in the severe restrictive lung disease model (compliance 30 ml/cmH_2O) with increased respiratory muscle effort (8 and 15 cm H_2O) and lower respiratory rate (15 breaths/min). Failure to trigger occurred in the obstructive lung disease model (resistance 10-30 cm H_2O/L/s) with reduced respiratory muscle effort (2 cm H_2O) as well as a combined obstructive and restrictive model (compliance 15-30 ml/cm H_2O and resistance 20-30 cm H_2O/L/s) with reduced respiratory muscle effort (2 cm H_2O).

Intended outcome and impact: Ventilator asynchrony is strongly related to respiratory effort, respiratory rate and underlying lung pathology.

046

A NOVEL METHOD TO EVALUATE UPPER AIRWAY ANATOMICAL IMBALANCE

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Background: Upper airway anatomical imbalance, characterised by excessive upper airway soft tissue for a fixed bony enclosure size, is implicated in the pathogenesis of Obstructive Sleep Apnoea (OSA). Furthermore, its role in treatment response has recently been recognised. The measurement of anatomical imbalance is complex, requiring sophisticated imaging modalities and analyses,

limiting its use in clinical practice. Such imaging studies have shown that anatomical imbalance can predict response to MAS therapy. Hence, our primary aim is to develop a simple clinical method for assessing anatomical imbalance, using a combination of craniofacial soft tissue and intraoral measurements. Our subsequent aim is to assess the utility of this method in predicting treatment response to MAS.

Methods: Subjects are patients with OSA (AHI>10/hour) participating in a MAS treatment study. Frontal and profile facial photographs and dental impressions are collected in all patients. MAS treatment outcome is determined by polysomnography (PSG) with MAS in-situ. Anthropometric and craniofacial soft tissue measurements (from quantitative photographic analysis) and intra-oral dimensions (inter-tooth distances) will be assessed together in ratios as a marker of anatomical imbalance. These derived anatomical balance ratios will be assessed for relationship to: 1) OSA severity (AHI); and, 2) MAS treatment response.

Progress to date: Demographic and PSG data from forty subjects (29 males, 11 females) have been collected. Measurements of facial and intraoral distances are in progress.

Intended outcome and impact: To develop a simple clinical tool for the assessment of anatomical imbalance by using ratios of facial soft tissue and inter-tooth dimensions. This measure of anatomical imbalance may delineate the subgroup of OSA patients who are more likely to respond to MAS therapy.

047

PREVALENCE AND ASSOCIATIONS OF INSOMNIA IN LUNG TRANSPLANT RECIPIENTS: A CROSS SECTIONAL STUDY

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Background: Insomnia is common and often unrecognised. It impairs daytime function and quality of life. Medical disorders and medications associated with insomnia are common amongst lung transplant recipients. However, the prevalence of insomnia in this population is unknown. We aimed to determine the prevalence and associations of insomnia in lung transplant recipients.

Methods: We conducted a cross-sectional study within a state-wide lung transplant service. Consecutive patients attending the lung transplant clinic on random days in November and December 2016 were invited to participate in the study if they were more than 4 weeks post-transplant and had no pre-existing diagnosis of a sleep disorder. Participants completed the Insomnia Severity Index (ISI) and Hospital Anxiety and Depression Scale (HADS). Insomnia was defined as an ISI score of ≥15 out of 28. The HADS has a maximum score of 21 for each of the two components, anxiety (HADS A) and depression (HADS D). Medications and lung function data were also recorded.

Results: N = 81. Mean age 57 ± 13 years; 46 male. Median time since transplant 350 days (128-1228). All patients were on prednisolone, mean dose 10.4 ± 4.2 mg. Mean FEV1 76 ± 26% predicted. Mean ISI score 9.3 ± 7.4, and the prevalence of insomnia was 32% (95% confidence interval (CI) 23, 43). Mean HADS A score 5.4 ± 3.7, and mean HADS D score 3.8 ± 3.4. Insomnia was more common in female patients (odds ratio (OR) 5.0, 95% CI 1.8, 14.3). In a multivariate analysis, insomnia was associated with the HADS A (OR 1.24, 95% CI 1.06, 1.46) and HADS D scores (OR 1.27, 95% CI 1.05, 1.52), adjusted for age, sex, FEV1 and prednisolone dose. Insomnia was not associated with age, prednisolone dose, time since transplant, FEV1, 6-minute walk distance, analgaesic use, or use of anti-depressant or anti-anxiety medications.

Discussion: There is a high prevalence of insomnia amongst lung transplant recipients, irrespective of prednisolone dose, time since transplantation or lung function; and it is associated with symptoms of anxiety and depression. It is important to note that the ISI does not differentiate insomnia from sleep disturbance due to other sleep disorders. Therefore, clinician assessment remains essential.

048

DETAILED POLYSOMNOGRAPHY IN AUSTRALIAN VIETNAM VETERANS WITH AND WITHOUT POST TRAUMATIC STRESS DISORDER

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Introduction: Recent results from GMRF-PTSD-01, a cross-sectional cohort study in 214 Vietnam Veterans (VV) with and without post traumatic stress disorder (PTSD), demonstrated an increased prevalence of sleep disorders in PTSD subjects, based on self-reported questionnaires. This study aims to objectively assess the prevalence and severity of both sleep disordered breathing and periodic limb movements (PLM) using detailed polysomnography (PSG) in VV with and without PTSD.

Methods: Participants from GMRF-PTSD-01 were recruited to undergo detailed PSG. PTSD status was confirmed using the clinician administered PTSD scale (CAPS-5). Supervised questionnaires including Epworth Sleepiness Scale (ESS), Berlin and Mayo, self reported restless legs, and alcohol use (AUDIT) were attained. Detailed PSG data including sleep architecture, body position, respiratory and arousal indices, periodic limb movements and cardiovascular parameters were collated. Statistical analysis directly comparing the PTSD and non-PTSD cohorts was undertaken.

Results: Seventy-four VV (all male; 40 with PTSD) underwent detailed PSG, 59 prospectively. No difference in age, BMI, ESS, or AUDIT was seen. VV with PTSD had significantly higher Berlin scores (69.2% vs. 38.2%; $p < 0.01$) and higher rates of reported restless legs (41% vs. 20.6%; $p = 0.06$) and limb movements (55% vs. 17.6%; $p < 0.01$). Based on respiratory disturbance index, no difference was seen in obstructive sleep apnoea (OSA) prevalence or severity, however VV with PTSD had an increased duration of sleep with oxygen saturations ($SpO2$) < 90% (10.2% vs. 1.8%; $P = 0.02$). Other respiratory indices, SpO2 nadir, sleep architecture, EEG arousals, PLM, mean heart rate and blood pressure were similar between groups.

Discussion: In VV with and without PTSD, apart from duration of sleep with SpO2 < 90%, no difference was seen in the prevalence and severity of OSA, PLM, and other PSG parameters. Moreover, VV with PTSD demonstrated an increased perception of sleep disorders. Exploration into these objective and subjective discrepancies is warranted in order to better understand and manage individuals with PTSD, particularly in the veteran population.

049

EVALUATION AND MANAGEMENT OF PERSISTENT OBSTRUCTIVE SLEEP APNOEA IN DOWN SYNDROME CHILDREN: BEYOND ADENOTONSILLECTOMY

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Introduction: Obstructive sleep apnoea (OSA) affects 60-80% of Down syndrome (DS) children. Adeno-tonsillectomy (AT) and /or CPAP are usually offered as first-line treatments for OSA in this population. Multilevel airway collapse however is common in DS and these conventional therapies are seldom completely curative. Drug-induced sleep endoscopy (DISE) may identify sites of persistent upper airway obstruction and direct customized surgical procedures.
Aim: To assess the role of DISE in evaluation of persistent OSA in DS children.
Methods: Retrospective analysis of DS children who had polysomnography (PSG) between 2000-2017, identifying those with persistent OSA despite previous AT, adenoidectomy or revision adenoidectomy, and who had a DISE evaluation under propofol and sevoflurane. 6 anatomical levels were assessed during DISE and the influence of these findings on management was analysed. Obstructive Apnoea-Hypopnoea Index (OAHI) was compared using paired T-test.
Results: 46 DS subjects were identified: 36 had OSA. Of these, 25 with mean age 3.25y (0.11-14.90), BMI z-score 1.61 (−1.08-4.53), were included because they had persistent OSA despite conventional surgery. Fourteen underwent further intervention: DISE-directed in 10; conventional in 4. The commonest DISE finding was hypopharyngeal obstruction due to tongue base collapse: complete in 9, partial in one. Ten patients had DISE-directed surgery including revision adenoidectomy, lingual tonsillectomy, coblation tongue channelling, epiglottopexy. Post-DISE PSG data were available in 5 patients. There was significant OAHI improvement before and after DISE-directed surgery ($t_4 = 2.5$, P 0.03): pre DISE mean 14.58 (SD 12.12); post DISE mean: 5.54 (SD 4.96). There was significant improvement of OAHI in DISE-directed surgery group (n = 5) compared with conventional surgery group (n = 4): $t_7 = 3.35$, P 0.01.
Discussion: DISE has a role in identifying sites of upper airway obstruction in DS. Treatment decisions based upon the DISE findings may improve outcomes. In our cohort, both clinical and OAHI improvements were observed in the DISE-directed surgery group. Further prospective studies are needed to confirm our findings.

050

EMAIL/INSTANT MESSAGING BEFORE BED IS ASSOCIATED WITH LESS TIME IN BED FOR AUSTRALIAN 8-16 YEAR OLDS

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Introduction: Achieving adequate sleep is associated with improved health (mental and physical), performance (academic and social) and general wellbeing in children and adolescents. Evening technology use is increasingly common and may impact sleep. However, current knowledge on interactive online use before bed is limited, and little is known about the relationship between interactive media and sleep outcomes in children and teens. Given that different forms of engagement with screen time may differentially influence sleep, this study aimed to determine whether frequency of email and instant messaging (email/IM) during the hour before bed is predictive of reduced time in bed (TIB).
Methods: Children (8-16 years) from two Australian were invited to complete the Children's Report of Sleep Patterns (CRSP) questionnaire. TIB was calculated from most recent bed and wake times. Frequency email/IM use was derived from self-report response to: *"During the hour before you go to bed how often do you email or instant message with friends?"* Response ranged from: *Never* to *always* on a 5-point Likert scale. Hierarchical multiple regression analysis was used to develop a model for predicting TIB based on age, gender (Model 1) and frequency of email/IM use (Model 2, with age and gender).
Results: A total of 239 students (77.1% female) completed the questions on age, sex and email/IM use. Increasing age, and sex (female) were associated with shorter TIB (Model 1, $F_{2,236} = 40.62$, $p < 0.001$; $\Delta R^2 = 0.25$). Including email/IM use in Model 2 revealed that higher frequencies of email/IM use during the hour before bed were associated with shorter TIB (Model 2, $F_{6,232} = 15.43$, $p < 0.001$; $\Delta R^2 = 0.27$). This was particularly apparent in children who reported usually using email/IM to socialise with friends during the hour before bed.
Discussion: Higher frequency of interactive email and instant messaging technology use during the hour before bed for socialising was associated with less TIB. Appropriate management of screen time during the hour before bed should include restricting social interactions with peers as a strategy for improving sleep behaviours in children and adolescents.

051

DEMOGRAPHIC FACTORS RELATED TO SLEEP OUTCOMES AMONG NEW ZEALAND ADOLESCENTS

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Introduction: Insufficient sleep is a major issue for many New Zealand (NZ) adolescents and is adversely associated with poorer physical and mental health, including body weight. The aim of this study was to examine demographic characteristics associated with sleep outcomes among New Zealand adolescents.
Methods: Adolescents aged 13-17 yrs (n = 4,811) were recruited via Facebook advertisements to complete an online questionnaire between November 2016 and January 2017. This included questions on demographics, weight, height and the Pittsburgh Sleep Quality Index (PSQI). Preliminary analyses were conducted using multiple linear regression and logistic regression to investigate relations between demographic factors (gender, age, ethnicity, area-based deprivation) and sleep outcomes.
Results: Mean sleep duration was 8 h 16mins (SD 1 h 46mins) and 56% reported poor sleep quality. Weekday sleep duration declined with increasing age (13 yrs: 9 hr 2mins, 17 yrs: 8 hrs 6 mins, $p < 0.001$). There was no evidence of a difference in sleep outcomes between Māori and NZ European adolescents however sleep duration was significantly lower among those reporting Chinese ethnicity (7 h

46mins) compared to NZ Europeans (8 hr 22 mins, $p < 0.001$). There was no evidence of a difference in sleep duration by the NZ Index of Deprivation ($p = 0.979$). The odds of a poor global PSQI score were higher for girls compared to boys (OR 1.85, $p < 0.001$), adolescents 17 years compared to 13 years (OR 1.45, $p = 0.020$) and obese compared to normal BMI category (OR 1.49, $p = 0.003$). Poor scores for sleep efficiency also increased with age but the odds of reporting sleep disturbances declined with age ($p < 0.001$).

Discussion: These preliminary results show no evidence of a difference in sleep outcomes by area level deprivation. Adolescents of Chinese ethnicity had shorter sleep duration due to later bed times and further research to understand the lifestyle factors contributing to this is warranted. Sleep quality was a particular problem among older adolescents, girls, and obese adolescents.

052

AN RCT OF LIGHT THERAPY AND MORNING ACTIVITY FOR DELAYED SLEEP-WAKE PHASE DISORDER IN ADOLESCENTS

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Flinders University

Introduction: Delayed Sleep-Wake Phase Disorder (DSWPD) is common in young people. Sleep timing is significantly delayed relative to their daily commitments (e.g., school), which results is restricted sleep and impaired daytime functioning. However, there are a lack of trials investigating the effects of treatment on the sleep and functioning of young people with DSWPD. The present study investigated the effects of bright light therapy (via portable light glasses) and morning activity (via exergames) over three weeks of treatment and at 1- and 3- month follow up.

Methods: Adolescents were randomly allocated to receive one of four treatments; Green Bright Light Therapy (BLT) and sedentary activity (N = 15, mean age = 15.9 ± 1.8y), Green BLT and morning activity (N = 15, mean = 16.2 ± 2.8y), Red LT and sedentary activity (N = 15, mean = 15.5 ± 1.6y) or Red LT and morning activity (N = 15, mean = 15.7 ± 2.8y). Each participant undertook a structured clinical assessment interview and three treatment sessions with a psychologist, each held one week apart. Measures of sleep (e.g., online sleep diary) and daytime functioning (e.g., Pediatric Daytime Sleepiness Scale, Flinders Fatigue Scale, Sheehan Disability Scale, Short Mood and Feeling Questionnaire) were taken pre- and post-treatment and at 1- and 3-months post treatment.

Results: Adolescents significantly advanced their school night sleep onset time ($d = 0.53$) and wake up time ($d = 0.31$), reduced sleep onset latency ($d = 0.32$) and increased total sleep time ($d = 0.25$) from pre- to post-treatment. Daytime sleepiness ($d = 0.89$), fatigue ($d = 0.59$), functional impairment ($d = 0.65$) and depression symptoms ($d = 0.23$) also improved from pre- to post-treatment. However, there were no significant interaction effects ($p > .05$). Improvements were maintained at follow up.

Discussion: Bright Light Therapy appears to be beneficial to the sleep and daytime functioning of adolescents with DSWPD. The addition of morning activity did not lead to improved outcomes in the present study. Implications of these findings will be discussed.

053

IMPACT OF MATERNAL SLEEP APNOEA ON CHILDHOOD HEALTH AND DEVELOPMENTAL OUTCOMES: LONGITUDINAL POPULATION RECORD LINKAGE STUDY

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Introduction: Sleep apnoea in pregnancy is known to adversely affect birth outcomes. Whether in utero exposure to maternal sleep apnoea is associated with long-term childhood consequences is unknown.

Methods: Population-based longitudinal study of singleton infants born during 2002 to 2012 was conducted using linked birth, hospital, death, developmental, and educational records from New South Wales, Australia. Maternal sleep apnoea during pregnancy was identified from hospital records. Outcomes were mortality and hospitalisations up to age 6, developmental vulnerability in the 1st year of school (aged 5-6), and performance on standardised tests in the 3rd year of school (aged 7-9). Cox proportional hazards and modified Poisson regression models were used to calculate hazard and risk ratios for outcomes in children exposed to maternal apnoea compared to those not exposed.

Results: 209 of 626,188 singleton infants were exposed to maternal sleep apnoea. Maternal apnoea was not significantly associated with mortality (Fisher's exact $p = 0.48$), developmental vulnerability (adjusted RR 1.29; 95% CI 0.75-2.21), special needs status (1.58; 0.61-4.07), or low numeracy test scores (1.03; 0.63-1.67) but was associated with low reading test scores (1.55; 1.08-2.23). Maternal apnoea significantly increased hospitalisations in the 1st year of life (adjusted HR 1.81; 95% CI 1.40-2.34) and between the 1st and 6th birthdays (1.41; 1.14-1.75). This is partly due to admissions for suspected paediatric sleep apnoea.

Conclusions: Maternal sleep apnoea during pregnancy is associated with poorer childhood health. Its impact on developmental and cognitive outcomes warrants further investigation especially as the impact of treatment for maternal apnoea could not be evaluated in this study.

054

SLEEP GENOTYPES IN INDIGENOUS CHILDREN AND RELATIONSHIP WITH ACADEMIC PERFORMANCE

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Background: Individual differences in paediatric sleep duration and sleep phase preferences have been clearly identified and could be described as different 'phenotypes' of sleepers. Understanding these differences impacts treatment planning. There is a paucity of empirical evidence regarding sleep genotypes in Australian children and even less in Australian Indigenous children. This is important given the health education and equity gap between indigenous and non-indigenous children.

Methods: Data for 513 children (7 – 9 years; 52% male) were sourced from the Australian Longitudinal Study of Indigenous Children (LSIC) and the National Assessment Program - Literacy and Numeracy (NAPLAN). Latent class analysis were used to determine classes of sleep schedules taking into account sleep duration, bedtimes, waketimes and variability in sleep schedules from week to weekends controlling for SES and family demographics. General linear models were used to associations between sleep and NAPLAN scores.
Results: Five sleep schedule phenotypes were identified: Normative sleep; Early Risers; Long Sleep; Variable Sleep; and, Short Sleep. NAPLAN scores differed significantly between some of the classes, with the Short Sleep class having significantly poorer grammar and numeracy performance compared with Long Sleepers. The Variable Sleep class also had significantly poorer numeracy performance compared with Long Sleepers. Maternal education and geographical remoteness were associated with poorer sleep.
Conclusions: Short sleep and highly variable sleep are associated with poorer performance on numeracy and literacy in Indigenous children. Sleep scheduling is modifiable with increased awareness and education as a first step, so this offers opportunity for improvement in sleep and thus downstream performance outcomes for these children. Further studies in non indigenous children may produce similar findings and present similar opportunities.

055

A META-ANALYSIS TO PROVIDE NORMATIVE PAEDIATRIC DATA FOR ACTIGRAPHY VARIABLES

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Background: Sleep patterns across childhood and adolescence have been derived primarily from subjective measures using parental questionnaires or diaries. Actigraphy provides a greater degree of objectivity, however despite its now widespread use in paediatric sleep studies, there are currently no age-related normative data available. The ASA Paediatric Council Actigraphy Working Party conducted a systematic review and meta-analysis of the sleep literature to derive normative values for actigraphy sleep variables from studies of healthy children. This study aimed to calculate pooled mean estimates of key actigraphy-derived sleep variables across the paediatric age range and to examine weekday-weekend differences.
Methods: In January 2016, a systematic search was performed across 8 databases of studies that included at least one actigraphy sleep variable from healthy children aged 0 to 18 years. Data were analysed using random effects meta-analysis and meta-regression using age as the covariate.
Results: We identified 81 studies from 1067 publications with suitable data. Heterogeneity was high for all variables. Sleep duration declined 8.4 minutes (95% CI: 5.4,11.4) for each one-year increase in age. Similar results were found for total sleep time. There was a significant curvilinear association between both sleep onset and sleep offset with age ($p < 0.001$). There was a small but significant decrease in sleep efficiency with age ($r = -0.2$, $p < .001$). Sleep latency was stable across the age range; mean estimate 20.7 minutes (95% CI: 17.9, 23.5). Wake after sleep onset measures showed too much variability to combine. Twenty-one studies yielded weekday-weekend data in 3 age bands from 8-18 years. Significant differences were found within the 15-18 year age band where sleep duration was 50 minutes longer; and sleep onset and offset 1 and 2 hours later respectively on the weekend compared to the weekday.
Conclusion: This meta-analysis provides comprehensive normative values of sleep patterns derived from actigraphy in healthy paediatric populations. These values have important applications as reference values to guide clinic assessments and as comparison values for research data.

056

SLEEP QUALITY AND QUANTITY ON EXERCISE PERFORMANCE, COGNITION AND MOOD STATES IN ADOLESCENT ATHLETES

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Introduction: Due to the high metabolic, neurological and cognitive cost of exercise, athletes need sufficient sleep to recover in preparation for subsequent training or competition. Adequate sleep quantity and quality may be more relevant to adolescent athletes due to growth and maturation at this stage of their lives. Therefore, the aim of the study was to examine effect of sleep quality and quantity in adolescent athletes on exercise performance, mood and cognition.
Methods: 15 youth athletes from a local high performance athlete program aged 14-17 years participated in the study. Participants completed a familiarisation session followed by four conditions in a randomised order including a) normal (CONT) night sleep (7-8 hours); b) shortened sleep duration (4 hours) due to late bed time (2am), c) extended sleep duration (10 hours) and d) sleep fragmentation (FRAG) including 7-8 hours sleep but with alarms set every 3 hours during the night. Participants wore an Actiwatch for the intervention night and 5 nights baseline sleep prior to the study. The day following each sleep intervention, athletes completed a battery of tests including vertical jump, 20 m sprint times, agility run test, throwing reaction task, Stroop Task, and Wellness and Mood States questionnaires.
Results: Mean 20 m sprint was quicker during the EXT condition compared to CONT and FRAG ($P = 0.02$-0.04), while agility times were quicker in the EXT condition compared to FRAG ($P = 0.05$). There were no differences between conditions for peak or mean vertical jump height. Total number of accurate throws during the throwing reaction task was significantly lower in FRAG compared to all other conditions, despite no effects on total test duration. Incongruent questions were affected by sleep quality during Stroop task with slower times in FRAG compared to all other conditions. Wellness and mood states were negatively in the RES and FRAG compared to CONT.
Discussion: Sleep quality rather than quantity may be of greater relevance to cognition but quality and sleep duration appear to influence exercise performance attributes in youth athletes that are common to many sports. Questionnaire data also indicate that reductions in both sleep quantity and quality negatively affect wellness and mood states which may have implications on both sporting and school performance.

057

EFFECTS ON POLYSOMNOGRAPHIC AND QEEG SLEEP OUTCOMES OF MULTIPLE NIGHTS ON-CALL IN A LABORATORY ENVIRONMENT

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Objectives: Disturbed and/or shortened sleep is reported by individuals engaged in on-call working arrangements, as a result of either overnight calls or stress. Given the known adverse impact of sleep disruption on cognitive performance, and the safety- and time-critical nature of on-call work, changes to sleep in on-call workers may have significant impacts. As such, this laboratory study aimed to investigate the impact of being on-call on sleep over consecutive nights. It was expected that additional nights on-call would result in more disturbed sleep.

Methods: Forty-six male participants (aged 20-35) spent four nights in a time-isolated sleep laboratory (one adaptation night, one control, and two on-call nights). Despite being instructed prior to bed that they were on-call, participants were not actually woken until the end of the 8 h sleep period (2300 – 0700). Polysomnography utilising standard electrode channels (C4/M1, F4/M2, O2/M1) was used to record and score sleep, and subsequent quantitative power spectral analyses on the Cz channel were performed. Linear mixed-effects analyses of variance were employed to compare conditions for all variables.

Results: No significant differences were found in total sleep time, wake after sleep onset, sleep efficiency or sleep onset latency. Latency to REM (minutes) was significantly shorter on the second on-call night (67.8 ± 12.4) compared with the control night (77.0 ± 21.3, $p = .007$) and the first on-call night (77.5 ± 21.8, $p = .003$). Additionally, fewer minutes of REM were found in the control condition (105.6 ± 18.6) compared with the second on-call night (113.9 ± 19.7, $p = .012$). Power spectral analyses indicated that there were no significant differences between conditions in the proportion of delta, theta, alpha, sigma, or beta activity within each sleep stage (REM, NREM, N1, N2, N3).

Conclusions: There may be a cumulative effect of nights on-call on REM outcomes, as decreased REM latency and an increase in the proportion of REM occurred only on the second on-call night. These changes have been suggested in other research areas to be an adaptive response to stress, which in an on-call environment may be linked with the knowledge that the individual may be called to perform a task at any time. As these effects are apparent after just two on-call nights, additional consecutive nights, which often occur in real world work environments, may result in greater changes to sleep outcomes.

058

PERCEPTION VERSUS REALITY – CHANGES IN SUBJECTIVE SLEEP OUTCOMES IN DIFFERENT ON-CALL SCENARIOS

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Introduction: On-call working arrangements are an effective way for industry to manage unpredictable, 24 h operations. However, a consistent finding in the (limited) literature is that being on-call has negative consequences for sleep, even in the absence of actual calls. It has been hypothesised that stress, relating to certain aspects of on-call, is a mechanism by which sleep is impacted. Using three separate studies, our aim was to compare participants' perception of their sleep when on-call and not on-call.

Methods: Healthy, adult (20-35 yrs) males ($n = 72$) participated in one of three studies, which involved 4-days and nights in the sleep laboratory. Following Adaptation and Control nights (2300 h-0700 h) were two nights 'on-call' where each study manipulated a different aspect of on-call to elicit either high or low stress prior to bed; 1) *likelihood of getting called*; 2) *importance of the task required when called*; 3) *likelihood of missing a call*. Prior to bed each night, participants were asked how well they expected to sleep. After waking they were asked how much they slept, how well they slept and how restless their sleep was. Repeated Measures ANOVAs (within-subject factor of *night*) compared subjective sleep outcomes for each study.

Results: For all studies, there was a significant main effect of *night* for 'how well do you expect to sleep' and 'how much sleep did you obtain' with participants expecting to sleep less *and* poorly when on-call compared to a control night. For Study 1 only (*likelihood of getting called*) there was a significant main effect of *night* for 'how well did you sleep' ($F_{2,28} = 6.8$ $p < .05$) and 'how restless was your sleep' ($F_{2,34} = 9.5$ $p < .05$). Post-hoc analyses revealed that participants did not sleep as well and had a more restless sleep when told they would definitely get called compared to a control night.

Discussion: While there were no significant differences between the differing on-call nights in each Study, small differences were detected between on-call in general and control nights. Study 1, where the likelihood of being called was investigated, appears to have produced the most marked results with conditions of certain likelihood (definitely being called) resulting in differences in perceived sleep quality not seen in Studies 2 and 3. This is the first study to systematically assess subjective sleep outcomes and compare different on-call scenarios in a controlled laboratory environment.

059

NIGHTTIME SLEEP AND NEXT-DAY PERFORMANCE IN NEW MOTHERS: BETWEEN- AND WITHIN-PERSON ASSOCIATIONS DURING THE EARLY POSTPARTUM MONTHS

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Introduction: Early postpartum sleep disturbance is common and has been linked to maternal neurobehavioural impairment, based on

data averaged across multiple days. We micro-examined the relevance of nighttime sleep to next-day performance across the first 4 months postpartum.

Methods: Participants were N = 94 (M ± SD = 27.4 ± 4.9 years, 88.3% primiparous) women who wore actigraphy and completed 5-minute psychomotor vigilance tests (PVT) daily during postpartum weeks 2–13 (n = 70) or weeks 9–16 (n = 24). Multilevel models with continuous linear time examined the associations between nighttime sleep and next-day PVT, controlling for age, education, parity, and chronotype. Daily total sleep time (TST) and sleep efficiency (SE) were decomposed into between- and within-person variability. PVT outcomes included lapses-per-trial (using Poisson models), mean, fastest and slowest 10% reaction time (RT; log-transformed).

Results: All PVT outcomes worsened significantly over time ($p < .001$). Overall, shorter TST and lower SE were associated with worse next-day PVT performance. The significant effects of TST/SE within-person variability on performance were over and above between-person variability. Further, the strengths of associations between TST/SE and next-day performance (excepting TST and mean/fastest 10% RT) changed significantly over time (p-values<.05). Associations between TST and lapses/slowest 10% RT were strong initially (p-values<.001), but decreased to non-significance during later postpartum weeks. In contrast, associations between SE and all PVT outcomes were non-significant during the initial postpartum weeks, but strengthened to statistical significance later.

Discussion: Shorter and lower-quality sleep, particularly in relation to one's own patterns, are related to poorer next-day functioning in postpartum women. Importantly, this pattern changes: shorter sleep duration during early, and lower sleep efficiency during later postpartum weeks were particularly detrimental. It is important to consider sleep in the context of individual's own sleep/wake patterns. Protecting sleep duration in the first postpartum month, and promoting sleep quality/continuity thereafter may be protective against the adverse effects of sleep disturbance on new mothers' daytime functioning.

060

IT'S IN THE EYES: PUPILLARY RESPONSE PROVIDES A PHYSIOLOGICAL MARKER OF ALERTNESS AND PERFORMANCE IMPAIRMENT

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Introduction: Ocular parameters remain a primary candidate for predicting the alertness state, with several devices currently commercially available aimed at predicting alertness failure. A novel biomarker known as the Pupillary Unrest Index (PUI) reflects alterations in sympathetic nervous system activity via instability of pupillary response. The extent to which the PUI accurately predicts subsequent performance impairment is currently unknown.

Method: Sixteen healthy young adults (9 men, 21.3 ± 3.42y) underwent a three night stay in the laboratory, comprising one night of baseline sleep, a 40-hour extended wake period, and a night of recovery. Two hours post habitual wake-time, and thereafter bi-hourly, participants completed an 11-min test of PUI, a subjective rating of sleepiness (KSS), and a 10-min visual PVT. Data were averaged across the first 16 hours to create a baseline period, and each time point compared for time awake effects. To examine the predictive capacity of PUI, compared to subjective ratings alone, each PVT was classified as "impaired' if lapses exceeded a 25% (mild), 50% (moderate) or 75% (severe) threshold increase above individual baseline levels. ROC analyses were then performed.

Results: PUI, PVT lapses and KSS showed a similar time course across the 40 hours of sleep deprivation. All metrics increased as a function of time awake ($p < 0.0001$), peaking 22-26 hours post wake. The predictive capacity of both PUI and KSS were moderate-high, (PUI: 0.76-0.82; KSS: 0.81-0.86), with no significant difference between the measures. Predictive capacity was dependent on the level of impairment: PUI was a better predictor at lower levels of impairment [AUC 0.82 (25/50%) vs. AUC 0.76 (75%), while KSS remained high for all (AUC > 0.81).

Discussion: While self-reported sleepiness accurately predicts performance impairment, few drivers engage in self-monitoring and/or adaptive behaviours. Objective markers are therefore essential in combating drowsy driving. Our data provides the first evidence that PUI can be used as a predictor of performance impairment, particularly in the early stages of alertness failure, and allows for the development of appropriate cut off scores.

061

HIGHER ORDER COGNITION IS PRESERVED IN THE WAKE MAINTENANCE ZONE DURING 40 H SLEEP DEPRIVATION

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Introduction: Sleep deprivation adversely impacts cognitive functions. Increased time without sleep may not correspond to greater cognitive impairment, however, as the alerting signal from the circadian system during the biological day counteracts the effects of increased time awake. Despite the prevalence of sleep deprivation studies where cognition has been tested either in the morning (24-27 h sleep deprivation) or in the evening (34-37 h sleep deprivation), comparatively few have compared sleep deprived performance to well-rested performance at the same time of day. This comparison forms the basis of this study.

Methods: Twenty-three healthy volunteers (18 males; mean age = 25.4 ± 5.7y) were sleep deprived for 40 hours under constant routine conditions. The Psychomotor Vigilance Test (PVT) and Karolinska Sleepiness Scale (KSS) were administered bi-hourly. A cognitive test battery assessing processing speed, visual learning, visual attention, and working memory was administered at 3 h, 13 h, 27 h, and 37 h after habitual wake time. Paired t-tests compared sleep deprived performance with well-rested performance at the same time of day, namely morning (3 h versus 27 h post-wake) and early evening (13 h versus 37 h).

Results: PVT mean reaction time, number of lapses, and the cognitive test of processing speed were significantly greater at 27 h and 37 h, relative to the time-matched controls. In contrast, visual attention, visual learning, and working memory were significantly

poorer at 27 h compared to 3 h (the morning tests), but there was no significant difference in performance between 37 h and 13 h of wake. The tests at 13 h and 37 h occurred within a 3 hr window prior to evening melatonin onset timing, described as the wake maintenance zone (WMZ), a period where the circadian alerting signal is strongest.
Discussion: Vigilant attention and processing speed were significantly poorer during sleep deprivation, including in the WMZ. In contrast, performance on more complex cognitive tasks was impaired at 27 h awake, but preserved in the WMZ despite increased homeostatic sleep pressure (37 h awake). This builds on previous findings of improved performance in the WMZ by showing that its effects depend on the cognitive domain being measured. Overall, these data show that the impact of time awake and circadian factors on cognition depends on the domain and complexity of the task used.

062

REFLEX SUPPRESSION OF DIAPHRAGM AND GENIOGLOSSUS ACTIVITY AT FLOW LIMITATION ONSET IN OBSTRUCTIVE SLEEP APNOEA

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Introduction: Obstructive sleep apnoea (OSA) is characterised by frequent partial (hypopnoea) or complete (apnoea) collapse of the upper airway in sleep. Hypopnoea events dominate in OSA and reflect snoring and Starling resistor-like behaviour of the upper airway, where a choke point develops to limit airflow irrespective of downstream pressure. A direct consequence is reduced ventilation and failure of increasing inspiratory effort to effectively compensate. Thus, flow limitation represents a major challenge to breathing in sleep, particularly in OSA. Inspiratory muscles are known to exhibit reflex suppression to airway occlusion, and this has been postulated to protect against worsening choking through deeper foreign body inhalation. However, differential reflex suppression could also help to re-adjust upper airway versus inspiratory pump muscle activity in response to flow limitation; a far more common form of choking and a major breathing impediment in sleep. The aim of this study was to test the hypothesis that flow limitation onset is a potent stimulus for differential genioglossus versus diaphragm EMG reflex suppression in sleep.
Methods: Flow limited breaths and the point of flow limitation onset were identified from existing overnight recordings of airflow, oesophageal pressure (Poes), diaphragm and genioglossus EMG (EMGdi and EMGgg respectively) in 5 OSA patients. Within each patient, each flow-limited breath was classified as mild, moderate, or severe according to peak ΔPoes/ΔFlow tertiles. Average rectified EMGgg and EMGdi 1000 msec before and after flow limitation onset were subsequently determined within each patient, and reviewed for signs of EMG reflex responses and flow limitation severity dependence.
Results: Three of the five patients showed clear EMGdi suppression following flow limitation onset, but with no clear evidence of severity dependent effects. Two of these three patients also appeared to show a small EMGgg suppression around the time of flow limitation onset. The remaining patients showed no clear evidence of EMGgg or EMGdia reflex responses.
Discussion: These data support the concept that flow limitation onset is a stimulus for EMG reflexes, and that differential responses in upper airway versus inspiratory pump muscles could play an important role in restoring non-flow limited breathing. Further work is needed to examine if these responses are defective in OSA.

063

OESOPHAGEAL PRESSURE AND DIAPHRAGMATIC EMG AS ALTERNATE MEASUREMENTS OF RESPIRATORY DRIVE DURING OBSTRUCTIVE SLEEP APNOEA

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Introduction: Diaphragmatic EMG (Edi) and oesophageal pressure (Pes) are used independently as surrogates of ventilatory drive. While the relationship between Edi and Pes has been reported as linear, the relationship may become uncoupled when there are changes in respiratory mechanics, i.e. airway obstruction in patients with obstructive sleep apnea (OSA). Here we aimed to investigate the relationship between Edi and Pes during (1) apnoeas, (2) hypopnoeas, and (3) post-event recovery periods associated with arousals.
Methods: 12 patients with OSA were studied overnight with a pneumotachograph, oesophageal pressure catheter (Pes), and intraoesophageal diaphragmatic EMG (Edi). For each breath, Edi was summarised by its peak integrated value; and Pes by the nadir pressure swing minus start inspiratory value. Values were presented as a percentage of eupneic breathing during stable wakefulness. Edi and Pes values were measured during scored apnoeas, hypopnoeas and post-event arousals (first 3 breaths).
Results: Edi and Pes values are shown for apnoeas, hypopnoeas and post-event arousals (Fig. 1; error bars show 95% confidence intervals). Note that Pes swings increased during both apnoeas and arousals; by contrast Edi fell during apnoeas and rose with arousals. Pes swings were $46 \pm 52\%$ greater than Edi during hypopneas ($P < 0.05$), $74 \pm 48\%$ greater during apnoea ($P < 0.05$), but were similar ($-11 \pm 37\%$) during post-event arousal breaths.
Discussion: Increased drive during apnoeas according to Pes may be the result of the effect of airway occlusion on increasing pressure swings (e.g. chest wall mechanics, mechanical advantage). In contrast, obstructive apnoeas are most commonly associated with reduced neural ventilatory drive as determined by Edi.

064

THE RELATIONSHIP BETWEEN LOW DRIVE AND AIRWAY RE-OBSTRUCTION IN THE POST-AROUSAL RECOVERY PERIOD IN OSA

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Introduction: Arousal from sleep elicits brief hyperventilation and more prolonged upper airway muscle activation that can rapidly overcome airway obstruction in obstructive sleep apnoea (OSA). However, hyperventilation-induced low ventilatory drive could also promote ongoing cyclical airway re-obstruction. The net effects of

transiently augmented upper airway muscle activation and low ventilatory drive on post-arousal airway function remains unclear. The aim of this study was to examine ventilatory drive versus output interactions in the post-arousal recovery period from prior obstruction using a new quantitative technique to assess breath-by-breath ventilatory effort.

Methods: Previously recorded airflow, oesophageal pressure (Poes) and sleep study data from 6 males with severe OSA (mean ± SD age 44 ± 9 yr, BMI 35 ± 5 kg/m², AHI 77 ± 29 /hr) were analysed. Arousals (3-15 sec) and awakenings (>15 sec) in response to airway obstruction events were scored using conventional scoring methods. A novel method was used to define inspiratory effort onset and offset and to calculate attempted tidal volume and minute ventilation from Poes for direct comparison with achieved ventilation, breath by breath in the four breaths prior to and ten breaths following each respiratory related arousal. Each breath was plotted relative to arousal time in order to profile the time course of effort changes relative to ventilatory output post arousal within each subject.

Results: 125 ± 20 arousals and 83 ± 15 awakenings per subject were available for analysis. In all subjects, a significant drop in attempted ventilation was observed shortly after airway re-opening around the onset of arousal, followed by a reduction in achieved compared to attempted ventilation; consistent with re-obstruction recommencing within 10 breaths following most arousals, but with some variability in the latency of responses between subjects.

Discussion: These observations support that ventilatory effort rapidly reduces after airway re-opening and arousal, and that insufficient ventilatory drive to maintain an open airway emerges early in the post-arousal period despite transiently augmented upper airway muscle activity.

065

LOW END EXPIRATORY LUNG VOLUME DECREASES STERNOHYOID MUSCLE LENGTH (AN UPPER AIRWAY DILATOR) IN RATS

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Reduced end expiratory lung volume (EELV), as a consequence of obesity, sleep and supine posture, increases upper airway collapsibility and reduces upper airway lumen size, potentially contributing to the pathogenesis of obstructive sleep apnoea (OSA). However, mechanistic links between EELV and upper airway collapsibility are not well understood. We hypothesise that altering the EELV will alter the passive length of the neck strap muscles, thereby influencing the efficiency of these upper airway dilator muscles through altered length-tension relationships. The aim of this study was to measure the impact of changing EELV on *in vivo* sternohyoid muscle (SHM) length in anaesthetised rats.

Method: Four adult male, anaesthetised (ketamine/xylazine), supine, Wistar rats were placed inside a custom-built head-out plethysmograph with a neck seal. Airflow ($\dot{V}$) was monitored via a pneumotachograph (Hans Rudolph Inc, Kansas) attached to a custom-built snout mask. SHM length change was monitored using two sonomicrometer crystals (Triton Technology Inc, California) surgically implanted (10 mm apart) in the mid portion of the SHM. Baseline EELV was measured via plethysmography, and EELV was altered by graded changes in extra-thoracic pressure (−8 cm H_2O to 8 cm H_2O in 2 cm H_2O steps from baseline = 0 cm H_2O); change in EELV was measured from the integrated $\dot{V}$ signal. Data were averaged for 3 repeat runs and normalised (%) for baseline values. Group data were expressed as mean ± SD, continuous data were analysed using linear regression. $P < 0.05$ was considered significant.

Results: For the group baseline EELV was 15.8 ± 3.8 ml. Across the range of extra-thoracic pressures applied, EELV increased by up to 19.67 ± 2.25% and decreased by 3.74 ± 1.08%. In all animals, Increasing EELV was associated with increased SHM length, while decreasing EELV was associated with decreased SHM length. SHM length increased by 0.12 ± 0.03% per % increase in EELV, and decreased by 0.60 ± 0.14% per % decrease in EELV (both $P < 0.04$, $R^2 > 0.78$). Conclusion

The principal finding in this study was that changing EELV alters SHM length, however, SHM length is most sensitive to a fall in EELV. Low lung volumes may increase upper airway collapsibility in OSA patients via, at least in part, changes in upper airway dilator muscle effectiveness mediated by alterations in muscle length-tension relationships.

066

THE EFFECTS OF NORADRENERGIC AND ANTIMUSCARINIC AGENTS ON UPPER AIRWAY DILATOR MUSCLE ACTIVITY, BREATHING AND SLEEP IN HEALTHY INDIVIDUALS

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Introduction: Recent studies indicate that noradrenergic and antimuscarinic processes are crucial for sleep-related losses in upper airway muscle tone. This study aimed to determine whether a combined noradrenergic and antimuscarinic intervention would preserve sleep-related reductions in two key upper airway muscles (genioglossus and tensor palatini) in humans.

Methods: Data were acquired in 10 healthy adults in a double-blind, placebo-controlled, randomised, cross-over study. Participants were administered a combination of reboxetine (4 mg) plus hyoscine butylbromide (HBB, 20 mg) or placebo across two night studies (separated by ~1 week) prior to sleep (ACTRN12616000469415).

Results: The combination of reboxetine and HBB significantly reduced REM sleep as a percentage of total sleep time (0.59 ± 1.12% vs. 14.52 ± 6.77%, $p < 0.001$) and increased stage two sleep (65.29 ± 7.61% vs. 55.98 ± 9.96%, $p = 0.042$) compared to placebo. Peak genioglossus muscle activity decreased in the reboxetine plus HBB condition compared to placebo during non-rapid eye movement (NREM) sleep (2.77 ± 2.34% vs. 5.04 ± 3.08% maximum; $p = 0.047$). Nadir epiglottic pressure swings were also smaller in stage one sleep (−2.16 ± 0.85 vs. −3.02 ± 0.66 cmH_2O, $p = 0.018$) and upper airway resistance was reduced in stage two sleep in the reboxetine plus HBB condition compared to placebo (3.55 ± 2.54 vs. 5.90 ± 3.65; cmH_2O/l/s, $p = 0.024$). Tensor palatini EMG activity reduced to a similar extend during sleep under both conditions.

Conclusions: Contrary to our hypothesis, peak genioglossus activity decreased and tensor palatini activity was unchanged with the combined drug treatment. However, consistent with improved upper airway function, airway resistance decreased in stage 2 sleep.

Elimination of REM sleep may be beneficial for OSA patients who have REM-dominant OSA.

067

DOSE-DEPENDENT EFFECTS OF MANDIBULAR ADVANCEMENT ON KEY PATHOPHYSIOLOGICAL TRAITS THAT CONTRIBUTE TO OBSTRUCTIVE SLEEP APNOEA

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Introduction: Response to mandibular advancement splint (MAS) therapy for obstructive sleep apnoea (OSA) is variable. Understanding the effects of mandibular advancement on upper airway (UA) physiology may facilitate patient selection. Key pathophysiological traits that contribute to OSA include impaired UA anatomy (collapsibility), poor pharyngeal muscle function and a low threshold for arousal to flow limitation (ArTh). Dose-dependent effects of mandibular advancement (MA) on these traits are unknown. Thus, we aimed to (1) determine dose-response effects of MA on UA collapsibility (upper airway critical closing pressure; PCRIT), genioglossus muscle activity (EMGGG) and ArTh, and (2) compare these relationships to MAS treatment response.
Methods: PCRIT, EMGGG responsiveness to negative epiglottic pressure and ArTh were measured during sleep in response to UA narrowing via transient CPAP reductions at three mandible positions, 0% (habitual bite), 50% and 100% of maximal MA prior to commencing MAS therapy.
Results: 12 OSA patients (1 female) completed the protocol (mean ± SD age = 55 ± 11 years, BMI = 31 ± 4 kg/m^2, baseline AHI = 33 ± 13 events/h). PCRIT decreased (improved) progressively from habitual bite to 50% and 100% MA (+1.9 ± 3.9, −1.0 ± 3.1, −3.9 ± 3.2 cmH_2O, respectively, p = 0.001). EMGGG responsiveness tended to improve with MA (n = 6 analysed thus far: −0.06 ± 0.08, −0.08 ± 0.14, −0.12 ± 0.14%max/cmH_2O, respectively). There was also evidence that less EMGGG was required to restore airflow with MA, consistent with improved genioglossus muscle effectiveness. Conversely, ArTh decreased progressively from habitual bite to 50% and 100% MA (−20.4 ± 10, −18.7 ± 11, −16.1 ± 11 cmH_2O, respectively, p = 0.021). Responders to MAS therapy (AHI<10 events/h & AHI reduction >50%) tended to have a lower baseline PCRIT compared to non-responders (n = 8 completed to date: −0.1 ± 3 vs. 2.7 ± 2 cmH_2O, respectively).
Conclusions: These findings indicate MA improves UA collapsibility and potentially pharyngeal muscle function. Mandibular advancement increases propensity for awakening to airway narrowing which may limit therapeutic effectiveness in certain individuals. These initial prospective findings also highlight the potential for between patient differences in the pathophysiological traits and their potential role in improving prediction of MAS therapy outcome.

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SLEEP APNOEA AND SYMPTOMS OF DEPRESSION AND ANXIETY DURING PREGNANCY

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Background: Symptoms of depression and anxiety have been shown to be more common in obstructive sleep apnea (OSA) patients than in the general population. Both the prevalence and severity of OSA increase during pregnancy. Pregnancy is also a time of high risk for the development of depression and anxiety. This study examined the association between OSA, sleep quality and symptoms of depression and anxiety in the third trimester of pregnancy.
Methods: This observational study recruited pregnant women at greater than 26 weeks gestation with a single fetus presenting for antenatal care at King Edward Memorial Hospital, WA. Measurements included: sleep quality using the Pittsburgh Sleep Quality Index (PSQI); sleep disordered breathing using an ApneaLink monitor (nasal pressure and pulse oximeter); and symptoms of depression and anxiety from the Edinburgh Postnatal Depression Scale (EPDS). Data from medical records included age, parity, BMI, smoking status, history of depression and use of antidepressants.
Results: Data from 126 women were analysed for presence of OSA (Apnea Hypopnea Index, AHI, ≥5). OSA was observed in 28 (22.2%) women. Symptoms of depression (defined as an EPDS score of ≥13) were observed in 11 (8.7%) women and symptoms of anxiety (measured as a score of ≥6 on questions 3, 4 and 5 of the EPDS) were observed in 16 (12.7%) women. Compared to women without depressive symptoms, those with depressive symptoms had higher AHI (p = 0.03). Women with symptoms of anxiety were more likely to have sleep apnoea (AHI≥5; p = 0.007). Multivariate analyses controlling for age, BMI, parity, smoking status and history of depression showed that: (i) depressive symptoms were related to AHI, ODI3%, ODI4% and antidepressant use (p < 0.001); and (ii) symptoms of anxiety were related to presence of sleep apnoea (AHI≥5) and antidepressant use (p < 0.001).
Conclusion: OSA occurs in one fifth of women in late pregnancy. The severity of OSA is independently associated with symptoms of depression, while the presence of OSA is associated with symptoms of anxiety in pregnancy. The direction of this relationship is unknown but is an important focus for future research.

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THE EFFECT OF EXTENDED WAKEFULNESS ON POSTURAL CONTROL IN OBSTRUCTIVE SLEEP APNEA AND HEALTHY CONTROLS

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Introduction: Impaired postural control is a risk factor for falls, which can lead to severe, and debilitating, musculoskeletal injuries. Numerous studies have established that extended wakefulness

impairs postural control in healthy young and older adults. Recent research shows that OSA patients have poorer postural control compared to healthy individuals and that worse respiratory parameters (e.g., ODI, average SpO2%) are associated with decreased postural control. We examined if additional extended wakefulness would further compromise postural stability in OSA patients and control participants.

Methods: 18 healthy controls (age 41.4 ± 13.0 years, AHI = 3.4 ± 2.6) and 65 suspected OSA patients (age 48.9 ± 13.1 years, AHI = 23.04 ± 23.1) performed postuography. Testing occurred 5 hours before (baseline), and 3 hours after extended wakefulness, at a time based on participant's individual habitual bedtime (as determined by actigraphy and sleep diary). Postuography was performed standing on a force platform for 60s, with eyes closed. Postuography measures comprised velocities in the X and Y planes, average overall velocity, area of sway movement, and distance of movement of sway. Linear mixed models and correlations were used for analysis.

Results: The mixed models analysis showed there were no significant condition (baseline vs. extended wakefulness) by group (OSA vs. control) interactions, nor were there significant condition differences. There were significant group differences. The OSA patients had faster velocity in the Y plane ($p = .002$), along with faster overall velocity ($p < .001$), covered greater area ($p = .007$) and further distance of sway ($p < .001$). Both AHI and 3%ODI were significantly correlated to average velocity in the y plane ($r = -.434$, $p = .005$, and $r = -.433$, $p = .005$ respectively) and area of sway movement ($r = .406$, $p = .008$, and $r = .461$, $p = .002$ respectively).

Discussion: These results are in agreement with literature demonstrating postural control impairments in patients with OSA compared to healthy control participants, but additional sleep deprivation did not result in greater postural impairment in either group. Postural impairment was significantly associated with OSA severity. This suggests that OSA patients may be at increased risk of falls, but requires further investigation.

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COMORBID INSOMNIA AND SLEEP APNOEA IS ASSOCIATED WITH GREATER NEUROCOGNITIVE IMPAIRMENT COMPARED WITH OSA ALONE

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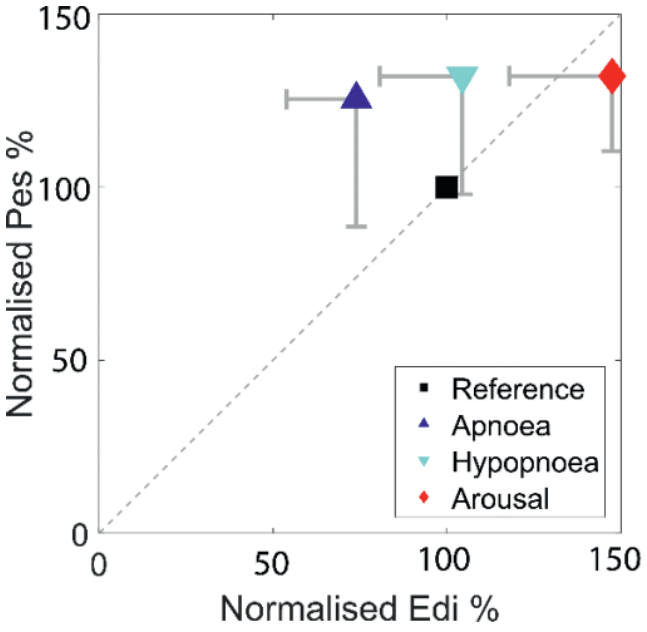
Introduction: Comorbid insomnia with sleep apnoea (COMISA) affects as many as 30% of patients with obstructive sleep apnoea (OSA) and may compound the negative health consequences associated with both conditions. The aim of this study was to compare neurocognitive function between patients with COMISA to patients with OSA alone.

Methods: 61 patients with snoring and suspected OSA underwent an in-laboratory overnight polysomnography (PSG). Prior to the PSG, patients completed the insomnia severity index and Epworth sleepiness scale and performed the psychomotor vigilance test (PVT) and a choice reaction time (CRT) test, starting at 7.30 pm. These tests were repeated after the patient woke up the next morning, starting at 7 am. Based on the questionnaires, patients were classified as suffering either COMISA (n = 18) or only OSA (n = 43). Other outcomes were compared between groups using independent samples t-tests.



Results: Compared to the OSA group, COMISA patients were similar in age (mean ± SEM 49 ± 2.7 vs 50 ± 2 yrs) but had higher BMI (mean ± SEM) (34.6 ± 1.8 vs 29.2 ± 0.8 kg/m², $p = 0.014$), AHI (32.3 ± 8.1 vs 17.1 ± 2, $p = 0.084$). and ESS scores (9.2 ± 1.14 vs 6.1 ± 0.5, $p = 0.02$) and spent more time in N2 sleep (57.2 ± 2.23% vs 49.8 ± 1.87%, $p = 0.016$). There was no significant difference in performance between groups in the evening test session, but in the morning session COMISA patients showed more lapses during both the CRT test ($p = 0.001$) and PVT ($p = 0.01$).

Conclusion: Patients with COMISA appear to show greater neurocognitive impairment when compared to patients with OSA alone, at least in the morning. Further research is warranted but these results suggest that it may be useful to assess the presence of insomnia symptoms more routinely in sleep clinic patients.

071

THE ASSOCIATION OF OBSTRUCTIVE SLEEP APNOEA WITH BRONCHIAL HYPER-REACTIVITY, CURRENT ASTHMA AND NOCTURNAL SYMPTOMS

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Introduction: Obstructive sleep apnoea (OSA) is associated with asthma, but the roles of nocturnal asthma-like symptoms (NAS) and bronchial hyper-reactivity (BHR) in this link are controversial. Our aim was to evaluate the association of OSA-risk with asthma, NAS and BHR, and whether BHR mediates or modifies these associations.

Methods: A subsample of the Tasmanian Longitudinal Health Study enriched for cough and asthma (n = 819) provided information on OSA-risk (score ≥3 on the STOPBang questionnaire) and asthma-

NAS clustering (based on symptoms, diagnoses, and treatment) and all underwent bronchial methacholine (MCh) challenge testing.
Results: Mean age of participants was 49.6 (SD 0.3) years and 50.2% were female. OSA-risk was associated with increased risk of: 1) current asthma (OR 1.6; 95% CI 1.1, 2.5), 2) current asthma with NAS (OR 2.5; 95% CI 1.1, 4.9), and 3) NAS without current asthma (OR 7.1; 95% CI 1.6, 31.4), but NOT with current asthma in the absence of NAS (OR 1.3, 95% CI 0.7, 2.4). Furthermore, BHR neither modified nor mediated these associations. Increasing probability of moderate-severe OSA (as defined by higher scores for STOP-Bang questionnaire) was positively associated with BHR only in those with asthma (log dose-response slope −0.19 per %change in FEV1 per mg MCh; 95% CI −0.36, −0.02), but not in those without asthma (log dose-response slope −0.06 per %change in FEV1 per mg MCh; 95% CI −0.22, 0.10).
Conclusions: OSA-risk is associated with current asthma only when nocturnal asthma-like symptoms are present, raising the possibility that some symptoms perceived as nocturnal asthma might in fact be symptoms of OSA. Further research using polysomnography to accurately determine the OSA status and its severity is required to confirm or disprove any association between OSA and BHR, and a role for BHR in the association between OSA and the asthma-NAS subgroups.

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LOOP GAIN VARIES ACCORDING TO SLEEP STAGE AND TIME OF NIGHT IN PATIENTS WITH OBSTRUCTIVE SLEEP APNOEA (OSA)

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Introduction: The severity of obstructive sleep apnoea (OSA) is known to vary during sleep. Specifically, patients are often able to achieve long periods of stable breathing during NREM stage 3 (N3) sleep that may not otherwise occur during NREM stage 2 (N2). Furthermore, in many individuals the severity of OSA can significantly worsen during REM sleep. Recent work has investigated how OSA pathophysiological factors such as upper airway collapsibility, muscle responsiveness and respiratory arousal threshold change according to sleep stage, however less is understood how ventilatory control (i.e. loop gain) varies in this way.
Methods: Standard diagnostic polysomnography was performed in forty-six OSA patients. Loop gain was estimated from spontaneous breathing using 7-minute windows of sleep containing at least one respiratory event. Square root transformed nasal pressure signal was used to provide a surrogate of ventilation, and a standard model of ventilatory control (gain, time-constant, delay) that best fit the observed ventilation data during periods of unobstructed breathing was used to estimate loop gain. Loop gains determined from windows dominated (>50%) by each respective sleep stage were averaged to provide loop gain values for stages N2, N3 and REM. To investigate how loop gain changes over the course of sleep, a secondary analysis was performed whereby the sleep period was split into 3 equal duration tertiles and mean loop gain calculated for each one.
Results: Loop gain was found to be significantly lower (i.e. ventilatory control more stable) in REM compared to N2 ($p = 0.001$) sleep. Differences in loop gain between REM and N3 ($p = 0.095$), and N2 and N3 ($p = 0.247$) sleep were not significant. Loop gain was lower in the first third of the sleep period compared to later 2nd ($p = 0.012$) and 3rd ($p = 0.015$) tertiles. REM loop gain tended to increase across the night, however this trend was not statistically significant ($F(2,12) = 3.49$, $p = 0.064$).
Discussion: These data suggest loop gain varies during sleep and modestly increases over the course of sleep. Lower loop gain in REM suggests that it is unlikely to contribute to the worsened OSA severity typically observed in REM sleep, but may in part, explain why respiratory events are of longer duration in this stage.

073

LESSONS TO BE LEARNT FROM THE SPANISH SLEEP NETWORK – PRAGMATISM, DATA SHARING AND GENEROSIDAD

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The Spanish Sleep Network was developed in the 1990s among a group of respiratory physician researchers from hospitals across Spain. Since this time they have been successful in producing major contributions to the field of sleep disordered breathing through their collaboration on large and impactful multicentre research projects.
Aim: To identify potential factors contributing to the success of the Spanish Sleep Network to enhance the success of a sleep research network in Australia.
Method: Sleep laboratory visits and interviews with members of the Spanish Sleep Network from four hospitals across Spain.
Results: There were four main areas that emerged as major contributors to the success of the Spanish Sleep Network in its multicentre research projects: 1. Pragmatism in the development of research questions and protocol writing. Projects are designed to be conducted wholly within the public health system, enabling rapid translation into the system and also minimising project costs. 2. Sharing of ideas and clear pre-project agreements between participating researchers. Research ideas are discussed openly twice a year at Spanish national conferences. Researchers are free to join or not join any project they wish to, and agreements state clearly the conditions for authorship. 3. Centralised logistics and data management for each project. Each project will allocate a lead site which is responsible for all study logistics. Each project also contributes funds to database development via a full time IT engineer. 4. Healthcare system level data sharing. Each of the 17 autonomous Spanish communities has its own healthcare system. Most of these have developed software that all hospitals and general practitioners must use in patient management. This improves research recruitment and minimises research data loss.
Discussion: Some factors which have contributed to the success of the Spanish Sleep Network may be implemented by Australian researchers to improve the success of our multicentre research: pragmatism, clear research agreements, open sharing of ideas and sharing of time consuming logistical tasks. There are others which are not able to be changed, but should be advocated for by the sleep research community, such as healthcare system level data sharing and fully-subsided sleep apnea treatments.

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EVALUATION OF A NEW SIMPLE DIAGNOSTIC TOOL FOR OBSTRUCTIVE SLEEP APNOEA

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Background: A major impediment to the provision of obstructive sleep apnoea (OSA) treatment is the reliance on sleep physician-led diagnostic laboratory-based polysomnography (PSG) which is labour-intensive, costly and has limited availability. A recent study indicated that a new two-stage model of screening questionnaire (OSA50), followed by home oximetry and nasal flow measurement (via the ApneaLink device; AL) might accurately identify patients with moderate to severe symptomatic OSA in primary care (1). This study investigated if a similar method could identify patients with moderate-severe obstructive sleep apnoea (OSA) in those already referred for polysomnography (PSG). Presented here is preliminary data.
Methods: All new referrals to The Prince Charles Hospital (TPCH) Sleep Disorders Centre were assessed for study suitability. Demographics, anthropometrics, Epworth Sleepiness Score, and OSA50 questionnaire were collected. Exclusion criteria included age <18-years old, pregnancy, patients with significant cognitive impairment, poorly controlled psychiatric disorder, those on treatment for OSA or on domiciliary oxygen. Participants underwent concurrent PSG and AL assessments. Receiver operating characteristic (ROC) analyses were performed and ROC area under the curve (AUC) was estimated.
Progress to Date: The population comprised 34 (62% males) patients with a mean age of 57 (SD 17). 14 (41%) had moderate-severe OSA based on Level 1 PSG. AL apnoea-hypopnea index (AHI) ≥15 had ROC AUC of 0.85, sensitivity of 86% and specificity of 85%. AL 3% oxygen desaturation index (ODI) >16 had ROC AUC of 0.84, sensitivity 93% and specificity 75%. Composite variables involving AL variables and others anthropometrics measurements, ESS and OSA50 did not improve ROC AUC scores or sensitivity but did improve specificity.
Intended Outcome and Impact: This study's preliminary data provides evidence that AL can diagnose moderate-severe OSA in those referred for PSG. This has the potential to lessen the reliance on PSG for OSA diagnosis and shorten time to commence treatment, improve waiting lists for PSG and provide significant cost savings. Data collection is ongoing. Those patients whose AL did not correlate well with PSG are being examined to see if patient factors can predict who requires PSG for diagnosis.

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SCREENING FOR OSA IN INPATIENTS WITH SCHIZOPHRENIA: A FEASIBILITY STUDY

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Background: Mental health consumers have higher rates of obstructive sleep apnoea (OSA) than the general population, with inpatient rates as high as 50% in previous studies. OSA may be missed due to access barriers, misattributed symptoms and lack of healthcare provider awareness. Screening may overcome these issues, but there is no published method to date.
Methods: Consecutive mental health inpatients with schizophrenia or shizoaffective disorder were recruited. Participants demographics, physical examination, psychotropic medications, OSA-50 and Epworth Sleepiness Score (ESS) questionnaires were recorded. Portable ResMed ApneaLink devices were worn overnight to determine the presence of significant obstructive sleep apnoea (ODI>16/hr). Feasibility hypotheses were a > 70% recruitment rate, >95% protocol fidelity and <15% ApneaLink failure rate.
Results: 39 consecutive inpatients were identified over 50 days. 12 (31%) were excluded; 6 (15%) due to safety concerns, 4 (10%) had known OSA or recent polysomnogram, 2 (5%) were unable to provide informed consent. Of the 27 eligible for screening, 8 (30%) consented and 7 completed the protocol. Of the 19 eligible patients not screened; 10 (37%) were unavailable (on leave, discharged before approach, or in HDU) and 9 (33%) refused consent. No patients were found to have significant OSA.
Conclusion: Screening unselected mental health inpatients with schizophrenia and schizoaffective disorder using a combination of questionnaire and portable device is not feasible in our institution. Barriers to screening include patient availability, low participation rate and safety issues. Future screening of this group should consider alternative, lower risk, more acceptable methods to mental health consumers.

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CONSUMER-DRIVEN SERVICE DEVELOPMENT FOR NEUROMUSCULAR DISEASE AT THE PRINCE CHARLES HOSPITAL (TPCH)

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Background: Neuromuscular disease (NMD) is a chronic condition that requires complex care provision, requiring multiple medical, surgical and allied health inputs. Unfortunately NMD healthcare is often fragmented due to non-streamlined service provision and geographical isolation. This scenario is no better exemplified than in Queensland, with a land area of 1.85million Km^2 with tertiary sleep facilities mainly located in South-East corner of the state, which requires patients and carers to travel vast distances over multiple visits with substantial personal and financial burdens. It is hypothesised that consumer engagement in the development of a dedicated NMD clinic will better streamline services for this group and lead to improved evidence based care.
Methods: All patients currently under the care of the TPCH Sleep Disorders Centre (SDC) with neuromuscular disease will be invited to participate. Survey questionnaire will invite input from patients and carers and will be conducted online. Qualitative and quantitative feedback regarding current and proposed future NMD services will be collected.

Progress to date: Ethics has been submitted. Questionnaire has been formulated after consultation with all key stakeholders including medical, nursing and allied health staff.
Intended outcome and impact: This consumer engagement project will inform local practice at TPCH in NMD. It is projected that a new dedicated NMD clinic will lead to improvement of patient, carer and staff satisfaction, evidenced based practices and efficiency of service provision.

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QUANTIFYING RESIDUAL EXCESSIVE SLEEPINESS IN PATIENTS WITH OSA DESPITE CPAP THERAPY

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Background: Residual excessive sleepiness (RES) is an issue for a small group of patients with obstructive sleep apnoea (OSA) despite continuous positive airway pressure (CPAP) therapy. Subjective and objective measurements of excessive daytime sleepiness (EDS) can be useful in this group to evaluate changes over time, particularly after an intervention intended to reduce sleepiness.
Aim: Review the characteristics of patients investigated for RES on CPAP therapy, the utility of subjective and objective measurements of EDS and the role of adjunct interventions aimed to reduce RES in this group.
Methods: Retrospective analysis of all daytime sleep studies performed in a single sleep laboratory between March 2012 and March 2017, for patients with RES despite CPAP therapy. Data extracted from the local sleep database and sleep clinic notes.
Progress to date: 62 CPAP pressure determination studies followed by a multiple sleep latency test (MSLT) were performed during the 5 year period. 30 (48%) of these patients had a mean sleep latency (MSL) of less than or equal to 8 minutes suggestive of pathological hypersomnolence. Variables to be analysed between this group and those with an MSL greater than 8 include: demographics, BMI, co-morbidities, severity of OSA, CPAP compliance data prior to MSLT, CPAP study data (TST, time to REM onset), MSL, pharmacological and non-pharmacological interventions and Epworth Sleepiness Scores before and after intervention. Those with persistent OSA on the CPAP study (RDI >5) and those with inadequate CPAP compliance will be excluded from the analysis.
Intended outcome and impact: Identify patient characteristics that may predict RES despite CPAP therapy in those with OSA. Measure collinearity between subjective and objective measures of RES in this group.

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HOSPITAL ANXIETY AND DEPRESSION SCALE AND STRUCTURED CLINICAL INTERVIEW FOR DEPRESSION IN OBSTRUCTIVE SLEEP APNOEA

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Background: Obstructive sleep apnoea (OSA) is associated with increased prevalence of major depressive disorder (MDD) as well as high rates of depressive symptoms. Patients with OSA report significantly more depressive symptoms than healthy adults and this can impact on their uptake of and adherence to treatment. However some symptoms of depression, such as fatigue and loss of concentration, can overlap with symptoms of obstructive sleep apnoea itself. The Structured Clinical Interview for Depression (SCID) is the gold standard test for diagnosis of MDD, however administration of the SCID is not practical as a tool for patients attending a sleep laboratory or sleep clinic. The Hospital Anxiety and Depression Scale (HADS) is a self-administered questionnaire that has been found to be reliable for detecting anxiety (HADS-A) and depression (HADS-D) in the general outpatient setting.
Objective: Our study seeks to identify the HADS-D score that most accurately identifies MDD in OSA patients, as determined by the SCID.
Methods: All patients with diagnosed OSA attending a sleep laboratory for commencement of continuous positive airway pressure (CPAP) therapy were invited to participate. HADS-D data was taken from HADS questionnaires completed by participants at attendance for their diagnostic sleep study. SCID data was obtained by Recearch Assistants trained in administration of the SCID by a Clinical Psychologist. Receiver operating curves will be performed for HADS-D to determine the optimal score for the detection of MDD in this patient population.
Progress to date: Of the 113 recruited patients, both SCID and HADS-D data are available for 58 participants.
Intended outcome and impact: To our knowledge, this is the first study to validate HADS-D against the SCID for the detection of MDD in patients with OSA. We will report the HADS-D score with the greatest sensitivity and specificity for MDD in ambulant OSA patients, which can then be used by clinicians for a targeted approach to MDD in this patient population.

079

AN AUDIT OF THE ACTIVITY AND OUTCOMES OF A RESPIRATORY HIGH DEPENDENCE UNIT (HDU)

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Background: Respiratory HDUs have been established in some hospitals to provide single organ support environments for patients with acute respiratory failure. This has included the use of non-invasive ventilation (NIV) for treatment of acute hypercapnoea, and nasal high flow oxygen (NHFO) for the treatment of hypoxaemic respiratory failure. Recent local studies have reported on outcomes of ward based NIV. A limited number of studies report on predictors of HDU outcomes. One study identified worse outcomes in patients requiring intra-hospital transfer to the HDU compared with those admitted directly from the Emergency Department (Baird et al, Respirology 2015). Until now we have not audited outcomes of our Respiratory HDU admissions.
Objective: We present patient outcomes following care in the Respiratory HDU and aim to describe the patient population including demographics, acute and chronic respiratory diagnoses, comorbidities and the type of respiratory support provided.
Methods: This is a retrospective audit of the activity and outcomes of the Respiratory HDU in an adult quaternary referral centre, over a

12 month period. All patients accepted by the Respiratory Team for HDU care are included. Data are from existing patient records.

Progress to date: N = 83 HDU admissions have been identified over the study period. Mean age was 67.3 years (SD 16.8). 8.4% did not survive to hospital discharge (95% CI 8.4-16.6%). Charlson score with age included was associated with in-hospital mortality when calculated at admission ($p = 0.021$, odds ratio 1.4) and discharge ($p = 0.023$, odds ratio 1.4).

Intended outcome and impact: Preliminary statistical analysis has identified Charlson score with age included as being associated with worse outcomes in patients undergoing Respiratory HDU care. These findings add to the current knowledge regarding predictors of poor outcome. Further work will assess physiological variables and secondary outcome measures with a view to further understanding predictors of poor outcome of Respiratory HDU care. This work will enable better targeting of HDU resources and guide choice of appropriate care for patients presenting with acute respiratory failure.

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PREVALENCE AND PREDICTORS OF RESIDUAL EXCESSIVE DAYTIME SLEEPINESS IN CPAP USERS

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Background: CPAP is considered standard treatment for moderate to severe obstructive sleep apnoea and has been shown to reduce excessive sleepiness when used regularly. However, there are patients who despite the reduction in sleep-disordered breathing with CPAP therapy, continue to complain of excessive daytime sleepiness even after factors such as sleep hygiene and comorbid sleep pathologies have been ruled out. The severity of apnoeas have been shown to be associated with excessive sleepiness in OSA patients. The aim of this study is to assess the prevalence of residual excessive sleepiness (RES) in our population and to determine whether the severity of apnoeas are associated with RES and to also identify any clinical determinates of RES.

Methods: Patients undergoing a level 1,2 or 3 study confirming OSA and AHI/RDI >20 and commenced on CPAP will be retrospectively reviewed. RES will be defined as CPAP compliance >4 hours/night, 70% nights available, residual AHI <15 and ESS at 1 month follow up >10. Data collection: Baseline demographic information, sleep study characteristics including AHI, apnoea length, nocturnal SaO2 min, SaO2mean, PLM index and time SpO2 < 90%. Follow up data: ESS, residual AHI, number of nights used, average hour usage/night, CPAP side effects. All patients will be followed up at approximately 1 and 3 months. Further follow up will be arranged for patients with persistent sleepiness. If an MSLT is performed, mean sleep latency results, a final diagnosis and treatment including use of Modafinil will be collected. Patients will be grouped as RES-ve and RES +ve. Univariate logistic regression analysis will be performed in order to determine the contribution of each variable to residual excessive daytime sleepiness following CPAP therapy. A p- value of <0.005 will be considered to indicate significance.

Progress to date: Currently have reviewed 30 level 3 portable studies. RES +ve (3/30). The data is still being collected and will aim to include a total of 120 patients.

Intended outcome and impact: To examine the prevalence of RES in our population and identify which patients may not respond to CPAP therapy and who may benefit from stimulants such as Modafinil.

081

ADHERENCE TO CPAP IN A LOW INCOME POPULATION WITH MODERATE TO SEVERE OBSTRUCTIVE SLEEP APNOEA RECEIVING SUBSIDISED TREATMENT

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Background: CPAP is widely accepted as the gold standard treatment for severe OSA, however low socioeconomic status is associated with poor uptake and adherence to therapy. CPAP treatment is not universally subsidised under any Australian Government scheme, limiting access to CPAP for low income earners with severe OSA. The Monash CPAP Program is run through a public hospital clinic and offers significantly subsidised CPAP treatment to Pensioner Concession Card holders with at least moderate OSA and who meet clinical and adherence criteria. We studied a group of patients enrolled into the program to determine their baseline characteristics, the time on the waitlist for a CPAP machine, as well as their adherence at follow up.

Methods: We identified patients who met the eligibility criteria and placed on the waitlist between 1st January 2015 to 31st December 2015. Baseline demographic information, polysomnography data and time on the waitlist were determined from a database. We reviewed the medical records for follow up and any missing data. If no follow up was recorded, the patient was contacted and asked a short questionnaire regarding their adherence to therapy.

Progress to date: 194 patients were waitlisted over the 12 month study period. Mean total AHI was 52.4/hr at the time of waitlisting. Mean time spent on the waitlist was 193 days. Preliminary analysis based on 25 patients shows an adherence rate of 70% after at least 6 months.

Intended outcome and impact: Our primary aim is to identify the level of adherence to CPAP in the study population. We hypothesise adequate adherence will be present in > 50% of subjects, based on previously published data. Secondary aims will examine the effects of time on the waitlist, baseline OSA severity and symptoms on adherence. This analysis will be useful in assessing the impact of funded CPAP and provide a guide as to whether patients most in need are receiving access to treatment in a timely fashion.

082

FACTORS INFLUENCING THE NEED FOR NOCTURNAL VENTILATION IN MOTOR NEURONE DISEASE

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Background: Pulmonary function and respiratory muscle testing have often been used to screen for hypoventilation and the need for nocturnal ventilation in patients with Motor Neurone Disease (MND), however, a significant proportion of patients are unable to perform these tests. The Amyotrophic Lateral Sclerosis Functional Rating Scale (ALSFRS) is a physician assessment of functional impairment easily performed in the outpatient setting. This study reviews the association between the ALSFRS, pulmonary function testing and patient symptoms with the incidence and success of non-invasive ventilation (NIV).

Methods: Analysis was performed from a prospectively maintained database of 150 MND patients reviewed in a specialised outpatient

clinic. ALSFRS, pulmonary function, type of symptoms and their association with nocturnal ventilation were all assessed.
Progress to date: A preliminary review of the data from all patients has been performed. 126 patients were reviewed in the MND clinic (mean age 63.6 years, range 37-90). 55/126 patient are currently alive. 29 of the 126 patients (23%) treated were treated with NIV (13 for respiratory symptoms, 12 for symptomatic sleep disordered breathing and 4 for an unknown reason) and only 3 patients were intolerant of treatment. The mean duration of NIV prior to death was 267.8 days (range 23-813). NIV was most commonly used in patients with limb onset symptoms only (17/58 patients) rather than bulbar dysfunction. Further analysis of the ALSFRS, pulmonary function and their association with nocturnal ventilation will also be performed.
Intended outcome and impact: Further review from our database of Motor Neurone Disease patients will aid in determining predictors of the need for and the success of nocturnal ventilation.

083

COMPARISON OF THE DURABILITY OF NIV DEVICES: EXPERIENCE FROM A SLEEP DISORDERS CENTRE

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Background: The provision of non-invasive ventilation (NIV) devices as part of a publically funded sleep medicine program is an essential part of our tertiary hospital sleep service. Equipment failure and maintenance costs account for a significant burden on resources and as such, assessing equipment durability and cost effectiveness is vital for service planning.
Methods: The service history of 746 devices was retrospectively reviewed from the Sleep Disorders Centre Database. Overall and device-specific lifespan was assessed by Gehan-Breslow survival analysis. Devices were scheduled for replacement after 7-10 years depending on the availability of funding. The reasons for equipment condemnation and the frequency and cost of repair were compared between devices.
Progress to date: 285 of the 746 devices issued were condemned, with a mean lifespan of 9.23 + /- 0.28 years. Excluding devices that underwent scheduled replacement, the mean lifespan was 10.74 + /- 0.63 years. The most common faults included excessive noise (39 devices), faulty pressure delivery (22 devices), failed maintenance test (13 devices) and even insect infestation (10 devices). There were differences in lifespan between different devices associated with specific patterns of equipment failure ($P < 0.001$).
Intended outcome and impact: Service planners can predict a mean lifespan for NIV devices of 10.74 years which can be used in determining frequency for scheduled replacement. Individual devices have different lifespans and specific patterns of faults. Service providers should consider the survival pattern of specific devices when negotiating warranty periods for publicly funded programs.

084

IMPACT OF OBSTRUCTIVE SLEEP APNOEA ON POST-OPERATIVE OUTCOMES

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Background: Obstructive sleep apnoea (OSA) has been associated with higher rates of post-operative complications. However, a recent systematic review concluded that evidence to support the contention that OSA influenced peri-operative outcomes was not optimal, and hence further well designed studies were needed. Our study will address the limitations of previous studies by using objective tests to identify the presence of OSA and quantify severity.
Methods: Patients referred to the pre−operative anaesthetic clinic at Liverpool Hospital were screened for OSA using the STOPBang questionnaire. Those with low scores (0-2) and those with high scores (≥5) were given an ApneaLink home-oximetry device and their apnoea-hypopnoea index (AHI) recorded. Patients with an AHI<5 (control group) and those with an AHI>30 (OSA group) had their post-operative course followed. The primary outcome was the number of significant cardiac and/or respiratory complications, such as arrhythmias, ischaemic events and respiratory failure. Type of surgery, use of supplemental oxygen, use of opioid analgesia and length of stay were also recorded.
Progress to date: Of the 8 participants in the control group (mean AHI = 2.25, %male = 12.5, median age = 50, mean BMI = 27) and 7 participants in the OSA group (mean AHI = 47.5, %male = 57, median age = 59, mean BMI = 33), preliminary analysis showed no significant post-operative complications in either group. Both groups included both major and minor operations. 3 participants in the OSA group had a minor complication (hypoxia, fever, fall). Duration of supplemental oxygen use was equivalent (mean usage for 24 hrs in both groups). The proportion of patients requiring opioid analgesia was higher in the control group (86% vs 50%). Mean length of stay was similar in both groups (control group 3.5(1.6) vs OSA group 3.3 (1.6) days, $p = 0.13$).
Intended outcome and impact: We hypothesise as our sample size increases, and with the inclusion of orthopaedic patients, a higher proportion of patients with OSA will have more significant post-operative complications. We anticipate that screening patients for severe OSA pre-operatively will lead to better patient outcomes, lower complication rates and reduced length of stay.

085

IS COGNITIVE BEHAVIOURAL THERAPY FOR THE TREATMENT OF INSOMNIA HARMFUL? A SYSTEMATIC REVIEW OF THE LITERATURE

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Despite the increasing evidence regarding the effectiveness of cognitive behavioural therapy for the treatment of insomnia (CBT-I), data on the harms and adverse events of therapy remains scarce. Here, we aim to systematically review the harms of CBT-I in order to

quantify negative outcomes reported in the current literature. To obtain suitable studies, a literature search of MEDLINE, EMBASE, PubMed, PsycINFO and IPA (2004-2017) will be conducted using search terms including: *sleep, insomnia, CBT, cognitive behavioural therapy, cognitive behavioural therapy, harms, adverse effects, negative outcomes and unwanted outcomes.* The search criteria will be restricted to articles in English utilising a randomised controlled trial design that explore the relationship between a CBT-I intervention and sleep outcomes (e.g. Insomnia Severity Index, Polysomnography etc.) in adults with sleep difficulties. The intervention must contain at least two components of CBT-I (e.g., sleep restriction, stimulus-control, relaxation, or cognitive therapies). Articles focused on diagnosed insomnia will be prioritised. The screened articles will then undergo qualitative synthesis and analysed for any adverse effects or harms reported by participants or documented in trials of CBT-I. This review will add significant value to the literature, as it will provide some insight into the unexplored harm profile of CBT-I and the currently unsubstantiated claims that CBT-I is safer than pharmacotherapy.

086

SLEEP RESTRICTION THERAPY + ARMODAFINIL FOR INSOMNIA DISORDER (A PILOT STUDY FOR THE MODERATE TRIAL); TRIAL PROTOCOL AND PROGRESS UPDATE

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Introduction: Insomnia is the most common and socially costly sleep disorder in Australia. Sleep Restriction Therapy (SRT) is a standardised behavioural component of CBT-I that has been specifically tested in isolation and been found to be as effective as multicomponent interventions, however, SRT is complicated by excessive daytime sleepiness and performance impairments. The primary objective is to determine if Armodafinil can be used to moderate the effects of SRT for Insomnia Disorder in a preliminary proof-of-concept trial. Data will enable the evaluation of acceptability, safety, efficacy and tolerability of Armodafinil specifically in the context of SRT alone for Insomnia Disorder.

Methods: The MODERATE trial is designed as a nonrandomised open label trial with Armodafinil for 4 weeks, in patients with insomnia implementing SRT. 30 historical controls from studies that have undergone the exact same SRT intervention previously without Armodafinil will act as controls for this study. The study will last for 14 weeks in total consisting of a 2 week lead in period, 4 weeks of intervention and a final primary end point follow-up at 12 weeks from treatment start.

Results: At the time of abstract preparation 7 patients have undertaken screening with 5 subsequently recruited to the trial, 2 having completed the intervention component of the study. Armodafinil and SRT appears acceptable and tolerable in current trial patients. No adverse events or serious adverse events have been observed so far.

Discussion: If final results show that a short 4-week course of Armodafinil combined with a simple manualised SRT is acceptable, tolerable, and safe we will then assess efficacy in a larger randomized controlled trial.

087

PSYCHOLOGICALLY-BASED TREATMENT STRATEGIES FOR RESTLESS LEGS SYNDROME: A REVIEW

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Background: The restless legs syndrome (RLS) is a common neurological movement disorder, which is characterised by abnormal limb sensations, accompanied by an uncontrollable urge to move, impacting negatively on sleep and quality of life. Existing clinical and questionnaire-based assessments point towards patient distress as a key marker of RLS severity. Whilst pharmacological therapies have been the mainstay of treatment, inadequate response, adverse effects, and the emergence of symptom rebound and impulse control disorders related to dopaminergic therapy make a search for non-pharmacological approaches to reduce the impact of distress associated with RLS symptoms pertinent.

Methods: A review of the available literature concerning the assessment and treatment of RLS with a specific focus on psychologically-based strategies in adults was performed via the Pubmed, Ovid and Embase databases. The few publications attained focusing on non-pharmacological interventions involved small study populations in uncontrolled studies.

Progress to date: The articles acquired through the search have been reviewed and categorised. The data to be presented will encompass the evidence for the potential benefits and limitations of psychologically-based strategies including mindfulness and cognitive behavioural therapy.

Intended outcome and impact: The intended outcome of this review is to provide a summary of adjunctive management strategies for patients with clinically distressing RLS symptoms, where pharmacological therapy is poorly tolerated, partially effective or unsuitable for use due to comorbidities or interactions with other medications. Psychologically-based treatment approaches can be implemented across all symptom severities, as either monotherapy or add-on therapy, to potentially minimise medication use and maximise quality of life in RLS.

088

AHI VS ODI AND HYPOXAEMIC BURDEN AS CORRELATES OF CORONARY PLAQUE BURDEN

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Background: Obstructive sleep apnoea (OSA) is strongly associated with coronary artery disease, but whether this relationship is causative is currently unclear. Furthermore, markers of hypoxaemic burden generally exhibit stronger associations with cardiovascular disease than the Apnoea Hypopnoea Index (AHI). Mechanistic studies designed to tease out the relationship between OSA, its associated hypoxaemic burden and "vulnerable" coronary artery atherosclerotic plaque are necessary to help determine if OSA is a causative factor in acute coronary syndromes..

Hypotheses: 1) Markers of OSA severity correlate significantly with the coronary plaque burden as assessed by computed tomography

coronary angiography (CTCA) 2) Measures of hypoxaemic burden including oxygen desaturation index (ODI) have a stronger correlation with coronary plaque burden than the AHI.

Methods: In a single centre tertiary teaching hospital, 135 patients with CTCA who had diagnostic sleep studies within 6 months of their CTCA were selected. Coronary plaque burden will be assessed using the adapted CT-Leaman score. Quantification of coronary plaque volume in the proximal 50 mm of major epicardial vessels will also be assessed. Coronary plaque burden and volume will be analysed against the AHI, ODI and various novel markers of hypoxaemic burden using a multiple linear regression model. Secondary analyses using categorical measures of AHI and ODI severity will also be conducted.

Progress to date: Data analysis for this study is ongoing with aim to completion by August 2017. Analysis of coronary plaque volume currently being undertaken. AHI and ODI data are currently being analysed from the sleep database.

Intended outcome and impact: We expect that the analysis will show a significant correlation between both AHI and ODI and coronary plaque burden using a 95% confidence threshold. Additionally, we expect that measures of hypoxaemic burden including ODI will have a greater correlation with coronary plaque burden as compared to AHI. This result has not previously been established.

089

COMPARISON BETWEEN SUBJECTIVE AND OBJECTIVE MEASUREMENTS OF SLEEP/WAKE SCHEDULES IN PATIENTS BEING INVESTIGATED FOR HYPERSOMNIA

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Background: To improve the diagnostic utility of the multiple sleep latency test (MSLT) in patients being investigated for hypersomnolence, AASM guidelines suggest assessing sleep/wake schedules before MSLT. However, there is no consensus guideline about whether a sleep diary, actigraphy, or both should be used. Sleep diaries are convenient for patients and physicians but are subjective assessments of sleep patterns, which rely on recall. Wrist actigraphy provides assessment of sleep schedules based on light and movement recordings and may be a more objective measurement of sleep patterns. We wish to compare the results of sleep diaries with actigraphy in assessing sleep schedules prior to an MSLT.

Method: Retrospective sleep/wake data were analysed from consecutive subjects referred for an MSLT over a 24-month period. Subjects were included if they had both sleep diary and actigraphy data for the same 2-week period prior to the MSLT. Patient demographics including age, Epworth Sleepiness Scale (ESS) and total sleep time from polysomnography were recorded. Differences between subjective (sleep diary) and objective (actigraphy) measurements of sleep onset time, awakening time, total sleep time, and day nap time were compared with paired t-tests. Diary and actigraphy results will be compared with Bland-Altman plots.

Progress: Data have been collected for 8 patients (5 male, 3 female), who have had both actigraphy and sleep diaries. Mean age was 46 $\pm$ 16 years and ESS was 11 $\pm$ 5 units. There was no difference in average daily total sleep time (TST) from sleep diary compared with actigraphy (470 $\pm$ 111 minutes vs 492 $\pm$ 78 minutes; $p = 0.43$). There were considerable differences between diary and actigraphy with regards to bed time and wake up time; for example, group average earliest sleep onset time was 8.22 pm from sleep diary and 7.43 pm from actigraphy.

Intended outcome and impact: We hypothesised that sleep diary parameters may not correlate well with actigraphy estimates. In patients with excess sleepiness presenting for MSLT, objective measures of sleep patterns via actigraphy may be a more reliable method to estimate sleep-wake schedules, which may improve the clinical interpretation of MSLT.

090

PILOT STUDY: BARRIERS TO GOOD SLEEP IN THE HOSPITAL ENVIRONMENT

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Background: Barriers to good sleep in hospital are poorly understood with much of the previous research conducted on ICU patients. Previous studies have shown that sleep deprivation of patients can: impair their ability to participate in care; increase readmission rates; and increase likelihood of delirium. This pilot study will assess factors in non-ICU patients that contribute to poor sleep in hospital.

Aims:

1. To describe light and noise levels in the hospital setting
2. Assess associations between light, noise and operational processes (e.g. medication administration) and sleep quality.

Method: Initial data collection is occurring in two rooms in the sleep laboratory. This is to demonstrate feasibility and also to act as a control group given light and noise levels in the sleep laboratory are reduced to maximise sleep. Data will then be collected in a variety of hospital wards including the respiratory and general medical wards. Data will be collected over one month. Noise (dB) and light levels (lux) are being recorded and sampled every 5 seconds via a Lutron sound level monitor and a Sper Scientific visible light datalogger respectively, which are positioned at the bedside. Shift schedules, medication charts and medical notes are being used to determine interruptions throughout the day and night. Daily assessment includes validated questionnaires assessing sleep disturbance, insomnia, pain and mood. Data presented are Mean $\pm$ SD.

Results to date: 20 patients recruited from sleep laboratory [SL] (age: 57.9 $\pm$ 11.5y, 50% male). Recruitment from the wards is still underway with 8 patients recruited thus far [W] (age: 61.3 $\pm$ 14.0y, 38% male). Mean sound levels on the ward were significantly higher compared with the sleep laboratory (W: 49.2 $\pm$ 776 dB, SL: 43.4 $\pm$ 7.6 dB, $p < 0.01$), whilst mean light levels were significantly lower (W: 28.2 $\pm$ 57.2lux, SL: 61.2 $\pm$ 90.0lux, $p < 0.01$). Number of clinical interruptions overnight was significantly higher in the ward compared with the sleep laboratory (W: 15 $\pm$ 8.9, SL: 2.9 $\pm$ 2.3. Only 1 patient thus far from the ward described sleep of good quality, compared with 5 (25%) of sleep laboratory patients.

Conclusion: From our data to date, sleep quality appears to be worse in ward patients compared to those in the sleep laboratory. Sound levels and interruptions were significantly higher on the ward and this may be a significant barrier to good quality sleep.

091

CAN CPAP COMPLIANCE BE PREDICTED BY CLINICAL FEATURES OR SERVICE DELIVERY CHARACTERISTICS IN PATIENTS WITH MODERATE TO SEVERE OBSTRUCTIVE SLEEP APNEA?

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Background: Obstructive sleep apnea (OSA) is associated with a reduced quality of life and a range of neurocognitive and cardiovascular complications. Continuous positive airway pressure (CPAP) is an effective treatment for OSA but patient compliance is often poor. Various patient characteristics, polysomnographic measures and treatment factors have been implicated as predictors of compliance. This study aims to identify factors associated with short-term and long-term CPAP compliance, with a particular focus on various components of service delivery.
Methods: Retrospective review of clinical and compliance data of all new OSA patients who were initiated on CPAP between Jan 2016 and June 2016. Patients were included if they had a previous diagnostic and CPAP titration study with our service, had a diagnosis of moderate or severe OSA (AHI > 15) and had short-term and long-term compliance data available (approximately 2 months and 12 months respectively). Clinical records and databases were analysed for the following: 1. Patient characteristics including age, sex, BMI, ESS, RDI, CPAP interface and pressure 2. Service delivery characteristics including type of diagnostic study (Type I or II), laboratory-based CPAP titration or autotitrating CPAP, period of time between diagnostic study, CPAP titration and CPAP initiation, and frequency of follow-up post-CPAP initiation. Compliance data was obtained from device downloads. Non-compliance was defined as mean CPAP use < 4 hours per night.
Progress to date: 159 patients were identified for inclusion in this study. Data collection will be completed mid-July.
Intended outcome and impact: This study aims to identify patient and service characteristics associated with CPAP compliance. Knowledge gained can then be applied to identify patients at high risk of poor compliance and also guide further development of our sleep service's Model of care in order to optimize patient compliance.

092

CLINICAL UTILITY AND TECHNICAL QUALITY OF UNATTENDED HOME POLYSOMNOGRAPHY IN A LARGE, TERTIARY REFERRAL SERVICE

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Background: Use of unattended in-home Type 2 polysomnography (PSG) is increasing in popularity given easy accessibility, cost effectiveness and clinical equivalence when compared with attended in-laboratory sleep studies in patients with high pretest probability for moderate to severe obstructive sleep apnoea (OSA). Current literature suggests that home PSG has higher signal loss than laboratory PSG and approximately 10% of studies performed underestimate the apnoea-hypopnoea index (AHI), which may affect patient clinical outcomes. Hence we aimed to audit technical quality and the impact on clinical outcomes of unattended home PSG at our tertiary sleep center.
Methods: All home PSGs performed at Monash Health Sleep Centre between 1 January and 31 December 2016 will be reviewed. Information on data loss from all PSG signals will be collected and compared to the clinical determination of the need for repeat sleep testing or ongoing patient management. Patient demographics and PSG results will be compared to diagnostic laboratory PSG over the same time frame. Audit of waiting times at various stages of the clinical pathway will also be compared.
Progress to date: Preliminary data analysis of 50 out of a total of 460 home based studies performed during last year indicate that technical problems with a partial degree of signal loss occurred in 14/50 studies (28%) The signal that was most likely to fail was oximetry (12%) followed by abdominal (8%), flow (6%) and thoracic signals (4%). However, all these studies were deemed diagnostically acceptable and resulted in a treatment decision without the need for re-testing. Further data collection and analysis is being conducted to cover all studies and outcomes.
Intended outcome and impact: We expect to find frequent partial signal loss during home PSG, but without significant impact on the clinical utility of the test. With analysis of secondary outcomes, we predict fewer co-morbidities than in the cohort undergoing laboratory PSG and a more rapid pathway through the diagnostic and treatment process

093

PERIOPERATIVE CARE OF PATIENTS WITH OSA: A SURVEY OF BELIEFS AND MANAGEMENT APPROACHES AMONGST CLINICIANS

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Introduction: Obstructive sleep apnoea (OSA) is associated with an increased risk of perioperative complications. Consensus guidelines on the management of such patients are lacking in Australia. Our survey aims to evaluate current beliefs and management approaches towards these patients from relevant specialty groups, including physicians, anaesthetists, and surgeons.
Methods: A 24-question online questionnaire was created, and accepted for dissemination by the Royal Australasian College of Physicians (RACP), the Australian and New Zealand College of Anaesthetists (ANZCA), the Royal Australasian College of Surgeons (RACS), and The Thoracic Society of Australia and New Zealand (TSANZ). A link to the survey was distributed via respective e-newsletters or websites. Responses were collected anonymously, over a four-month period from September 2016 to January 2017.
Results/Progress to date: 56 responses were collected across the specialties, including 28 (53%) from medicine, 16 (30%) from anaesthesia, and 9 (17%) from surgery. 94.5% of clinicians are regularly involved in managing patients with OSA, and 89% believe it is an important perioperative risk factor. The commonest complications personally encountered are post-operative oxygen desaturation (91%) and difficult intubation (34%). 43% would organise admission to a High Dependency Unit following surgery in confirmed OSA. More physicians (56.5%) would delay surgery in suspected OSA until a sleep study has been completed, whilst 78% of surgeons and 53% of anaesthetists would proceed but treat empirically for OSA. All three specialties agree that the availability of guidelines would assist in caring for their patients. Further result analysis is in progress.

Intended outcome and impact: We expect that the results will indicate that OSA is a significant problem in the perioperative setting. It is commonly encountered and prioritised by all specialty groups examined, and consensus guidelines would unify the current management approaches.

094

RETROSPECTIVE CASE-CONTROLLED STUDY OF OBSTRUCTIVE SLEEP APNOEA IN DOWN SYNDROME ADULTS

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Background: Down syndrome (DS) is a common chromosomal genetic disorder. It is associated with multiple health issues including obstructive sleep apnoea (OSA). Dysmorphic craniofacial features inherent to DS, such as mid-facial hypoplasia, predispose to OSA. The purpose of this study was to ascertain the prevalence and severity of OSA in adults with DS and identify possible barriers to treatment in DS patients by comparing demographic and polysomnography (PSG) indices, CPAP prescriptions rates, acceptance and adherence in DS adults matched to a group of non-DS adults referred for a sleep study at Repatriation General Hospital. We hypothesised that DS patients would have a higher prevalence and more severe OSA, and reduced adherence to therapy.
Methods: This was a retrospective case-control study of data collected from electronic and paper-based records. DS patients with OSA were identified by case review for comparison to a control group drawn at random from all available non-DS with matching age ($\pm$3 years), gender, BMI ($\pm$3 kg/m^2) and study date ($\pm$90 days), aiming for a 1:3 ratio between the cohorts. Between group comparisons were conducted using independent samples t-tests and Mann Whitney U tests for normally and non-normally distributed continuous data respectively, and Fisher's or Chi^2 tests for categorical variables.
Progress to date: 30 DS patients were matched with 58 non-DS patients for gender, age (mean$\pm$SD; 38.8 $\pm$ 12.5 versus 41.4 $\pm$ 12.4 years) and BMI (34.9 $\pm$ 9.1 versus non-DS 32.8 $\pm$ 6.8 kg/m^2). We were not able to achieve the stated 1:3 ratio but managed to achieve close to 1:2 ratio. 28 of 30 (93%) DS patients had OSA (1 mild, 27 moderate to severe OSA) compared to 32 of 58 (55%, $p < 0.001$) non-DS patients (10 mild, 22 moderate to severe OSA). The percentage of time spent with SpO2 $< 90\%$ was higher in the DS cohort (26.4 [2.1 - 42.6] versus 3.5 [0.0 - 1.0], $p < 0.001$). 26 DS (93%) and 16 non-DS (50%) patients with OSA were commenced on CPAP ($p < 0.001$). At first follow up visit (post CPAP commencement),11 DS patients were adherent to CPAP compared to 10 non-DS patients where "adherent" was defined as an average of $\geq$4 hours' use per night for $\geq$70% of nights.
Intended outcome and impact: Further CPAP adherence outcomes in DS and control cohorts are currently being studied to help identify potential barriers and gaps in current service provision for DS.

095

OXYGEN THERAPY FOR TREATING PATIENTS WITH RESIDUAL SLEEP APNOEA FOLLOWING UPPER AIRWAY SURGERY

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Background: Obstructive sleep apnoea (OSA) leads to repetitive collapse of the upper airway during sleep. There are 4 key pathophysiological traits which contribute to OSA: 1) poor airway anatomy; 2) ineffective upper airway dilator muscle responsiveness; 3) low arousal threshold and 4) ventilatory control instability (high loop gain). Upper airway surgery (UAS) is a treatment for OSA which improves the airway anatomy and leads to significant improvement in ~25% of patients. Our team has recently shown that a high loop gain predicts a poor response to surgery. Given that oxygen therapy is known to lower loop gain, we therefore hypothesise that oxygen therapy will improve OSA in surgical "non-responders".
Methods: This is a prospective randomised control single blinded trial. Participants enrolled will have residual sleep apnoea despite having undergone UAS. Each participant will undergo two sleep studies over two nights – one night with supplemental oxygen (4 L/min) and another night with room air (control). Measurements of breathing pattern, heart rate, blood pressure, eye movements, brain activity and oxygen levels in the blood will be compared between both conditions.
Progress to date: Project approved by HREC. Recruitment and consent of 30 participants into the clinical trial has commenced. Participants will begin their sleep studies between May 2017 – October 2017. Preliminary results and conclusions will be ready for the conference.
Intended outcome and impact: Establish that oxygen therapy lowers loop gain and therefore improves OSA to a significant degree in patients with residual OSA following UAS in those with a high loop gain at baseline. This could provide additional treatment options for sufferers of residual OSA despite surgical management.

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THE RELIABILITY OF THE EPWORTH SLEEPINESS SCORE IN A SLEEP CLINIC POPULATION

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Introduction: Despite the Epworth Sleepiness Score (ESS) being widely used in the assessment of OSAS (Obstructive Sleep Apnoea Syndrome), there are limited studies of its reliability in clinical practice. The aim of this study was to assess the reliability of the ESS in a clinical population undergoing assessment for OSAS.
Methods: This retrospective study included 133 patients who were referred to Middlemore Hospital sleep service on suspicion of OSAS between October and November 2014. The reliability of repeated measurements of ESS at up to three different points of the diagnostic pathway was measured: at the general practitioner's (GP) assessment, at the time of overnight oximetry and at assessment by a Sleep

Physician. No treatment for OSAS was administered between measurements. Reliability was analysed using the Bland Altman method and Intraclass and Pearson correlation coefficients.
Results: There were 133 patients included in the study. The GP ESS were taken first. There was median 91 days until ESS was measured again at time of oximetry, then median 11 days until a final ESS was measured at specialist assessment. The results suggest good reliability of the ESS between the oximetry and specialist scores with an Intra Class Correlation coefficient (ICC) of 0.82, however poor reliability between the GP and oximetry or specialist scores with ICC of 0.34 and 0.31 respectively.
Conclusion: The reliability of the ESS is unproven in clinical settings. Our study shows that in this population there is significant variation in the score over repeated baseline measures. This may be interpreted as an effect of passage of time (oximetry and specialist clinic measurements being significantly closer together than GP and oximetry/specialist clinic measurements), or of the different clinical settings in which the score was measured. Clinicians should be aware of the limitations of ESS in clinical practice.

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ASSOCIATION OF SLEEP QUALITY WITH SLEEPINESS AND QUALITY OF LIFE IN PATIENTS WITH ILD

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Background: Sleep disorders are common in patients with interstitial lung disease (ILD). There are emerging data showing an association between sleep disordered breathing and fragmented sleep with poor sleep quality in ILD. However little is known about whether physiological, psychosocial or symptom-related measurements in stable ILD are also associated with poor sleep quality.
Methods: We performed a retrospective chart review of patients with ILD who were assessed at two teaching hospitals prior to enrolment in a pulmonary rehabilitation programme between June 2014 and June 2016. Our primary outcome variable was sleep quality using the Pittsburgh Sleep Quality Index (PSQI). Potential explanatory variables included anthropometric data, spirometry, and 6 minute walk test results. We also obtained questionnaire data including Epworth Sleepiness Scale (ESS), St George's Respiratory Questionnaire (SGRQ), Hospital Anxiety and Depression Scale (HADS) and the modified Medical Research Council Dyspnoea Scale (MMRC). We compared normal (PSQI < 5) versus abnormal (PSQI ≥ 5) groups using Mann Whitney test or unpaired t-test for continuous variables, and Fisher exact test for categorical variables. Data were expressed as mean $\pm$ SD for normally distributed variables, and median (interquartile range) for non-normal data. Questionnaire data all reported in arbitrary units.
Progress to date: Of 79 patients, 54 (68%) had an abnormal PSQI. When abnormal versus normal PSQI groups were compared, the abnormal PSQI group had a higher median ESS [7 (4 to 9) vs 3 (1 to 6); $p = 0.004$]. The abnormal PSQI group also had higher mean total SGRQ (57.0 ± 2.8 vs 46.7 ± 3.3; $p = 0.015$), HADS-anxiety (6.9 ± 0.6 vs 4.8 ± 0.6; $p = 0.03$) and HADS-depression (6.8 ± 0.6 vs 4.5 ± 0.8; $p = 0.02$).
Intended outcome and impact: There was a high prevalence of poor sleep quality among ILD patients. The abnormal PSQI group were subjectively sleepier, had worse respiratory quality of life, and higher anxiety and depression scores. We plan to perform multivariable logistic regression analysis to identify independent predictors of poor sleep quality which can be targeted in future studies to improve sleep quality and fatigue in this patient population.

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THE USE OF OVERNIGHT OXIMETRY FOR DIAGNOSING AND MANAGING OSA, ARE PATIENTS WORSE OFF?

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Background: The review is looking at whether patients diagnosed with OSA using oximetry alone have equivalent reported benefit and compliance with CPAP therapy at 12 months, compared to those who have further testing prior to therapy.
Methods: A retrospective audit of a sleep centre's new sleep patients in 2015. All patients undergo pre-visit home based overnight oximetry. They are then seen as new patients in the sleep clinic – either by a physician or clinical sleep nurse specialist, for clinical history and physical examination. They then proceed directly to positive airway pressure therapy (if deemed appropriate) with provision of a auto-adjusting pressure machine followed by fixed pressure machine; or undergo further testing (PSG/Embletta) if further investigation / confirmation deemed necessary – followed by therapy if confirmed obstructive sleep apnoea.
The list of patients were obtained from sleep medicine database for 2015. Only new clinic patients were reviewed (769 identified) – with information on demographics, medical history, presumptive and actual diagnosis, sleep test results, date of initiation of therapy and compliance with therapy at 12 months obtained from computerized medical records, clinic letters and sleep service notes.
Progress to date: Data collection has just been completed. Have started reorganizing and sifting through data.
Intended outcome and impact: To show that overnight oximetry can be used in more centres as a screening and diagnostic tool for OSA, coupled with proper review and examination and that patients improvement and compliance are at least equivalent to those patients diagnosed with further testing before therapy.

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UNRAVELLING THE RELATIONSHIP BETWEEN SLEEP, EATING BEHAVIOUR AND BODY WEIGHT: A MEDIATION ANALYSIS

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Introduction: Sleep deprivation has direct effects on both eating behaviour and weight status. However, less is known about the relationship between these three factors. The aim was to determine whether the relationship between sleep and body mass index (BMI) is mediated by eating behaviour (i.e. cognitive restraint, disinhibition and/or hunger) in a large sample of American adults.

Method: We used data from the Nathan Kline Rockland sample (n = 602; 38.9 ± 14.5 years). Sleep and eating behaviour were measured subjectively using the Pittsburgh Sleep Quality Index and Three Factor Eating Questionnaire, respectively. Path analysis with multiple mediators was conducted to test the hypothesized model, with mediation tested via bootstrapped confidence intervals.
Results: Sleep quality was inversely associated with both hunger (P = 0.03) and disinhibited eating (overeating in the presence of palatable foods or other disinhibiting stimuli like emotional stress; P < .001) behaviours. Disinhibited eating behaviours were also positively associated with BMI (P < .001). There was a significant indirect relationship between sleep quality and BMI via disinhibition (b [95% CI] = 0.13 [0.06, 0.21], P = 0.001) No effects were found when total sleep time or time in bed were replaced as predictors in the mediation model.
Discussion: Disinhibited eating behaviours (not cognitive restraint or hunger related behaviours) mediated the relationship between sleep quality and weight status. Interestingly, only sleep quality not duration was mediated by eating behaviour. Findings indicated that improving sleep quality could benefit weight loss by helping to reduce the hedonic attraction of highly palatable food.

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BIOLOGICAL AND BEHAVIOURAL CIRCADIAN RHYTHMS IN DELAYED SLEEP-WAKE PHASE DISORDER AND NON-24-HOUR SLEEP-WAKE RHYTHM DISORDER

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In this study we investigated biological, sleepiness and behavioural rhythm period lengths (i.e., *taus*) of Delayed Sleep-Wake Phase Disorder (DSWPD), Non-24-Hour Sleep-Wake Rhythm Disorder (N24SWD) patients and healthy control sleepers. We also ran cross-correlation analyses between different rhythm variables to examine phase angle of entrainment. The aim was to explore if behavioural rhythms, in addition to the biological circadian rhythms contribute to misalignments of sleep timing symptomatic of DSWPD and N24SWD. Twenty-six DSWPD participants who met diagnostic criteria (17 m, 9f, age: 21.85 ± 4.97 years) and 18 controls (10 m, 8f, age: 23.72 ± 5.10 years) participated in an 80-hour modified constant routine. Additionally, 4 full-sighted patients (3 m, 1f, age: 25.75 ± 4.99 years) were diagnosed with N24SWD and included as a discrete study group. A forced-desynchrony ultradian protocol of 1-hour 'days' in dim light, controlled conditions alternated 20-minute sleep opportunities with 40-minute enforced wakefulness. Subjective sleepiness ratings were recorded prior to every sleep opportunity and median reaction time (vigilance) was measured hourly. Amount of sleep obtained (sleep propensity) was derived from 20-minute sleep opportunities to quantify hourly objective sleepiness. Hourly core body temperature was recorded and salivary melatonin assayed to measure endogenous circadian rhythms. Rhythm data were curved using the 2-component cosine model. DSWPD and N24SWD patients had significantly longer melatonin and temperature *taus* compared to controls. There were no significant *tau* differences between groups as measured by subjective sleepiness, sleep propensity and vigilance rhythms. However, DSWPD patients showed a greater interval between maximum sleep propensity and minimum core body temperature. Their sleep propensity rhythms lagged behind core temperature rhythms by an hour more compared to controls' sleep propensity and core temperature rhythms. The findings provide further evidence that delayed circadian rhythms in DSWPD may result from larger phase angles between core body temperature and sleep propensity. This interval may result in later sleep timing in DSWPD patients relative to their circadian timing thus masking their light exposure during a time that is critical to phase-advancing the circadian system.

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INCREASED VULNERABILITY TO ACUTE SLEEP DEPRIVATION IN WOMEN DEPENDS ON MENSTRUAL PHASE

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Women have been reported to demonstrate greater intolerance to sleep deprivation than men, exhibiting more alertness failure in both laboratory settings and in the workplace. The degree to which this sex difference is stable, or influenced by menstrual phase in women is not known. In order to investigate sex differences and the impact of menstrual phase on the response to sleep deprivation, we examined objective and subjective alertness data from 124 healthy men and women (40 women, 84 men; aged 18 – 30 years) who maintained wakefulness for 30 hours in a laboratory setting. Women in the follicular phase of the menstrual cycle demonstrated the poorest level of performance. This poor performance was most pronounced at times corresponding to the habitual sleep period, demonstrating a window of vulnerability at this critical menstrual phase. At the slowest reaction times, women in the luteal phase were not more impaired than men. These results have important implications for women working shift work, demonstrating that menstrual phase should be considered when scheduling overnight shifts, especially for work in which alertness failure could result in injury.

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DOES SLEEP RESTRICTION ATTENUATE THE BENEFITS OF INTERRUPTING SITTING ON GLUCOSE METABOLISM? A PILOT STUDY

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Purpose: Prolonged sitting and sleep restriction are both independent risk factors in the development of cardiometabolic disease. Interrupting sitting with short bouts of physical activity reduces cardiometabolic risk in rested individuals. However, 33-45% of Australians are chronically sleep restricted. Given that prolonged sitting and sleep restriction influence the same cardiometabolic parameters, the aim of this pilot study was to determine whether the positive effects of interrupting sitting persist under the conditions of sleep restriction.
Methods: This laboratory counterbalanced, crossover trial consisted of two 4 day (4 night) experimental conditions separated by a two-week washout period. On the first night participants were given a 9-h sleep opportunity to allow for steady state baseline measures the following day. Three consecutive nights of sleep restriction (5-h sleep opportunity) followed. In the sitting condition (SIT), participants

remained seated between 1000-1800. In the physical activity condition (PA), participants completed 3-min bouts of light-intensity walking every 30 mins on a motorised treadmill. At all other times, in both conditions, participants remained seated, except when walking to the dining room or to use the bathroom (max 32 m). Six male participants were randomised to one of two trial orders, 1) SIT then PA, or 2) PA then SIT. Interstitial glucose concentrations were measured every 5 min using a continuous glucose monitor to derive average daily glucose concentrations. Analyses were conducted using a linear mixed-effect ANOVA with condition (SIT or PA) and order (1 or 2) as fixed effects, and participant as a random effect.

Results and Conclusion: Average daily glucose concentrations increased from baseline in both conditions after night one of sleep restriction (SIT = +1.13 $mmolL^{-1}$; PA = +0.96 $mmolL^{-1}$). No difference was observed between the SIT and PA condition across the three nights of sleep restriction (SIT = 5.7 $\pm$ 0.2 $mmolL^{-1}$; PA = 5.6 $\pm$ 0.2 $mmolL^{-1}$). These data support our contention that sleep restriction may attenuate the positive benefits of interrupting sitting time on glucose metabolism. Further research with larger samples appropriate control groups (8-9 h sleep opportunities) should be conducted to confirm these findings.

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DSM-5 TOBACCO USE DISORDER AND SLEEP DISTURBANCE: FINDINGS FROM NESARC-III

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The DSM-5 Tobacco use disorder diagnosis incorporates tobacco misuse, addictive behaviours and withdrawal symptomology. Tobacco use is bidirectionally associated with sleep pathology; however, no epidemiological studies have yet evaluated the associations between DSM-5 Tobacco use disorder and self-reported sleep disturbance. A total of N = 36,177 adults who participated in the 2012–2013 National Epidemiologic Survey on Alcohol and Related Conditions were included for analyses. Current and lifetime DSM-5 Tobacco use disorder diagnoses were associated with poorer health and medical outcomes and higher rates of subjective sleep disturbances (all $p < 0.001$). Associations between current and lifetime DSM-5 tobacco use disorder and subjective sleep disturbances were maintained in multivariable analyses following adjustment for a range of health, lifestyle and psychiatric factors (adjusted OR 1.11, 95% CI 1.00-1.23 and adjusted OR = 1.24, 95% CI 1.15-1.34, respectively). Data from this large, representative survey indicates that the association between DSM-5 Tobacco use disorder and sleep disturbance is explained by underlying diagnoses of DSM-5 alcohol use disorder. Multifaceted substance abuse treatment protocols may improve treatment outcomes for affected patient groups.

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LONGITUDINAL EFFECTS OF SLEEP PROBLEMS OF MĀORI AND NON-MĀORI OF ADVANCED AGE: LILACS NZ

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Introduction: Sleep problems become more prevalent with aging. However, the predictors and impact such problems have on people of advanced age are not well understood. This project explores the relationship between reporting sleep problems and the effects on independent living and health outcomes over time, amongst Māori and non-Māori of advanced age.

Methods: Participants were 251 Māori, and 398 non-Māori adults from *Te Puāwaitanga o Ngā Tapuwae Kia Ora Tonu* Life and Living in Advanced Age: A Cohort Study in New Zealand. The relationship between reporting a sleep problem in wave 1 (median age 84 years) and current sleep and health outcomes at wave 5 (median age 89 years) were investigated. Outcomes included continued sleep problems, use of medications, physical and mental health status, hospital admittance, and mortality. Multiple logistic regression was also used to identify predictors and health outcomes for reporting a current sleep problem at wave 5 cohort (n = 285).

Results: At Wave 1, 29.6% of the sample reported a current sleep problem (26.3% of Māori and 31.7% on non- Māori) and this was related to poorer physical and mental health, and falling. At Wave 5, 16.1% of the initial problem sleepers continued to report a problem, compared to 8.5% of those who did not originally report a sleep problem. 65.1% of the sleep problem group had withdrawn from answering the full survey (35.4% were deceased, 19.8% dropped out for other reasons), compared to 57.5% withdrawal within the non-problem sleepers (26.0% of whom were deceased, 25.8% dropped out for other reasons). At Wave 5, 29.4% of Māori and 26.5% of Non-Māori reported a current problem. Ongoing analyses will be presented and discussed.

Conclusion: Findings help us to understand sleep as a component of health ageing. Sleep problems are commonly reported and associated with poorer health. Early recognition and management of sleep problems could improve physical and mental health with ageing.

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ADHERENCE IMPROVEMENT EFFECT OF SUVOREXANT WITH POOR ADHERENCE CAUSED BY INSOMNIA UNDER CPAP USAGE

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Introduction: Adherence is important for CPAP therapy to treat obstructive sleep apnea syndrome (OSAS). However, some patients cannot maintain their adherence due to difficulty falling asleep or nocturnal awakening.

Studies show that suvorexant is effective to reduce sleep onset latency and nocturnal awakening. Also, reports show that using suvorexant to OSAS patients will not worsen their clinical conditions. In this current study, we administered suvorexant to patients with poor adherence of CPAP usage, and examined the effect of adherence improvement.

Methods: A retrospective study has been carried out. Overnight polysomnography tests were performed to outpatients who came to our department with snoring problems, daytime sleepiness, or cardiovascular diseases. Among those who were diagnosed with mild to severe OSAS and adopted CPAP therapy, patients with CPAP use rate less than 70%, or use time less than 240 minutes (4 hours), or both were administered with suvorexant (less than 65 years old: 20 mg, 65 years old and above: 15 mg) for a month to examine whether adherence improvement was observed. Also, after use of suvorexant was examined to determine whether exacerbation of AHI and increase in CPAP pressure were observed.

Results: 14 patients were subjected from December 2015 to March 2016. As baseline, the average age was 65.6 years, two subjects were male, average AHI was 37.0events/hour, average 90%

pressure was 7.75cmH_2O, average use rate was 55.7%, and average use time was 151.3 minutes. There was no difference of AHI (P = 0.527) and CPAP use rate (P = 0.136) between before and after use of suvorexant. Improvement were observed in CPAP use time (P = 0.004) and CPAP use time 4 hours and above (P = 0.001) between before and after use of suvorexant. A rise was observed in 90% pressure between before and after use of suvorexant.

Discussion: In our current study, by administering suvorexant to patients using CPAP with poor adherence, adherence was improved and no exacerbation of OSAS was noticed. Hence, it is effective to administer suvorexant to patients using CPAP with poor adherence, and this suggests the possibility that suvorexant can be used safely.

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EFFECTIVENESS OF A SLEEP CLINICAL PATHWAY IN AN INPATIENT REHABILITATION SETTING: A RANDOMISED CONTROLLED TRIAL

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Introduction: Sleep is important for health, quality of life and general well-being yet sleep in rehabilitation patients is poorly studied and treatments are lacking. Poor sleep in hospitalized patients is common and can affect recovery and hospital stay. We aimed to assess the effect of a sleep clinical pathway in improving sleep quality in an inpatient rehabilitation setting.

Methods: Musculoskeletal inpatient rehabilitation participants were recruited over four months and randomised into "usual care", and "clinical pathway" groups. Outcome assessors were blinded to which arm the patient was in. Outcome measures include: Pittsburgh Sleep Quality Index (PSQI), Hopkins Rehabilitation Engagement Rating Scale (HRERS), Fatigue Severity Scale (FSS), and actigraphy. Outcome measures and actigraphy were conducted within 72 hours of admission and again within 72 hours of discharge.

Results: 51 patients underwent randomisation, 29 controls and 22 intervention (mean age 61.7 ± 17.2 and 63.4 ± 13.8 respectively). No significant differences was shown in any of the outcome measures except for less "Hours Spent in Bed" in the intervention group at −0.43; p = 0.022). As a cohort there were significant differences from admission to discharge both in six of the outcomes measures. PSQI (−2.31; p = <0.001), FSS (−8.75; p = <0.001), HRERS-Physiotherapists (PT) (+1.37; p = 0.037), HRERS-Occupational Therapists (OT) (+1.84; P = 0.008), Hours Asleep (+0.833; p = 0.05), and SRSQ (+0.824; p = 0.001).

Conclusion: Though there was no statistically significant difference between groups, the cohort as a whole improved. Participation in the study may have raised awareness regarding sleep variables and types of disturbances which may have contributed to the cohort improvements. Larger studies are needed to confirm these findings.

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A NOVEL SMARTPHONE APPLICATION FOR THE ESTIMATION OF SLEEP ONSET

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Introduction: When does sleep start? This is a fundamental theoretical question that also has applied clinical importance. Sensory and cognitive capacity seem to dissipate rapidly at about the start of polysomnography (PSG) measured N1 sleep. However, the ability to respond to an external stimulus seems to disappear later. Since this cessation of response can be measured precisely its correspondence to PSG sleep may provide an alternative valid measure of sleep that is much less expensive and more readily available than traditional PSG. The aim of the study was to investigate the correspondence of Sleep On Cue: a novel iPhone application that uses behavioural responses to auditory stimuli, to estimate PSG sleep onset.

Methods: Twelve young adults underwent polysomnography recording while simultaneously using Sleep On Cue. Participants completed as many sleep onset trials as possible within a two-hour period following their normal bed time. On each trial, participants were awoken by the app following behavioural sleep onset. Then after a short break of wakefulness, commenced the next trial.

Results: There was a high degree of correspondence between polysomnography determined sleep onset and Sleep On Cue behavioural sleep onset, $r = .79$, $p < .001$. On average, Sleep On Cue overestimated N1 sleep onset latency by 3.17 minutes ($SD = 3.04$). When PSG sleep onset was defined as the beginning of N2 sleep, the discrepancy was reduced considerably, ($M = 0.81$ min, $SD = 1.96$) and the correlation increased, $r = .92$, $p < .001$.

Conclusion: The behavioural response measure of sleep onset was a highly valid measure of PSG N2 sleep onset. Sleep On Cue may thus be used effectively for sleep applications requiring the detection of N2 sleep onset in the home environment such as the insomnia treatment, Intensive Sleep Retraining, or to facilitate the optimal 10 minute power nap in the home or work environment.

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PREVALENCE STUDY OF SLEEP DISTURBANCE, MENTAL HEALTH, AND PSYCHOSOCIAL CONCERNS AMONG ASYLUM SEEKERS AND REFUGEES

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Asylum seekers and refugees report high rates of trauma and experience significant mental health and psychosocial stress. However there are no reports documenting the severity of sleep disturbances and its relationships to these other issues. Our aim here is to examine sleep disturbance, mental health symptoms and psychosocial concerns in a large sample of asylum seekers and refugees. Data was obtained between October 2014 and May 2017 from an Initial Intake Assessment with 2703 clients seeking mental health services from a non-profit organization providing services to asylum seekers and refugees. Self-report data collected included gender, age, country of origin, migration status, sleep disturbance, mental health symptoms (anxiety, depression, and traumatic stress symptoms) and psychosocial concerns (family dysfunctions, interpersonal difficulties, and social isolation). Sleep, mental health and psychosocial concerns were measured on a 4-point severity scale ('absent', 'mild', 'moderate', 'severe'). Analyses focused on the prevalence of sleep disturbance and the relationship between sleep disturbance and mental health symptoms and psychosocial concerns. Proportion of all clients reporting severity level of sleep disturbances was: 'absent' 11.7%, 'mild' 12.8%, 'moderate' 33.4%, and 'severe' 42.1%. Asylum seekers reported lower levels of 'absent' and 'mild' sleep disturbance as well as greater levels of 'severe' sleep disturbance relative to refugees (chi square, p < 0.001). Within asylum seekers there was no difference in severity of sleep disturbance between those in detention and those

living in community. Within asylum seekers increased sleep disturbance was correlated with increased severity of all mental health (r = .454-.539) and psychosocial concerns (r = .124-.242). Within refugees increased sleep disturbance was also correlated with increased severity of all mental health (r = .615-.667) and psychosocial concerns (r = .256-.367). Overall asylum seekers and refugees both report very high level of sleep disturbance. Sleep disturbance was more strongly correlated with mental health symptoms than with psychosocial concerns and these correlations were especially strong among refugees. These data suggest the need for systematic screening of sleep disturbance among asylum seekers and refugees during all health related visits.

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BED PARTNER ACCOMMODATION OF INSOMNIA IN TREATMENT-SEEKING COUPLES

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Introduction: Insomnia is largely seen as an individual condition despite the fact ~ 60% of Australian adults sleep with a partner. Emerging evidence shows that bed partners affect clients' insomnia (e.g., mismatched bed/wake times in couples). However, no data exist documenting the specific behaviours in which partners of individuals with insomnia engage. Research in other disorders (e.g., OCD) indicates partners can inadvertently reinforce maladaptive behaviours, and thus interventions should address partner behaviours. We provide initial data on bed partner accommodation in insomnia.
Methods: Thirty-one partners (14F, 20-76 years) of individuals seeking treatment for insomnia completed baseline questionnaires as part of an ongoing RCT investigating partner-assisted insomnia interventions. We identified partner accommodation using the Family Accommodation Scale (FAS). Partners and clients completed the Beck Anxiety Inventory, Patient Health Questionnaire, and Dyadic Adjustment Scale. To assess insomnia, clients completed the Insomnia Severity Index and a sleep diary at baseline.
Results: Three-quarters of partners encouraged early bed or late wake times, 65% adjusted their own sleep, and 42% reported client distress when assistance was not given. Forty-eight percent adjusted their family routine, 35% encouraged naps, caffeine or reducing daytime activities, and 52% modified leisure activities in response to the client's insomnia. Sixteen percent modified their work schedule, and 10% encouraged the client to take sleep medication or alcohol. Partner accommodation was not linked to client insomnia severity. Exploratory analyses found partner accommodation was linked to better client relationship satisfaction (r_s = .35, p = .053), but more partner anxiety (r_s = .38, p = .033).
Conclusion: Results indicate bed partners of individuals with insomnia engage in a range of accommodating behaviours, some of which occur at high rates and are contrary to CBTI recommendations. Partner accommodation was not linked to client insomnia. It is possible that the FAS lacks sensitivity to adequately detect partner accommodation, and/or there are ceiling effects to insomnia severity limiting the ability to detect a relationship. More data is needed to determine whether insomnia interventions may further benefit clients and their partners by proactively assessing and addressing bed partner behaviours in treatment.

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A BENCH STUDY OF OXYGEN (O2) DELIVERY DURING NON-INVASIVE VENTILATION (NIV)

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Abstract:
Introduction: Children who are on non-invasive or invasive ventilator support long term usually are ventilated in room air. However some children need supplemental O2 which is usually administered by adding it into some part of inspiratory arm of the circuit. Current portable ventilators do not measure delivered O2 concentration. In this bench study we determine the O2 concentrations delivered during NIV using different test conditions.
Methodology: A Philips Respironics Inc. Trilogy 100 machine delivered CPAP and Bilevel pressures with an O2 flow input at the machine end to a Maquet test lung ("mask end") fitted with 3 different levels of leaks [Respironics Swivel passive exhalation port (high), Whisper Swivel II (medium) and passive exhalation outlet (low)] and tested each setting with two tubing (2 m) diameters of 15 mm and 22 mm. An O2 concentration monitor (Teledyne Analytical Instruments, MX300) measured O2 percent (%) just prior to the test lung. A baseline, calibrated, room air O2 level was established prior to each measurement and the maximum value after a 3 minute steady state in O2 value was measured at the mask for CPAP (5, 10, 15, 20 cmH2O), and bilevel pressures IPAP/EPAP (10/5, 15/5, 20/5, 15/10, 20/10 and 25/10) using ventilation rates of 15 and 35 bpm.
Results: During CPAP (22 mm tubing), the O2 concentration at CPAP 5cmH2O (3.96 litres/min flow) vis-à-vis 20cmH2O (10.75 litres/min flow) for 1, 5 and 10 L/min O2 are: 24.4%, 39% and 65.2% vs. 22.4%, 28.5% and 40%, respectively. There was no significant difference in O2 concentration delivered via 15 mm compared to 22 mm tubing in similar testing conditions during CPAP. During Bilevel ventilation, with 22 mm tubing, a higher O2 concentration was seen with 15 bpm compared to 35 bpm. There was significant difference in O2 concentration between 15 to 35 bpm at 25/10 (highest) and at 10/5 (lowest). The difference in O2 concentrations with 15 mm tubing was smaller than 22 mm tubing for all O2 flow rates and ventilator rates.
Conclusions: Higher CPAP pressures require higher flow which in turn resulted in reduced O2 delivered at patient end. During bilevel ventilation, the O2 concentration delivered to the patient is influenced by the pressures used, ventilator rate and circuit tubing size.

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INSOMNIA MANAGEMENT PRIOR TO ATTENDING AN OUTPATIENT MULTIDISCIPLINARY SLEEP DISORDERS SERVICE

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Introduction: Insomnia is common, and is often managed with hypnotic medications in the community. Cognitive behavioural

therapy for insomnia (CBT-I) is an effective non-pharmacological treatment. This study aims to obtain baseline data on community-based clinical practices for patients presenting with insomnia to our multidisciplinary service. Subsequently this data can be used to evaluate the impact of our service on prescribing practices.

Methods: Data were collected using self-report questionnaires and extraction of medical records through opt-out consent.

Results: Data collected by May 2017 consisted of 251 patients who consented to having data evaluated for research purposes. Of these subjects 239 (95.2%) patients reported using prescribed medications at least once a month to help them sleep (63 patients ≥3 times/week) prior to attending our service. 239 (95.2%) patients reported using over-the-counter medications at least once a month to help them sleep (43 patients ≥3 times/week). However only 77 (30.7%) patients reported that they had been previously diagnosed with insomnia by a doctor. Of these 77 patients, 58 (75.3%) were prescribed hypnotic medications, 43 (55.8%) took over-the-counter medications, 32 (41.6%) were given lifestyle advice, 44 (57.1%) were referred to a psychologist, 16 (20.8%) were referred to a psychiatrist, 9 (11.7%) were prescribed acupuncture or hypnotherapy, and 37 (48.1%) tried meditation, yoga or relaxation techniques.

Medical data extraction regarding the changes in insomnia management after attending the multidisciplinary clinic is currently underway.

Discussion: Prior to attending the multidisciplinary clinic, the number of patients taking hypnotic medications exceeded the number of patients with a prior diagnosis of insomnia. Of the patients diagnosed with insomnia by the referring doctor, pharmacological treatment was more frequently offered than non-pharmacological measures.

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INFLUENCES OF FETAL MOVEMENT ON A PREGNANT WOMAN'S SLEEP: USING FETAL MOVEMENT ACCELERATION MEASUREMENT RECORDER

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Introduction: A pregnant woman's sleep disturbance due to fetal movement is well-known. We have been developing a system of fetal movement acceleration measurement (FMAM) in order to investigate fetal well-being since 2008. This system consists of two channels of fetal and maternal movements. This study examined influences of fetal movement during a pregnant woman's sleep on maternal sleep using the FMAM system.

Methods: The subjects were eighteen healthy pregnant women (23-39 yr) at 24-36 gestational weeks. They gave written informed consent to the study. They were instructed to record fetal and maternal movements during their sleep by themselves once every four weeks. The fetal movement sensor was placed on maternal abdomen, and maternal movement sensor was on her thigh. We detected fetal and maternal movement signals independently, and analyzed detected signals using an original software. We calculated parameters; maternal time in bed, maternal waking time, the number of synchronized fetal-maternal movements, and characteristics of fetal movement signals synchronized with maternal movement.

Results: Mean values of maternal time in bed ranged from 392.0 min to 421.5 min. Mean values of maternal waking time ranged from 13.6 min to 15.2 min. Mean values of the number of synchronized fetal-maternal movements ranged from 62.9 to 79.4. These parameters corresponded to results with our previous polysomnographic findings. The number of synchronized fetal-maternal movements was similar to results of maternal micro-arousals. The fetal movement signals with synchronized maternal movement were longer and larger than those without synchronization.

Conclusion: This study suggest that the FMAM system is useful to see a pregnant woman's sleep disturbance, especially relationships with her fetus.

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POORER SLEEP OUTCOMES ASSOCIATED WITH WORSE SELECTIVE ATTENTION IN OLDER ADULTS WITH SUBJECTIVE MEMORY IMPAIRMENT

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Introduction: Reduced sleep duration and slow wave sleep (SWS), and increased sleep fragmentation are hallmarks of the normal ageing process. These adverse outcomes are typically exacerbated in unhealthy ageing (i.e., MCI, dementia). Poorer sleep outcomes are associated with poorer performance on high order cognitive functions. Despite attention underpinning much of cognition, the extent to which sleep is associated with attention is much less clear. Existing studies focus primarily on vigilant attention – using simple reaction time as their primary measure. Ocular-motor assessments can provide a more detailed assessment of attention, by utilizing novel paradigms designed to tap into selective attention. The aim of this study was to examine how sleep is associated with vigilant and selective attention in older adults with subjective memory impairment (SMI) using this novel ocular-motor approach.

Method: Twenty-four older adults (60-80 years; AHI <15) with SMI slept overnight in the sleep laboratory. During an 8-hour sleep opportunity, participants had their sleep recorded with polysomnography. Six hours after their scheduled wake time, participants completed two ocular-motor attention tasks involving moving the eyes toward (visually guided) or away (anti-saccade) from different visual targets. Saccade latency for both tasks and the number of errors (looking at the stimulus instead of inhibiting the response) made on the anti-saccade task were calculated.

Results: Age-related changes in sleep were associated with poorer outcomes on selective attention, but not vigilant attention. The number of errors (lack of inhibition) was significantly correlated with SWS duration, total sleep time (TST) and sleep efficiency (SE%), such that worse performance was strongly associated with less time spent in SWS, lower sleep duration, and poorer SE%. Spectral analysis is currently underway.

Discussion: These findings demonstrate that the common changes that occur in sleep with ageing are associated with poorer selective attention. Many complex cognitive functions and daily tasks rely on selective attention. This suggests that interventions aimed at improving sleep, in particular those that enhance SWS, may benefit selective attention and broader cognitive function in older adults.

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EXPLORATION OF THE RELATIONSHIP BETWEEN CHILD'S SLEEP DISTURBANCES ON PARENT'S SLEEP QUALITY AND PRE-SLEEP AROUSAL

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Introduction: Recurrent sleep disturbances in children can impact parent's sleep and functioning. However, this relationship is scarcely reported in the literature despite studies suggesting that 25-40% of general paediatric population experience sleep difficulties. Existing studies have mainly focused on infant sleep, assuming that the child would develop a regular sleeping pattern by the age of two years. Therefore, the nature of sleep in parents of children beyond infancy is not well understood. This study aims to (i) explore the relationships between parent's sleep quality, pre-sleep arousal and child's sleep disturbances; and (ii) compare sleep quality of parents of children with and without sleep difficulties secondary to a neurodevelopmental disorder.
Methods: To date, 30 parents of children aged 2-10 years (mean age = 36.6 $\pm$ 3.9 years), completed an online questionnaire assessing sleep quality (Pittsburgh Sleep Quality Index, PSQI), pre-sleep arousal (Pre-Sleep Arousal Scale, PSAS), child's sleep habits (Child's Sleep Habits Questionnaire, CSHQ) and bedtime routines (Bedtime Routines Questionnaire, BRQ). Inclusion criteria were a cut-off score of > 5 on the PSQI and ≥ 41 on the CSHQ, indicating a significant sleep problem in parent and child respectively.
Results: Pearson's correlations indicated a significant positive correlation between CSHQ, and PSQI scores ($r = .40$, $p = .025$), and parent's somatic and cognitive pre-sleep arousal ($r = .38$, $p = .035$). Parents' daytime sleepiness was related to inconsistency in child's bedtime ($r = .61$, $p < .001$). A Mann-Whitney U Test found no significant differences in sleep quality between parents of children with and without sleep difficulties secondary to a neurodevelopmental disorder ($U = 69.5$, $z = -.132$, $p = .89$, $r = .014$).
Conclusions: The study indicates that a child's sleep disturbance, irrespective of the aetiology can have a significant impact on the parent's sleep quality and daytime sleepiness. Children's sleep problems were also shown to significantly increase parent's pre-sleep arousal, possibly resulting in insomnia-like symptoms. From this data, we intend to examine the relationship further using objective sleep parameters to understand nature of sleep in parents while assessing a novel, therapeutic approach for parent's sleep.

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DETERMINING THE FUNCTIONAL CONSEQUENCE OF THE RF-EEG EFFECT

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Introduction: Telecommunications technologies, have developed rapidly since their introduction and their use is now global and abundant. To date the consensus in the research is that there are no harmful effects to human health resulting from exposure to radio frequency electromagnetic fields (RF-EMF) produced by mobile phones. However, increases in the spindle frequency range during sleep have been repeatedly demonstrated. The ramifications of these EEG effects are unknown and due to the vital importance of sleep it is crucial to understand the consequences of this effect. Recent studies suggest that the lack of findings could be due to methodological flaws. Loughran et al. (2012) found that there was significant individual variation in response to RF-EMF exposure, which was repeatable within the individual, a factor that was not taken into account in previous studies. The current study will account for individual variation and provide the strongest evidence to date as to whether the EEG changes during sleep result in functional consequences. As the spindle frequency range in particular is associated with memory consolidation and learning, one consequence of this RF-EMF effect may be changes in memory consolidation, which will be tested for the first time in this study. Cognitive performance will also be assessed using digit span tasks. Based on previous research it is hypothesised that the EEG will be affected by mobile phone-like exposures, and that this response will be consistent within an individual. By dividing the group based on EEG response and improving on previous methodologies and calibrating the cognitive tasks to each individuals own performance level, it is also hypothesised that cognitive performance will show an effect of exposure, which will provide some insight into the functional significance of the EEG response.
Method: Double-blind, randomised, counter-balanced cross-over design. 24 participants will be required to spend 4 consecutive nights in the sleep laboratory (3 exposure nights comprised of one sham and 2 active exposure conditions, preceded by an adaptation night).
Results: Data collection and analysis is currently being undertaken.

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PROLONGED CARDIORESPIRATORY DISTURBANCE FOLLOWING CONVULSIVE SEIZURES

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Introduction: Sudden unexpected death in epilepsy (SUDEP) is the most common cause of epilepsy-related death. SUDEP or near-SUDEP often follow a convulsive seizure. Recent efforts to understand the pathophysiology of SUDEP have demonstrated that there is a rapid, centrally mediated alteration to cardiorespiratory function that occurs immediately following convulsive seizures. Despite its relevance to SUDEP, changes in heart and respiratory function accompanying convulsive seizures have not been adequately investigated. Assessment of continuous cardiac and respiratory function before, during and after convulsive seizures may improve our understanding of the mechanisms leading to SUDEP.
Methods: A retrospective study to characterize cardiac and respiratory function during seizures recorded in patients admitted for video-EEG monitoring with concurrent polysomnography was undertaken between February 2012 and May 2017. Seizures were classified as convulsive seizures (focal to bilateral tonic-clonic and generalized tonic-clonic seizures) and non-convulsive seizures. Heart and respiratory rates, heart rate variability (HRV), and

peripheral capillary oxygenation levels were assessed at baseline, and compared to immediately before, during and after each seizure.
Results: A total of 18 convulsive seizures and 140 non-convulsive seizures were recorded from a series of 70 patients. Significant and persistent tachycardia occurred following all convulsive seizures ($P = <0.0001$). These seizures were also followed by significant tachypnea ($P = <0.0001$). Many patients had prolonged tachycardia and tachypnea, which persisted for more than 60 minutes following convulsive seizure termination. HRV was higher in convulsive seizures with post-ictal generalized electroencephalogram suppression ($n = 12$) compared to those without ($n = 6$; $P = 0.02$).
Discussion: Considerable cardiorespiratory dysfunction occurs after convulsive seizures, which may explain why these seizures carry the greatest risk of SUDEP. Sustained cardiorespiratory dysfunction may increase the risk of further convulsive seizures and SUDEP. Targeting mechanisms underpinning this dysfunction may potentially prevent the occurrence of SUDEP.

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INADEQUATE TOTAL SLEEP TIME IS FREQUENTLY OBSERVED IN HYPERSOMNOLENT PATIENTS UNDERGOING MULTIPLE SLEEP LATENCY TESTING

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The multiple sleep latency test (MSLT) is an objective assessment of an individual's tendency to fall asleep. It is utilised in the evaluation of hypersomnia, particularly when narcolepsy is suspected. However, test results are influenced by recent sleep, pharmacotherapy, co-morbid medical and psychiatric conditions. Our team undertook a review of pre-MSLT parameters to identify whether any components correlated with MSLT outcomes. The study was conducted as a retrospective cohort analysis at a metropolitan tertiary hospital. All patients with a completed MSLT performed between May 2015 and December 2016 were included in the analysis. Data parameters were derived from the 2005 American Academy of Sleep Medicine practice parameters paper. These parameters included patient clinical information, laboratory pathology tests and formalised assessments of sleep. Narcolepsy was only diagnosed in 3.7% (3/82) of patients. Additionally, 6.1% (5/82) of patients were ultimately diagnosed with idiopathic hypersomnia. Of note, 12.2% (10/82) of patients had indeterminate results despite short sleep latency. Mean sleep duration in our cohort was 6.4 hours with 40% (33/82) of patients sleeping less than 6 hours on the preceding night's polysomnography (PSG). The latter was the most frequent explanation for an indeterminate MSLT outcome. There was a weak association between pre-MSLT PSG and baseline PSG total sleep time ($r = 0.36$, $p = 0.03$) and no significant association between the pre-MSLT PSG and sleep diary or actigraphy total sleep time. Our cohort also demonstrated high prevalence (41%) of anti-depressants therapy and an elevated Hospital Anxiety and Depression Scale (HADS) with a mean HADS(A) and HADS(D) score of 9 respectively. In conclusion, an invalid MSLT as a result of inadequate total sleep time was a frequent finding. Total sleep time on baseline PSG, actigraphy or sleep diary was not helpful in predicting which patients would achieve adequate sleep on the pre-MSLT PSG. We also observed a high prevalence of antidepressant therapy and a mild elevation of depression score.

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IDENTIFICATION OF POSSIBLE CAUSES OF EXCESSIVE DAYTIME SLEEPINESS IN PATIENTS WITH NORMAL MSLT

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Introduction: Multiple sleep latency test (MSLT) is the gold standard for the diagnosis of hypersomnolence disorders. While MSLT has a strong negative predictive value, the alternative diagnosis for the cause of excessive daytime sleepiness (EDS) often remains indeterminate. The aims of this study were to determine the prevalence of normal MSLT in our laboratory and to identify possible causes of subjective EDS in these patients based on clinical, polysomnographic and actigraphy data.
Methods: This is a retrospective study of consecutive patients referred for MSLT by sleep physicians for the investigation of EDS from 2012 to present. Data collected include patient demographics, ESS, questionnaires on medical history and medications, 7-day actigraphy, overnight polysomnography (PSG), followed by MSLT and urinary drug screen. Normal MSLT was defined as a mean sleep latency >10 mins and without SOREM. All tests performed in the sleep laboratory, were in accordance with current AASM standards.
Results: A total of 110 patients were included in the analysis. In this cohort, normal MSLT result was common, ($n = 79$, 71.8% of patients), despite a high mean ESS of (13.0 ± 5.1). The majority were females (71.9%) with a mean age of (45.5 ± 15.7) years and mean BMI of (29.3 ± 6.0 kg/m ^{2}). Amongst those with a normal MSLT, self-reported drug use was common, including antidepressants (39.2%), opiods (13.9%) and those with polypharmacy (≥ 4 medications) (24%). Positive urine drug screen was identified in 12.7% of patients. PSG showed that 26.6% of patients had moderate-severe OSA (RDI $\geq$ '15/hour'), while 17.7% had severe REM-related OSA (REM RDI $\geq$ '30/hour'). Actigraphy data showed 11.4% of patients had sleep restriction with a mean sleep duration $\leq$ 6 hours. Collectively, a significant proportion of patients ($n = 51$; 64.6%) with a normal MSLT had at least one or more potential causes for their daytime sleepiness identified.
Conclusion: In our cohort or patients, a normal MSLT result is very common when investigating for subjective excessive daytime sleepiness. Potential alternative causes appear frequent and may be identifiable from detailed clinical assessment, in addition to polysomnographic and actigraphy data.

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CLIENTS REFERRED FOR SLEEP PSYCHOLOGY TREATMENT DEMONSTRATE HIGH LEVELS OF CO-OCCURRING PSYCHIATRIC SYMPTOMATOLOGY

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Introduction: Sleep psychology client referrals can be complex and clients often present with co-occurring psychiatric symptomatology. The Diagnostic and Statistical Manual of Mental Disorders Ed. 5 (DSM-5) Task Force and Work Groups developed a questionnaire to help address the issue of co-occurring symptoms across mental disorders. This questionnaire, the DSM-5 Level 1 Cross-Cutting Symptom Measure, was incorporated into the psychology screening process at a private sleep disorder centre in Melbourne, Australia, to

assess for the presence of co-occurring psychiatric symptoms in people presenting with psychological sleep disorder concerns, such as Insomnia Disorder. The aim of this study was to conduct a clinical audit on sleep psychology referrals to investigate responses to the DSM-5 questionnaire.

Methods: Fifty clients who attended an initial sleep psychology session from June 2015 to January 2017 had their clinical record reviewed and information about their basic demographics and responses to the DSM-V Cross Cutting questionnaire and Insomnia Severity Index (ISI) were gathered.

Results: The mean age of clients was 38.6 years with the main reason for referral listed as Insomnia or Hyperarousal (88%). 41/50 clients had one or more diagnosed comorbidity (health, psychiatric and sleep disorder included) prior to referral, and the average score on the ISI was 16.24. The DSM-5 Level 1 Cross Cutting Symptom Measure revealed domain scores recommending further inquiry into psychiatric symptoms for the following percentage of clients: Depression = 64%; Anger = 64%; Mania = 40%; Anxiety = 64%; Somatic Symptoms = 50%; Suicidal ideation = 26%; Psychosis = 6%; Sleep problems = 88%; Memory = 34%; Repetitive Thoughts and Behaviours = 26%; Dissociation = 20%; Personality Functioning = 40%; and Substance Use = 40%.

Discussion: Results of this clinical audit suggest a high level of co-occurring psychiatric symptomatology in clients referred for sleep psychology treatment. This has implications for psychological treatment, as psychiatric symptoms can exacerbate sleep issues and also impact on adherence to psychological treatment for sleep disorders, such as Cognitive Behavioural Therapy for Insomnia (CBT-I).

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SHIFT WORK DISORDER AND THE RELATIONSHIP BETWEEN DEPRESSION AND ANXIETY SEVERITY AMONGST NURSES

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The demand for shiftwork is continually increasing. Currently, a quarter of the workforce worldwide undertakes shiftwork. Some shift workers cannot adapt to their shift work schedules and experience chronic sleep insufficiency, excessive daytime sleepiness or insomnia due to their work schedules, known as Shift Work Disorder (SWD). SWD is a circadian misalignment sleep disorder resulting from irregular work schedules, effecting 20-30% of shift workers. Workers with SWD have a higher rate of sick leave and absenteeism as well as mental health problems such as depression and anxiety. Healthcare shift workers are a unique population because it is a female-dominated sector involving naturally higher emotional and physical demands. However, the link between mental health and SWD has not been explored in this population. The aim is to evaluate the relationship between depression, anxiety and SWD in healthcare shift workers. A cross sectional sample of healthcare shift workers was collected from a larger multi-centred, prospective clustered randomised controlled trial. Participants completed an online questionnaire consisting of questions including the Shift Work Disorder Questionnaire (SWDQ) to measure SWD, Patient Health Questionnaire (PHQ-9) to measure depression and General Anxiety Disorder Questionnaire (GAD-7) to measure anxiety. The proportion of participants with high risk for SWD was calculated and comparisons were made between Mean depression and anxiety scores associated with low and high SWD groups**.** Analysis was conducted on 153 participants out of 404 staff invited to participate on 16 wards. 97% were female, average age 36.32 yrs (SD = 12.27) and 33% (95%, C.I = 25.9-41.3) were at high risk of SWD. There was a significant difference between depression scores for high SWD (M = 7.36, SD = 4.16) compared to low SWD (M = 3.51, SD = 3.29), $t(153) = 6.23$, $p < 0.001$. There was also a significant difference between anxiety scores for high SWD (M = 5.68, SD = 3.87) compared to low SWD (M = 2.7, SD = 3.51), $t(153) = 4.75$, $p < 0.001$. SWD appears common amongst healthcare shiftworkers and that individuals at high risk for SWD are at significantly higher risk of depression and anxiety compared to low SWD shiftworkers. The severity of the scores where clinically significant with high SWD shiftworkers close to the clinical threshold indicating major depression/ general anxiety disorder.

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SLEEP QUANTITY AND QUALITY OF ON-CALL FROM HOME FIRE AND EMERGENCY SERVICE WORKERS

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Introduction: 'On-call' work is a form of irregular work scheduling that allows the provision of 24-h services when full shift coverage is not required. Previous research investigating the sleep of workers when on-call from home has predominantly employed subjective sleep measures. The aim of this study was to determine the extent to which sleep quantity and quality is affected in fire and emergency service workers who operate on-call from home, using objective sleep measures.

Methods: Participants wore an Actical activity monitor and completed daily sleep and work diaries for two weeks. Total sleep time, sleep onset latency, wake after sleep onset and sleep efficiency were recorded. Participants were included in the final analysis if they collected data in at least two of the following conditions: on-call with a night call, on-call without a night call, off-call. Data were analysed using within-subject generalised estimating equations (GEE), with separate models developed for each variable of interest (n = 35).

Results: On-call *with* a night call was a predictor of 20 ± 6 min more wake after sleep onset and 4 ± 1% poorer sleep efficiency compared to when off-call ($p < 0.05$). Being on-call *without* a night call was associated with 20 ± 10 min longer total sleep time and 6 ± 3 min more wake after sleep onset compared to when off-call ($p < 0.05$).

Conclusions: Wake after sleep onset was longer in both on-call conditions compared to off-call, strengthening the supposition of other researchers that there may be an anticipatory effect to operating on-call. Given that calls during night hours inevitably disrupt sleep, it is currently unclear as to why total sleep time was not less than in the off-call condition.

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THE INFLUENCE OF OBESITY, INSOMNIA AND OSA ON EXCESSIVE DAYTIME SLEEPINESS IN COMMERCIAL BUS DRIVERS

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Introduction: Recent research has found the evidence of an association between motor vehicle accidents and excessive daytime sleepiness (EDS) in professional drivers, and EDS may play an important role in drowsy driving which could induce serious personal and social damages. Therefore, the aim of this study is to elucidate the association of demographic characteristics, medical comorbidities, sleep disorders with the occurrence of EDS in a large sample of professional bus drivers.
Methods: A cross-sectional study was done for 800 urban bus drivers employed at urban bus depots in Republic of Korea from March to April, 2017. The Korean version of Epworth Sleepiness Scale (ESS), Insomnia severity index (ISI) and Berlin questionnaire (BQ) were administered, and demographic characteristics, comorbid medical conditions, including hypertension, coronary heart disease, cerebrovascular disease, thyroid disease, diabetes, were collected as well. We excluded the subjects who did not complete whole questionnaires for reliance of data. Logistic regression analysis was used to investigate the association of demographic characteristics, comorbid medical condition, insomnia and obstructive sleep apnea (OSA) with EDS, Odds ratio (OR) and their 95% confidence interval (95% CI) were computed. The statistical significance was defined as p value less than 0.05.
Results: Results are given on 304 individuals (38% of sample) with a mean age of 51.1 $\pm$ 6.8 years (range 30-63), 10 women bus drivers. The mean body mass index (BMI) and total sleep time of participants were 24.7 $\pm$ 3.2, 6.05 $\pm$ 1.51 h, respectively. Of the responding bus drivers, medical comorbidities were reported by 29.3% and 13.2% reported that they had EDS (ESS $>$ 10). Among the variables, EDS were significantly predicted by obesity (BMI $\geq$ 30) (OR = 3.50; 95% CI, 1.19 to 10.32), insomnia (ISI $\geq$ 8) (OR = 4.22; 95% CI, 2.05 to 4.68), high risk of OSA with BQ (OR = 5.10; 95% CI, 2.55 to 10.22).
Conclusions: This study shows a concerningly high rate of sleepiness among professional bus drivers. Also, our results indicate that professional bus drivers with obesity, insomnia, OSA have the significantly greater risk of EDS. These findings suggest that screening for high-risk group of EDS among commercial bus drivers needs to be seriously considered.

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GROGGY, DAZED AND CONFUSED: THE IMPACT OF ANTICIPATING AN IMPORTANT TASK WHEN ON-CALL ON SLEEP INERTIA

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Introduction: On-call scheduling is used in occupations to respond to emergency situations and results in workers' obtaining reduced sleep. Reduced sleep can increase the magnitude and duration of sleep inertia, the hypo-vigilant state experienced upon waking, resulting in impairments to cognitive performance. This study investigated how anticipation of performing an important task, upon waking, impacts performance when on-call.
Methods: Healthy male participants (n = 24) spent four consecutive nights in a sleep laboratory (an adaptation night followed by a control night and two on-call nights). Each night, participants went to bed at 2300 and were woken at 0700. On the on-call nights, participants were told that they would definitely be called and that upon waking would either a) perform a speech (high importance) or b) quietly read (low importance), instructions on the on-call nights (high or low importance) were counterbalanced. Upon waking, participants completed five 10-min test batteries every 15-min. Measures included the Karolinska Sleepiness Scale (KSS) and a 3-min Psychomotor Vigilance Task (PVT-B). For the PVT-B, mean reciprocal response time (RRT), fastest 10% of response times, slowest 10% of RRT and lapses were assessed. Analyses were conducted using linear mixed-effect ANOVAs.
Results: Response times were slower and number of lapses and subjective sleepiness were higher at session 1 compared to subsequent sessions (time points 2-5) ($P < .001$). Participants reported being sleepier on the experimental days compared to the control day ($P < .001$), and were sleepier during the low importance condition compared to the high importance condition ($P < .001$). There were no differences in all PVT-B variables between conditions.
Conclusions: A consistent sleep inertia effect was found amongst conditions whereby subjective sleepiness was higher and cognitive performance worse immediately upon waking compared to the proceeding time points. However, this response did not differ between the high and low importance task conditions in terms of cognitive performance but did with subjective sleepiness. It is possible that participants' anxiety in anticipation of the speech task may explain these results.

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ASSOCIATION BETWEEN SELF-REPORTED WORKPLACE LIGHTING QUALITY AND SLEEP QUALITY IN A MULTI-ETHNIC POPULATION IN ASIA

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Background: Cardiovascular disease (CVD) is expected to be the leading global cause of morbidity and mortality by 2020. Sleep quality is associated with CVD and addressing sleep behaviour could promote optimal cardiovascular health. Light exposure is found to be an important predictor of sleep quality.In this study, we investigated the association between self-reported workplace lighting quality and sleep quality.
Method: We studied 409 full-time employees working in aboveground and underground offices in Singapore. Shift-workers were then excluded from the analysis as shift-work is known to be associated with sleep quality. Light quality was assessed by a 7-point scale (1 = dissatisfied; 7 = satisfied) questionnaire used in the OFFICAIR project. Light parameters assessed were: "Natural", "Artificial" and "overall". Sleep quality was assessed by Pittsburgh Sleep Quality

Index (PSQI); Poor sleep quality was defined as PSQI > 5. *Factors associated with poor sleep quality with p-value <0.05 in the univariate were included in the multivariate models*. Univariate and multivariate logistic regression were conducted to determine the association between light quality and poor sleep quality.

Results: Poor sleep quality was prevalent in 36% of non-shift workers. Workers with a higher satisfaction of overall lighting quality were 23% less likely to have poor sleep quality (OR: 0.77, CI: 0.61-0.96). However, association between artificial lighting and sleep quality did not reach statistical significance. We did not find any association between natural lighting and sleep quality. These associations with lighting and sleep quality did not change significantly (OR: 0.74, CI: 0.59-0.92) after adjusting for known confounders.

Conclusion: In this study, we found that perceived light quality is strongly associated to perceived sleep quality. This highlights the importance of maintaining good light quality in workplaces thus helping to address sleep behaviour and consequently improving cardiovascular outcomes.

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CLINICAL DENTAL EXAMINATION CAN INDICATE SUSCEPTIBILITY FOR SLEEP DISORDERED BREATHING

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Introduction: Analyses based on examination of the oropharyngeal area such as Mallampatti Classification and Friedman Staging have been shown to be of predictive value in determining obstructive sleep apnoea (OSA) severity. However, there are many oropharyngeal factors that can play a role in OSA. These include micrognathia, retrognathia, velum shape, macroglossia, tonsillar hypertrophy, raised floor of mouth, morphology of oropharynx and the presence of lingual, palatal or buccal tori. Importantly, all these features are examined as part of a regular dental check-up making dentists ideally situated to determine susceptibility for sleep disordered breathing. While dentists specialising in sleep dentistry are best placed to interpret the clinical significance of these multiple features, it would be beneficial if the most important of these clinical features can be identified and distilled into a simpler format for broader utilization. The present study aimed to determine which grouping of the above oropharyngeal features was the best predictor of objective OSA severity.

Method: Relevant data collection has been prospectively collected on fifty five patients (29M, 26F) referred to a laboratory sleep study (SleepSA, Adelaide) and underwent standard dental examinations (The Dental Practice, Adelaide) by the single observer. For these patients, their laboratory-determined apnoea-hypopnoea index (AHI) was recorded as was the presence and/or degree of severity of the oropharyngeal features described above. This data was subjected to a stepwise multiple regression analysis to determine which grouping of features was the best predictor of AHI severity.

Results: Data analysis is currently underway and will be presented at the conference.

Discussion: The provision of oropharyngeal features that best predict objective OSA severity will enable dentists to more confidently broach the subject of sleep apnoea with their patients given these patients are typically not expecting to have this topic discussed. Clear and confident reasoning at this point will increase the likelihood of effective patient screening, clinical diagnosis with follow through referral for laboratory investigation and ultimately effective treatment.

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BENZODIAZEPINE USE: RISK PERCEPTIONS OF ADULT USERS

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Introduction: Benzodiazepines are widely prescribed psychotropic medications. Our study aimed to explore the sleep characteristics and risk perception patterns of benzodiazepine users.

Methods: This study involved a point of purchase survey with patients obtaining benzodiazepines from selected pharmacies across New South Wales (NSW), Australia. Survey items included questions about patients' demographic characteristics and their reason for taking benzodiazepines. Scales such as Insomnia Severity Index (validated) and perception of risk (customised) were included in the survey. Data obtained from the surveys was entered into the SPSS package and was then descriptively analysed.

Results: 44 patients (61% females) taking benzodiazepines have been recruited. The median age of the participants was 51.5 years (range 23 to 86 years). The reported reasons for benzodiazepine use were - sleep disorders (45.5%), anxiety (20.5%), muscle spasm (11.4%), depression (9.1%), stress (9%) and pain management (4.5%). Insomnia Severity Index (ISI) score indicated that about 29.5% of the study population had clinical insomnia (score range: 15-21) during the survey. 70% of the respondents had been taking benzodiazepines for at least one year. About 25% and 50% of the participants perceived that driving a motor vehicle within 3-4 hours and 12 hours of taking benzodiazepines respectively are not risky at all.

Discussion: Despite the potential side effects of prolonged benzodiazepine use, long-term use of benzodiazepine remains high in the Australian population. Of concern is the perceived reduced risk perception about driving a car after taking benzodiazepines in a large proportion of the sample. The findings of this study emphasize the need to develop an effective communication tool to improve risk perception and to reduce chronic benzodiazepine use.

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IDENTIFYING PATHWAYS FOR NEW TREATMENT STRATEGIES FOR CHILDREN WITH PRIMARY SNORING

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Aim: Although children with primary snoring (PS), the mildest form of sleep disordered breathing (SDB), represent the greatest proportion of those with the disease and exhibit equivalent daytime deficits as children with severe obstructive sleep apnoea (OSA), they rarely receive treatment. This study aimed to address why equivalent deficits exist in children with PS and OSA through the unique examination of sleep-dependent learning, potentially providing information for the development of non-surgical treatment strategies.

Methods: General intellectual ability and parent-reported behaviour were assessed in children (5-10y) with clinically diagnosed PS (N = 17; obstructive apnoea hypopnoea index (OAHI) ≤1 event/h),

moderate-severe OSA (N = 14; OAHI > 5 events/h), and non-snoring population Controls (N = 18) one week prior to an in-home polysomnography (PSG). A sleep-dependent learning protocol was conducted pre- and post-PSG. Slow wave activity (SWA) was used a marker of sleep disturbance. Group differences in IQ, behaviour, sleep-dependent learning performance and dissipation of SWA were assessed. Associations between OAHI, SWA and sleep-related memory consolidation were analysed.

Results: Mean IQ outcomes were 10 points higher in Controls than moderate-severe OSA. Both SDB groups had significantly worse parent-reported behaviour and performed worse at acquisition of learning in the narrative memory task. Recall performance remained consistent in all groups pre- and post-sleep. There were no group differences in dissipation of SWA, which was not associated with post-sleep recall performance. Increasing OAHI was significantly correlated with poorer post-sleep recall of learned narrative ($r_s = -0.39$, $p < 0.01$) and picture recognition ($r_s = -0.40$, $p < 0.01$).

Conclusion: Contrary to our hypotheses, learning potential and sleep disturbance as assessed through SWA was equivalent between SDB groups and not associated with memory consolidation. However, as the number of obstructive events was related to reduced memory performance, why children with primary snoring experience deficits remains a mystery. Identifying appropriate non-surgical treatment strategies is important to ameliorate any lifelong deficit in these children and requires further investigation.

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OBJECTIVE AND SUBJECTIVE SLEEP MEASUREMENT; PARENTAL PERCEPTIONS AND IMPLICATIONS FOR CLINICAL PRACTICE

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Background: Sleep knowledge and parental perceptions of infant sleep vary considerably among parents of infants. Parents can report their infant as having a severe sleep problem despite objective methods often differing from subjective measurements. This might suggest that parents are misinterpreting sleep as a problem when in fact it is a normal sleep pattern. This can have clinical implications and lead to a sleep intervention instead of a basic psychoeducation and further can impact significantly on the mental health of parents. This study aimed to assess whether parents can accurately identify a sleep problem in their child.

Methods: Whilst data collection is ongoing, to date, 15 families with infants aged 6-12 months have measured their infants' sleep using actigraphy, and the Brief Infant Sleep Questionnaire (BISQ). Parents responded to the question Do you consider your child's sleep as a problem? (A very serious problem, A small problem and Not a problem at all). These ratings were compared to the objective data to assess if the sleep patterns of the infant could be considered problematic compared to normative data.

Results: Data collection is still ongoing but preliminary data analysis, suggest that parents overestimate sleep problems such as night wakings and sleep duration. and that there is a difference between the objective and subjective measurements of infant sleep.

Conclusions: Parental perceptions of their infants' sleep is in accurate. Furthermore, parents who believe their infant has problematic sleep may be in need of psychoeducation rather than costly sleep interventions. This suggests a need for a clinical understanding of parental perceptions of sleep and a need for sleep education in new families providing the required support to parents in a clinical setting. Further research is required to confirm the validity of different sleep measurement methods in infants.

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SLEEP DISTURBANCE AND SLEEP HYGIENE IN CHILDREN WITH TRAUMATIC BRAIN INJURY

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Introduction: Sleep disturbances, which have many forms, are found in 30-70% of people who sustain traumatic brain injury (TBI). Nevertheless, characterization of sleep disturbances post TBI and their treatments have been largely neglected, especially in children with TBI. The aim of this study was to characterize sleep disturbances experienced by children with TBI, and to establish whether these sleep disturbances related to sleep hygiene.

Methods: Children aged 5 to 15 years with TBI ($n = 47$) and control children who sustained orthopaedic injuries (OI; $n = 34$) participated. The groups were matched on age and sex. Sleep disturbances were assessed with a multidimensional sleep scale: Sleep Disturbance Scale for Children (SDSC). Sleep hygiene was assessed with either the Children's Sleep Hygiene Scale (completed by parents for participants < 13 years of age) or the Adolescent Sleep Hygiene Scale (completed by participants ≥ 13 years old).

Results: The total sleep disturbance score on the SDCS was significantly higher in the TBI compared to the OI control group. Not all aspects of sleep were equally affected. Compared to the OI group, children with TBI showed significantly greater sleep disturbance on the SDCS subscales assessing: initiating and maintaining sleep; sleep-wake transition; excessive sleepiness; and sleep breathing, but not arousal or sleep hyperhidrosis. The total sleep disturbance score was significantly correlated to caregivers' ratings of sleep hygiene, but not adolescents' ratings of sleep hygiene. Discussion

Our study shows that children with TBI have significant, albeit selective disturbances in sleep. Given that poorer sleep hygiene was related to greater sleep difficulties in children, future studies examining the efficacy of sleep hygiene interventions for children with sleep difficulties post-TBI are warranted.

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BOTH OBESITY AND OBSTRUCTIVE SLEEP APNOEA SEVERITY CONTRIBUTE TO INCREASED ARTERIAL STIFFNESS IN CHILDREN

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Background: The prevalence of obese children with obstructive sleep apnoea (OSA) is increasing. Both obesity and OSA are

independent risk factors for adverse cardiovascular outcomes. Arterial stiffness is an early sign of developing cardiovascular disease. Pulse wave velocity (PWV) depends on arterial compliance and is a marker of arterial stiffness.. We aimed to determine PWV in overweight/obese children with and without OSA and non-snoring controls.

Methods: Overweight/obese children aged 8-18y with OSA (n = 21) or without OSA (n = 30) referred for clinical assessment of OSA and healthy weight non-snoring controls recruited from the community (n = 24) underwent overnight polysomnography. Pulse transit time (PTT) was calculated from the top of the R wave on the electrocardiogram to the 50% point on the pulse wave recorded by a photoplethysmographic pulse oximeter. The distance from the sternal notch to the fingertip, which corresponds to the distance travelled by the pulse wave from the heart to the oximeter sensor was measured. PWV was calculated as that distance divided by the PTT. PWV was compared between groups for wake and sleep (N1/2, N3 and REM) using Kruskal-Wallace and Mann Whitney post hoc tests. The association between PWV and OSA severity indicated by the obstructive apnoea hypopnoea index (OAHI), and the BMI Z-score was determined using Spearman's Correlations.

Results: Children who were obese with OSA had elevated PWV compared with controls and non-obese children with OSA, during N1/2 ($p = 0.006$, $p = 0.04$ respectively) and REM ($p = 0.005$, $p = 0.04$ respectively). The obese OSA group also had higher PWV compared with controls during N3 ($p = 0.006$). PWV was positively correlated with the OAHI during N1/2 (rho=0.39, $p = 0.04$), and N3 (rho = 0.46, $p = 0.04$). During N1/2 (rho = 0.26, $p = 0.006$), N3 (rho = 0.37, $p = 0.008$) and REM (rho = 0.33, $p = 0.02$), PWV was correlated with BMI Z-score.

Conclusion: We have demonstrated that both OSA severity and obesity contribute to arterial stiffness when assessed using PWV. As arterial stiffness is a precursor to the cardiac remodelling seen in children with OSA, this study highlights the importance of early evaluation and treatment of obese children with OSA.

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SLEEP DISORDERED BREATHING (SDB) IN CHILDREN WITH PIERRE ROBIN SEQUENCE (PRS)

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Introduction: Pierre Robin sequence (PRS) is commonly associated with sleep disordered breathing (SDB). Obstructive sleep apnoea is considered to be the most common form of SDB in PRS.

Aims and objectives: To review the clinical profile of children with PRS attending a tertiary paediatric centre and to detail the prevalence and features of SDB.

Methods: Review of database, medical records and polysomnography (PSG) results of patients with PRS born between 1991 and 2014.

Results: Forty-four patients with PRS were identified. Of these, 38 (86%) underwent pre-operative PSG prior to palate repair. Seventeen (45%) were male, 1 (2%) was of indigenous origin, 8 (21%) had an associated syndrome or chromosomal abnormality, 4 (10.5%) were premature, and 5 (13%) had a low birth weight. The maternal age was greater than 35 years in 5 (13%). There was a family history of cleft palate or PRS in 10 (26%). Recurrent otitis media occurred in 6 (16%), allergic rhinitis in 11 (29%), gastro- oesophageal reflux in 6 (17%) and echocardiographic abnormalities were found in 11 (29%). A percutaneous feeding gastrostomy was required in 6 (17%). The mean age at first PSG was 3.4 months. SDB was present in 28 (73.6%): 6 (15.7%) had obstructive SDB; 5 (13%) had central SDB; and 17 (45%) had mixed central and obstructive SDB. Nine children (24%) required preoperative respiratory support: CPAP therapy in 5; BiPAP in 1; and supplemental oxygen in 3. Mandibular distraction osteotomy was performed in 1 patient. Thirty-seven patients had a postoperative PSG, of whom 6 (16%) had persistent SDB, 5 had mild central SDB, while one patient had mild mixed SDB.

Conclusions: SDB is a frequent finding in children with PRS. In addition to obstructive SDB, central and mixed SDB were also found to be a feature in this cohort.

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IS BRUXISM ASSOCIATED WITH OBSTRUCTIVE SLEEP APNOEA IN CHILDREN?

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Introduction: Sleep bruxism has been frequently associated with sleep-disordered breathing particularly with snoring and obstructive sleep apnoea (OSA). It has been hypothesized that sleep bruxism may help to reinstate the airway patency following an obstructive respiratory event during sleep.

Objective: To look for the association of bruxism with obstructive sleep apnoea and other additional comorbidities related to bruxism in a group of otherwise normal children referred for a sleep studies to exclude OSA.

Method: Retrospective study done for a period of 18 months (from November 2015 to May 2017) at Sleep Medicine Department, Sydney Children's Hospital. All children presenting with a history of bruxism and snoring in a semi-structured clinical sleep questionnaire were included in this study and the overnight-attended polysomonography (PSG) of each patient was reviewed to look at the obstructive apnoea/hypopnea index (OAHI), chin electromyography (EMG) and periodic limb movements (PLM).

Result: A total of 34 patients were identified. Males accounted for 70% (n = 24). The commonest age group was 5-8 year old (44%) with mean SD of 2.68. Eighty two percent (82%, n = 28) of the cohort presenting with a history of bruxism and snoring had an OAHI of less than 1 per hour (regarded as normal) ($P < 0.05$). In addition, 97% (n = 33) of the patient had no periodic limb movements (defined as more than 5 periodic limb movements per hour of sleep) as comorbidity ($P > 0.05$).

Conclusion: Although bruxism commonly presents with snoring, there is no significant association between bruxism and obstructive sleep apnoea on PSG. A larger prospective study is needed to look for associated comorbidities with bruxism.

Keywords: Bruxism, obstructive sleep apnoea, OSA

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SLEEP, BULLYING, AND DIET ARE RELATED TO ANXIETY, SADNESS, AND HEALTH IN CHILDHOOD AND ADOLESCENCE

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Introduction: Adolescence is a time during which biological and environmental changes impact the ability to obtain a good night's sleep, mood disorders become prevalent, and adult health behaviours and biomedical risk factors are established. The aim of this study was to assess the associations of sleep, diet, and bullying and self-reported sadness, anxiety, and health in a large sample of South Australian children and adolescents.
Methods: 27,025 children and adolescents aged 9.7-17.7 years ($M = 13.3 \pm 1.3$, 13,701 male) enrolled in 368 schools in South Australia completed the Middle Years Development Instrument, which includes questions about frequency of breakfast consumption, junk food consumption, bullying, and good sleep frequency, and weekday bedtime.
Results: The most severe categories were obtaining a good night's sleep less than three times a week (21.5% of participants), a weeknight bedtime of after 11 pm (15.7%), eating breakfast less than three times per week (18.2%), consuming junk food at least five times per week (29.6%), and being bullied many times per week (9.6%). Reporting one of these most severe categories approximately doubled the odds of reporting high (compared to low) sadness, high (compared to low) anxiety and fair to poor (compared to excellent health), while reporting all five resulted in at least a sevenfold increase.
Discussion: While late bedtimes, poor sleep quality, frequent junk food and infrequent breakfast consumption, and bullying were associated with increases in self-reported sadness, anxiety and impaired health, reporting combinations of these factors had compounding effects.

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TELEHEALTH-SUPPORTED PAEDIATRIC HOME POLYSOMNOGRAPHY: AUDIT OF A CLINICAL SERVICE

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Background: Our paediatric clinical sleep unit runs a limited home polysomnography (HPSG) service utilizing telehealth support. We utilise telehealth support to improve technical accuracy. The aim of the present study was to audit all HPSG studies completed between the commencement of the service (December 2013) until the end of February 2017.
Methods: The HPSG reports of children aged 5-18 yrs with suspected obstructive sleep apnoea (OSA) and no significant comorbidity were analyzed retrospectively. All studies were Type 2 tests using the Compumedics Somte PSG V2 (unattended, ≥ 7 channels). The primary outcome was technically accurate studies achieving an adequate diagnosis. Secondary outcomes were sleep architecture, sleep efficiency, sleep duration and parental acceptance (by questionnaire).
Results: A total of 94 patients (39 females) aged 5.1 to 18.2 years underwent Telehealth-supported HPSG between December 2013 and February 2017. A diagnosis was made in 87% after the first HPSG study. Repeat studies (inpatient PSG) were indicated in 12.7% due to major signal loss. The median total sleep time was 8.52 hrs (range 4.45-11.5 hrs), with 94.7% of patients achieving the hospital in-laboratory PSG minimum total sleep time of 6 hrs. The median sleep efficiency was 83.4% (range of 50.0-94.9%). Sleep architecture was normal in 82%. Questionnaire responses confirmed acceptance of the procedure with 96% reporting more convenience than "in lab PSG", 84% reporting very good/excellent Telehealth support, and 96% reporting high level care.
Conclusions: Telehealth-supported HPSG at our center achieves 87% technical accuracy, adequate sleep architecture, duration, and efficiency as well as family acceptability.
Keywords: home polysomnography, telehealth, sleep, paediatrics

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FEASIBILITY AND REPRODUCIBILITY OF PERIOPERATIVE MEASUREMENTS OF AIRWAY COLLAPSIBILITY IN CHILDREN WITH OBSTRUCTIVE SLEEP APNOEA

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Introduction: Removal of adenoid and/or tonsillar tissue is a common treatment for children diagnosed with or at high suspicion of obstructive sleep apnea (OSA). Post-surgical improvements in OSA severity and symptoms are thought to be due to a decrease in upper airway (UA) collapsibility. This study sought to measure perioperative changes in UA collapsibility in children undergoing adenotonsillectomy.
Methods: 56 children (1-8 yrs old) who were undergoing adenotonsillectomy for diagnosed or suspected OSA were recruited for this study (parental consent). Measurements of UA closing pressure (Pclose) were obtained during general anaesthesia immediately before (pre-Pclose) and after (post-Pclose) adenotonsillectomy. Each measurement was obtained in triplicate.
Results: Complete sets of triplicate pre- and post-Pclose measurements were obtained in 53 of 56 children (94.6%). Each set of triplicate measurements was performed in approximately 2 mins. Intraclass correlation coefficients of pre- and post-Pclose measurements were 0.98 and 0.98, respectively ($p < 0.001$ for both) indicating good repeatability. Pclose measurements following the procedure (median = -7.3 cmH_2O, range = -28.1 to -0.1 cmH_2O) were significantly more negative than Pclose before the procedure (median = -4.5 cmH_2O, range = -22.4 to -0.4 cmH_2O), ($p = 0.005$), indicating a less collapsible UA following surgery.
Conclusions: Repeatable measurements of Pclose are feasible in the setting of a busy clinical perioperative environment. Pre- and post-operative measurements can be obtained rapidly, thereby ensuring minimal disruption to standard clinical practice. The change in Pclose to a more negative value following surgery demonstrates that adenotonsillectomy improves UA collapsibility in children. The magnitude of this change and/or the post-surgical Pclose value may be helpful in determining which patients require an extended period of monitoring in the postoperative period and which will have derived most benefit from surgery beyond it.

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UTILIZING NEW TECHNOLOGIES TO CAPTURE INFANT SLEEP-WAKE BEHAVIOUR: PROTOCOL FOR THE BABYCAM PILOT STUDY

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Introduction: The ability of an infant to self-settle without the use of external aids predicts the development of healthy sleep-wake patterns. Traditional methods of assessing settling techniques and baby responses rely on parental report, which can be inaccurate, or video capture, which is limited as the camera is fixed in one place. Day time naps are an important component of an infant's total sleep, and they nap at various times of the day and not always in the same place as night sleep (eg. car seat or pushchair). This pilot study aims to establish methods and determine the feasibility of using a self-worn auto-camera to capture important aspects of infant sleep-wake behaviours in all environments.
Methods: Thirty healthy infants aged three to six months will be recruited via community advertising. Sleep, wake and self-settling behaviour will be captured during daytime naps using four different tools. A video camera will be fixed to the cot/bassinette, which has the advantage of continuously recording all sleep behaviour. An auto-camera (NarrativeClip2) will be worn on a headband by the infant which takes a still image every 15 seconds. Infants will wear an accelerometer, which measures both sleep and rest but not settling, and parents will complete sleep-wake and behaviour diaries to log crying and self-settling behaviour. Video and auto-camera recordings will be viewed offline using suitable software and a coding system will be established based around the main themes of sleep, awake, drowsy, awake content, awake fuss/crying, awake feeding, indeterminate, out of view, and camera turned off. Accelerometer data and sleep-wake diaries will be used as comparative markers of sleep and wake periods. Finally, parents will complete questionnaires assessing the acceptability of methods, which will be used to revise the protocol and operational use of the auto-camera.
Discussion: By comparing our gold standard video measure with the sample of still photos, we will be able to determine the proportion of behaviours correctly identified by the auto-camera, and therefore whether they provide an accurate indication of behaviour occurring out of view of the fixed video camera. Developing valid and accurate assessment tools for capturing self-settling behaviours is necessary before further research focusing on developmental patterns of sleep and later outcomes related to infant self-settling as an early marker of self-regulatory skills can proceed.

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MANAGEMENT OF OBSTRUCTIVE SLEEP APNOEA IN INFANTS

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Introduction: Obstructive sleep apnoea (OSA) in infants has a distinctive aetiology and therefore treatment compared with older children. There is a paucity of international data regarding management of OSA in infants. We aimed to investigate interventions used for treatment of OSA in infants < 24 months.
Methods: This was a retrospective study in a tertiary paediatric hospital with a paediatric sleep laboratory. Participants included all infants aged 0-24 months at the time of OSA diagnosis by polysomnography (PSG) between July 2015 and December 2016. OSA was defined by an obstructive respiratory disturbance index (ORDI) >1/hr.
Results: 81 patients (44 M 37 F) were included. Mean (SD) age at OSA diagnosis was 6 (6) months; 51 infants <6 months, 13 infants 6-12 months and 17 infants 12-24 months. Mean (SD) ORDI was 12 (11). Seventy-two (89%) infants had specific risk factors for OSA including craniofacial and airway abnormalities, a congenital syndrome or neurological condition and 15 (18%) had undergone surgery for upper airway obstruction prior to PSG. In 34 (42%) infants the treatment for OSA was surgical; the most common intervention based on age was jaw distraction in infants <6 months and adeno-tonsillectomy in infants 6-12 and 12-24 months. 47 infants had non-surgical interventions; the most common were medication (19) e.g. anti-GOR drugs, nasal steroids, clinical observation (19), CPAP (15), supplemental O_2 (9), positioning (5), a naso-pharyngeal tube (3) and/or high-flow nasal prong therapy (2). Of the 15 infants trialled on CPAP, 6 failed initiation and only 7/9 remained on CPAP at follow-up. Regarding subjective improvement in OSA post intervention, 8/44 parents reported no change in symptoms, 23/44 reported some improvement, 13/44 reported resolution of symptoms and no parents reported worsening. 24 patients had a post treatment PSG, of whom 3 had worsening OSA, 9 had no change in OSA severity, 9 had an improved ORDI and 3 had resolution of OSA.
Conclusions: In this cohort of infants with a high prevalence of co-morbidities, jaw distraction was the most common surgical intervention in patients <6 months and adeno-tonsillectomy in patients 6-24 months. Medication and clinical observation were the most common non-surgical interventions. CPAP therapy in this population remains a challenge.

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THE EFFECTS OF EXERCISE TIME-OF-DAY ON SLEEP QUALITY AND QUANTITY AMONG INACTIVE MIDDLE-AGED MEN

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Introduction: Many adults remain physically inactive, despite the benefits of exercise for sleep architecture, due to increased sedentary behaviour and time restraints. Methods to improve exercise compliance may include preferential time-of-day or engage in short-duration, high-intensity exercise. High-intensity exercise has many health benefits including weight loss and increased cardiovascular fitness, but when performed close to bedtime, it may reduce percent of rapid eye movement (REM) sleep. Adequate sleep quality and quantity may be more beneficial for the health of middle-aged adults, due to increased risk of disease with aging, rather than delaying or disrupting sleep to engage in exercise. Hence, the aim of this study was to investigate the effect of exercise time-of-day in middle-aged men on sleep architecture.
Methods: 11 inactive men (age = 49 ± 4.6y) completed 3 exercise trials of high-intensity interval cycling in a randomised order (60s at

100% VO_{2peak}: 240s at 50% VO_{2peak}) in the morning (MORN; 0600-0700 h), afternoon (AFT; 1400-1600 h), and evening (EVEN; 1900-2000 h). Participants were screened for sleep conditions using questionnaires and 2 nights type 2 polysomnography (PSG) and the sleep studies were further used to determine baseline sleep parameters. Participants' sleep was monitored using PSG the night following each exercise trial and scored for time in bed, total sleep time, sleep efficiency, sleep onset latency, REM onset latency, wake after sleep onset, and sleep stages (N1, N2, N3, and REM) for the whole night and first 180 min after sleep onset.

Results: Percent N3 sleep was greater following the MORN trial (22.9 ± 7.3%) compared to baseline (18.0 ± 7.2%) ($p = 0.02$) with no other sleep-related differences. For the first 180 min of sleep, percent of NREM sleep (92.4 ± 5.1%) was greater and REM sleep (7.7 ± 5.1%) was reduced following the EVEN trial compared to baseline (87.3 ± 5.4%) ($p = 0.01$).

Conclusion: Sleep quantity does not appear to be influenced by high-intensity exercise regardless of exercise time-of-day. However, when high-intensity exercise is performed close to bedtime, sleep quality is reduced in the first 3 h, as indicated by decreased time spent in REM sleep and incomplete sleep cycles. Also, sleep diaries indicated decreased perceived sleep quality after evening exercise compared to baseline (no exercise), morning and afternoon exercise.

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WHY NASAL AIRWAYS EXPERIENCE DRYING DURING NASAL-APPLIED CONTINUOUS POSITIVE AIRWAY PRESSURE THERAPY

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Introduction: Since its introduction over thirty years ago, users of nasal-applied continuous positive air pressure (n-CPAP) therapy have commonly reported symptoms associated with airway drying. Here the normally robust ability of the human nose to heat and humidify inhaled ambient air seems to be incapacitated during n-CPAP breathing. Despite n-CPAP therapy being highly efficacious in resolving upper airway occlusion it is maligned with poor treatment compliance associated with user discomfort caused by airway drying. Relief from these symptoms is commonly provided by supplementary humidification however the causes(s) of airway drying remains speculative, and whether or not supplementary humidification is a solution has not been determined. During ambient breathing one nasal airway normally conducts the majority of airflow for a period of time before swapping sides in what is termed the 'nasal cycle'. This variation enables the ASL in one nasal passageway to remain fully hydrated, facilitating effective mucociliary transport, while the other side experiences ASL dehydration as a result of it carrying out the bulk of air-conditioning duty. Change in the status of the nasal cycle enables each side of the nose to experience periods of tissue rest and recovery.

Methods: Results from recent investigations that found n-CPAP therapy disrupts normal inter-nasal airflow apportionment and also reduces airway surface liquid (ASL) water supply from the mucosal wall were combined in a computational simulation of ASL hydration over a full breath cycle under pressurised conditions.

Results: During simulated n-CPAP breathing it was found that pressure elicited change in inter-nasal tidal airflow apportionment and ASL water supply cause both nasal airways to simultaneously experience severe ASL dehydration along 60-80% of their anterior length.

Discussion: While n-CPAP causes a 22% in ASL water supply, the predominant cause of nasal airway drying is change in normal inter-nasal airflow apportionment where a near equal amount of airflow passes through each nasal passageway. This finding bring a new understanding of the causes of airway drying during n-CPAP therapy and provides an opportunity to develop new breathing therapy technologies that resolve this problem without the need for supplementary humidification.

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COMPARISON OF NEW ZEALAND AND AUSTRALIAN SLEEP LABORATORY REFERRALS: DEMOGRAPHICS, ANTHROPOMETRICS AND SLEEP MEASURES

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Introduction: Risk factors for OSA include obesity, ethnicity, craniofacial anatomy, airway collapsibility age and sex. In New Zealand 32% of adults are obese (BMI > 30.0 kg/m^2) and 35% are overweight (BMI 25.0-29.9 kg/m^2); in Australia 28% of adults are obese and 36% are overweight. While some differences exist in funding for sleep services between countries it is unknown if the sleep study populations accessing services differ with regards to demographics, anthropometrics and sleep measures.

Aim: Describe and compare the patient demographics, anthropometric measures, sleep measures and PAP treatments at a tertiary sleep lab in Wellington and Melbourne.

Methods: Monash Lung & Sleep and WellSleep identified all diagnostic, split and PAP titration polysomnography sleep studies recorded from 1 July 2016 to 29 December 2016Attended studies were recorded using Compumedics Grael devices and unattended studies using Somte/Somte PSG devices. All studies were analysed in ProFusion using AASM v2 criteria, exported from Compumedics StudyFinder and de-identified prior to compilation. Patient and sleep measures collected were: age, sex, BMI, AHI, ESS, and for PAP studies the airway pressure prescribed. Proportion of study types were also recorded.

Statistical analyses were performed in Microsoft Excel/ SPSS v24.0.

Results: All values are mean ± SD

Measure	*% Male*	*Age*	*ESS*	*BMI*	*AHI*	*PAP pressure*
Monash (n = 1294)	61.7	51.6 ± 15.9	7.8 ± 5.0	33.1 ± 8.4	29.4 ± 30.4	11.9 ± 3.8
WellSleep (n = 372)	64.8	50.2 ± 13.7	11.4 ± 5.4	36.9 ± 8.8	42.6 ± 36.5	10.4 ± 2.7
P value	<0.001	0.14	<0.001	<0.001	<0.001	<0.001

PAP titration primarily performed as full night PSG at Monash and APAP at WellSleep.

Discussion: This review study shows that patients attending NZ based tertiary sleep services tend to be more likely male, heavier, sleepier, with more severe OSA than those in an Australian centre. The lower average PAP pressure for NZ patients may reflect the increased use of split night studies and APAP titration over attended full night titration. This data offers a framework for further comparisons between sleep services in New Zealand and Australia.

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FROM DIAGNOSIS TO LONG-TERM TREATMENT: THE EXPERIENCES OF OLDER NEW ZEALANDERS WITH OBSTRUCTIVE SLEEP APNOEA

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Introduction: The prevalence of obstructive sleep apnoea (OSA) increases with age. However, the presentation of symptoms and the treatment pathway is likely to differ for older compared to younger patients. In New Zealand (NZ), sleep services are somewhat limited and specific considerations are required for older patients. This study aimed to explore the experience of older people regarding diagnosis and treatment services for OSA in order to inform such considerations.
Method: Patients aged 65 years or over were invited to one of three 1.5-hour focus group discussions. 16 patients attended, 8 of whom also had their spouse/partner accompany them. Discussions were semi-structured to explore experiences with the OSA pathway, from diagnosis through to long-term treatment.
Results: Thematic analysis highlights the key symptoms of OSA. Patients experiences with diagnostic and treatment services are generally positive, however there was an overarching need for greater knowledge and longer term follow-up regarding OSA and CPAP treatment. The majority were happy with CPAP as a treatment, long-term issues and strategies used to overcome them are highlighted.
Conclusion: The three groups reported similar experiences. Resources to increase community awareness of OSA and the long term management of patients using CPAP would help overcome some of the service gaps identified in this study.

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SLEEP DISORDERED BREATHING IN PEOPLE WITH MULTIPLE SCLEROSIS

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Background: Poor sleep and sleep disordered breathing are common in people with Multiple Sclerosis (MS). These disorders have several shared consequences including fatigue and sleepiness. Thus, it is important to understand potential links between sleep disordered breathing and MS as their coexistence may increase morbidity in a bidirectional manner. This study aims to define the prevalence of sleep disordered breathing and symptoms of sleepiness and fatigue in a clinical MS cohort. We also aimed to assess the validity of common obstructive sleep apnea (OSA) screening questionnaires in the MS population.
Methods: People over 18 years with a confirmed diagnosis of MS and expanded disability status scale (EDSS) score between 2-6 were recruited for the study. Participants answered several fatigue- and sleep related questionnaires and three commonly used OSA screening questionnaires (Berlin, STOPBANG and OSA50). A home based overnight sleep study was also performed.
Results: Ten of the thirty-five participants (28%, 6 female) who completed the home overnight testing (BMI = 27 $\pm$ 3 kg/m_2) had OSA (median apnea-hypopnea index (AHI) = 13 [range 6-45] events/h sleep). 51% of the participants were fatigued. The participants with an AHI > 15 events/h were all fatigued. 34% of all participants reported poor sleep quality and 14% had excessive daytime sleepiness (ESS.10). The OSA screening questionnaires all overestimated the prevalence of OSA. The STOPBANG performed best.
Conclusions: Fatigue, poor sleep and sleep disordered breathing are common in people with MS. sleep disordered breathing and poor sleep may contribute to fatigue in people with MS and may be a novel therapeutic target. OSA screening questionnaires tend to overestimate the prevalence of sleep disordered breathing in MS.

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AUTOBIOGRAPHICAL MEMORY ACROSS THE LIFESPAN IN INDIVIDUALS WITH OBSTRUCTIVE SLEEP APNOEA

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Introduction: Obstructive sleep apnoea (OSA) is associated with deficits in memory, with recent data suggesting impaired recall for events in one's own life i.e., autobiographical memory (AM). This previous study did not have an age-matched control group, nor did it examine AM for events at different life stages. This study aimed to assess AM function in patients with OSA relative to age-matched controls, and to examine the quality of AMs at different life stages and the associations between AMs and OSA variables.
Method: N = 17 participants with untreated OSA and N = 17 age-matched healthy controls with no sleep disorder completed the Autobiographical Memory Interview (AMI). The AMI assesses semantic (personal knowledge of facts or details, e.g., name of your school teacher) and episodic (recollection of events, e.g., first day of school) autobiographical memory across different lifespan stages: childhood (0-18 years of age), early adult (>18 years) and recent life (last 5 years). Independent samples t-tests were used to compare semantic and episodic recall between OSA participants and healthy controls across the three time periods. Correlation analyses were used to examine the relationship between AM score and apnoea-hypopnea index (AHI), oxygen desaturation index 4%, daytime sleepiness (Epworth Sleepiness Scale), and self-reported estimate of age of OSA onset.
Results: OSA participants had significantly poorer semantic recall from the early adult life stage ($p = 0.005$) and recent life stage ($p = 0.015$) compared to controls. OSA participants had better episodic memory recall from recent life compared to controls ($p = 0.04$), but not childhood or early adulthood. Semantic recall from the early adult life stage was positively correlated with self-reported age of OSA onset ($r = 0.76$, $p = 0.03$) and semantic recall from the recent life stage was positively correlated with AHI ($r = 0.49$, $p = 0.05$).
Conclusion: Deficits in semantic autobiographical memories were found in patients with OSA. Impairment in memories from the early

adult stage were greater in individuals who reported that they had developed OSA at an early age, while deficits from recent memories were associated with the severity of current OSA. These results suggest that OSA impairs the capacity to either encode or consolidate semantic autobiographical memories, possibly through a reduction in the quality of sleep or through hypoxic injury to the temporal lobe.

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THE IMPACT OF EARLY DIAGNOSIS AND TREATMENT OF OBSTRUCTIVE SLEEP APNOEA IN BARIATRIC SURGERY PATIENTS

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Introduction: Obese bariatric surgery patients have a greater risk of having obstructive sleep apnoea (OSA). It is unclear whether appropriate initiation of CPAP treatment prior to surgery will have positive impact on their immediate peri-operative outcomes.
Methods: A retrospective analysis of demographic and polysomnographic data, post-operative complications and the length of hospital stay (LOS) of consecutive bariatric surgery patients between January 2013 and December 2016.
Results: 208 patients were included, with 90 (43%) having been assessed by a sleep physician prior to surgery. 56 (62%) patients had polysomnography, with the modest rate of polysomnographic evaluation due to low suspicion of OSA (as assessed by STOP-BANG questionnaire) and patient refusal. Among those with AHI > 20/hour (n = 28, 50%), 8 (29%) remained untreated with CPAP therapy perioperatively. Yet, there was no significant difference in the LOS between those who did and did not use CPAP, with a mean LOS of 2.77 $\pm$ 1.26 and 2.47 $\pm$ 0.79 days respectively. (p = 0.39) Higher weight (r = .27, p = 0.047) and Epworth Sleepiness Scale score (r = .31, p = 0.02) were significantly correlated with higher AHI, and thus, more severe OSA. Higher BMI was correlated with an increased LOS (r = .30, p = 0.03), while higher AHI (r = .06, p = 0.68) showed a positive trend towards increased LOS.
Discussion: Early assessment of possible OSA may help to identify patients at risk of prolonged hospitalisation, particularly those with more severe obesity and subjective daytime somnolence. Although CPAP use did not show significant impact on post-operative outcomes, AHI and ODI showed a positive trend towards increasing LOS, indicating appropriate management of OSA might help improve outcomes. This warrants further research.
Acknowledgements: None.

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IMPAIRED SPECIFIC AUTOBIOGRAPHICAL MEMORY IN PATIENTS WITH MILD COGNITIVE IMPAIRMENT IS ASSOCIATED WITH THE SEVERITY OF OBSTRUCTIVE SLEEP APNOEA

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Introduction: Autobiographical memory (AM) can be defined as "memory for events of one's life". Overgeneral AM, which is the inability to recall specific AM, has previously been linked to depression in patients with obstructive sleep apnoea (OSA). Recently, we reported impaired specific AM recall in OSA patients, regardless of the severity of depressive symptoms. Specific AM impairment has also been reported separately in patients with mild cognitive impairment (MCI). However, studies have yet to examine specific AM recall in patients with co-morbid OSA and MCI. This study aimed to compare specific AM recall in OSA patients with and without MCI, and the association between AM and OSA severity in patients with co-morbid OSA and MCI.
Methods: To date, 18 mild-to-severe OSA patients (mean AHI = 33.54 events/hr, mean age 67.2 $\pm$ 6.4 years, 5 female), 16 individuals with co-morbid OSA and MCI (OSA-M; mean AHI = 26.33 events/hr, mean age 67.5 $\pm$ 8.5 years, 7 female), and 6 healthy controls (mean AHI = 4.71 events/hr, mean age 62.5 $\pm$ 5.2 years, 3 female) completed an overnight sleep study and the Autobiographical Memory Test (AMT), which assessed specific AMs generated in response to 12 cue words (e.g. happy, blame).
Results: Mann-Whitney U tests revealed that both the OSA (Mdn = 6.50; U = 16.00, z = $-$2.87, p = 0.004, r = $-$.57) and OSA-M groups (Mdn = 5.00; U = 5.50, z = $-$3.41, p < 0.001, r = $-$.71) recalled significantly fewer specific AMs than the control group (Mdn = 10.00). The difference in specific AM recall between the OSA and OSA-M groups was not significant (U = 127.00, z = $-$.59, p = 0.574, r = $-$.10). A Pearson correlational analysis in OSA-M patients indicated a significant negative correlation between the total number of specific AMs recalled and the Apnoea-Hypopnoea Index (r = $-$.57, p = .023).
Conclusion: These preliminary findings show that the recall of specific AMs does not differ between OSA patients with and without MCI. Furthermore, the correlational analysis suggests that there is an effect of OSA severity, as measured by AHI, on specific autobiographical memory recall in patients with co-morbid OSA and MCI. Whether treatment of OSA improves this aspect of memory in patients with MCI is an area of on-going investigation.

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INCIDENCE OF RAST POSITIVITY IN PAEDIATRIC SDB AND RELATIONSHIP TO RESIDUAL SYMPTOMS AFTER ADENOTONSILLECTOMY

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Introduction: It is generally accepted that 80-85% of paediatrics undergoing adenotonsillectomy for SDB will significantly improve or resolve symptoms as well as polysomnographic disease parameters. However, it is not defined what percentage of paediatrics with SDB are RAST positive (a marker of allergic rhinitis predisposition) and whether this impacts on residual symptoms in the 15-20% with incompletely resolved SDB.
Methods: We performed a prospective clinical study of 69 consecutive children undergoing adenotonsillectomy for SDB. All had parental agreement for blood sampling of Total IgE and RAST to house dust mite, grass and pollen, animal mix and dander, moulds and staple food mix at the time of intravenous cannula insertion for induction of anaesthesia for surgery. Parents completed PSQ: SDB subscale and mini RQLQ pre-operatively and again at 6 weeks post-operatively.
Results: Data will be presented on the incidence of allergic rhinitis (via RAST test) in paediatric SDB and the noted trends of greater positivity in residual symptoms after adenotonsillectomy.

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CONTINUOUS POSITIVE AIRWAY PRESSURE IMPROVES COGNITIVE FUNCTION OF PATIENTS WITH OBSTRUCTIVE SLEEP APNEA

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Introduction: The prevalence of patients with obstructive sleep apnea (OSA) increases with advancing age. Cognitive dysfunction, which is also prevalent in the elderly, may be associated with OSA. However, whether treatment with continuous positive airway pressure (CPAP) can improve cognitive function is unclear. We therefore investigated the effect of CPAP on cognitive function in the elderly patients with OSA.

Methods: We enrolled patients aged ≥65 years who underwent overnight polysomnography for suspected OSA. The Alzheimer's Disease Assessment Scale cognitive subscale (ADAS-Cog), the Mini-Mental State Examination (MMSE), and the Trail Making Test part B (TMT-B) were used to examine their cognitive functions before and 4 months after initiation of CPAP. MMSE < 27 indicates mild cognitive impairment (MCI), and MMSE < 24 indicates dementia. The ADAS-Cog is scored from 0 to 70: higher score indicates greater cognitive impairment.

Results: Sixteen patients were included in the study and 10 patients continued using CPAP for 4 months and completed all the examinations. The mean age of these 10 patients was 73.1 ± 6.9 years and 30% of the patients were women. The mean apnea-hypopnea index (AHI) was 40.0 ± 13.6 /h and the mean usage of CPAP was 6.6 ± 1.8 hours. 40% of the patients had MCI, and 10% had dementia based on MMSE. In overall, the scores of ADAS-Cog at baseline was 11.2 ± 5.2 and significantly improved in 4 months (8.5 ± 5.0, $p = 0.015$). The change in scores of MMSE and TMT-B was not significant (MMSE, 27.1 ± 3.2 and 27.3 ± 2.2, $p = 0.830$; TMT-B, 142.8 ± 64.2 and 137.2 ± 74.9, $p = 0.640$).

Discussion: Although only 40% of the participants met the criteria for MCI and 10% of them met the criteria for dementia, CPAP improved the ADAS-Cog score. This implicated that treatment of OSA could lead to the improvement of cognitive function in patients with OSA and MCI.

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SLEEP APNOEA SCREENING FOR PATIENTS WITH ATRIAL FIBRILLATION: INTERIM RESULTS FROM THE SAFARI STUDY

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Introduction: Obstructive Sleep Apnoea (OSA) is an independent risk factor for stroke in patients with Atrial Fibrillation (AF). Untreated OSA may increase AF recurrence after Pulmonary Vein Isolation. OSA sequelae including intrathoracic pressure swings, intermittent hypoxia/hypercapnia and sympathetic nervous system activation may trigger AF events and contribute to atrial remodelling. Patients with AF are less likely to suffer from traditional OSA risk factors such as daytime fatigue and obesity, therefore OSA screening in this population is needed.

Aim: To examine the validity and reliability of a portable sleep study device as a screening tool for OSA in an AF population.

Methods: AF patients were recruited via two pathways: 1) a tertiary hospital emergency department and 2) Pulmonary Vein Isolation waitlists. All patients underwent both a home diagnostic sleep study (ApneaLink, ResMed Ltd) and in-laboratory polysomnography (PSG) within a week of one another (in random order). Demographic and phenotypic data were collected. Test characteristics of ApneaLink (sensitivity, specificity, ROC, positive and negative predictive values) were compared to results from PSG (gold standard for OSA diagnosis).

Results: To date, data from 27 patients have been analysed (total sample size N = 100). This sample was on average 61.5 (SD 11.0) years (range 33–82 years), 63% male, majority Caucasian ethnicity (77.8%) and slightly overweight (mean BMI 26.84, SD 3.17 kg/m^2). Most patients (92%) had paroxysmal AF, with 25.9% of these classified as having "high-burden" paroxysmal AF (>10 AF events in the past 12 months). A total of 19/27 AF patients (70.4%) were diagnosed with OSA on PSG (37.0% mild, 22.2% moderate, 11.1% severe). There was no correlation between ESS (Epworth Sleepiness Score) and AHI ($r = -0.051$, $p = 0.802$; mean ESS 6.67 (SD 3.23)). Apnealink performed well as a screening tool for OSA in this population, with a sensitivity of 87%, specificity of 100% and AUC of 0.947.

Conclusion: These results confirm a very high prevalence of OSA amongst unselected AF patients. Lack of association with traditional risk factors such as daytime sleepiness and a low prevalence of obesity confirm the need for other screening methods. Apnealink may be an effective screening tool in this high risk population. Studies of the impact of OSA treatment on outcomes in AF patients are warranted.

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REGIONAL VARIATION IN PROVISION OF VENTILATORY SUPPORT FOR GENETIC NEUROMUSCULAR DISORDERS ACROSS NEW ZEALAND

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Introduction: Genetic neuromuscular disorders (gNMD) are an important cause of respiratory failure with widespread impact on health and quality of life. Community-based ventilatory support (VS), particularly non-invasive ventilation (NIV), is a treatment for chronic respiratory failure shown to result in fewer chest infections, improvement in quality of life, higher likelihood of maintaining employment, and, for some conditions, increased survival. Previous research raised a number of questions regarding access to NIV and related specialist support services in New Zealand (NZ). We aimed to describe the regional variations in provision of VS among adults with gNMD in NZ.

Methods: The MD-PREV study was a comprehensive national prevalence study of the impact of gNMD involving an extensive nationwide case finding strategy, and in-depth interviews with contactable participants. Requirement for VS was ascertained by asking: *"Do you require ventilation support?"* with responses distinguished as: *"Yes, I have this"*, *"No, but I do need it"*, or *"No, and I don't need it"*. Participants were also asked in which DHB region they usually reside. Prevalence of VS was calculated (per 100,000 people) from the total DHB population (Census 2013) using mid-P exact tests.
Results: Sixty-eight adults with a gNMD in the MD-PREV study (n = 500) were using VS, with a further 17 reporting needing it. Geographically, these 68 adults were distributed across 17 of 20 DHB regions (all except: Lakes, West Coast, South Canterbury). There was considerable variation of VS use in gNMD between DHBs (range 0-16 adults per DHB) with a median 2.5 (IQR: 1-4) per DHB. The highest prevalence of gNMD-related VS occurred in Nelson-Marlborough (5.8 [95% CI: 2.7-11.1] per 100,000 people) followed by Canterbury (3.3 [95% CI: 2.0-5.3]). Lowest prevalence of VS use occurred in Bay of Plenty (0.5 [95% CI: 0.0-2.4]), Waitemata (0.8 [95% CI: 0.2-1.8]) and Auckland (0.9 [95% CI: 0.3-1.8]) DHBs. 8/17 (47%) of adults who reported needing VS, were from Auckland DHB.
Discussion: There was significant variation in the population prevalence, and unmet need, of VS in adults with gNMD between DHBs. Further investigation is required to determine the extent to which this variation is due to differential distribution of gNMD across NZ, limited access to specialist care/facilities, or management approaches between DHBs.

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PREVALENCE OF VENTILATORY SUPPORT IN GENETIC NEUROMUSCULAR DISORDERS IN NEW ZEALAND

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Introduction: Genetic neuromuscular disorders (gNMD) are an important cause of respiratory failure. Community-based ventilatory support (VS), particularly non-invasive ventilation (NIV), is a treatment for chronic respiratory failure shown to result in fewer chest infections, improvement in quality of life, higher likelihood of maintaining employment, and, for some conditions, increased survival. There is currently limited knowledge on the extent of use of VS in gNMD in New Zealand (NZ). We aimed to characterise the NZ population with gNMD, who require ventilatory support (NIV/IV) to determine prevalence and identify the extent (if any) of unmet need.
Methods: The MD-PREV study was a comprehensive national prevalence study of the impact of gNMD involving a nationwide case finding strategy and interviews. Requirement for VS was ascertained by asking: *"Do you require ventilation support?"* with responses distinguished as: *"Yes, I have this"*, *"No, but I do need it"*, or *"No, and I don't need it"*. Among those who responded as having or needing VS, this was further categorised into invasive or non-invasive (CPAP/Bi-level), and either part-time/nocturnal or continuous.
Results: The MD-PREV study included 500 adults with gNMD. Sixty-eight (13.6%) adults identified that they used VS, and a further 17 (3.4%) indicated they did not have it, but needed it. The majority (65, 95.6%) were being treated with NIV, with the remaining three (4.4%) being treated invasively via a tracheostomy. For 63 of the 68 (92.6%), the VS was part-time or nocturnal, while it was continuous for 5 (7.4%) patients. Of those adults receiving VS, 47 (69.1%) were male, with ages ranging from 17 to 71, with a median of 49 years. Six (8.8%) were Māori, 2 (2.9%) Pacific, and 4 (5.9%) Asian. The most common condition for which VS was required was Myotonic Dystrophy (24, 35.3%), followed by the Dystrophinopathies (Duchenne and Becker Type) (16, 23.5%) and Limb-girdle muscular dystrophy (11, 16.2%). Other diagnoses had fewer than 10% of the VS patients combined.
Discussion: Community-based ventilatory support is used among a diverse range of adults with gNMD, particularly with myotonic dystrophy or dytrophinopathies. The majority of adults with gNMD requiring VS are managed with NIV. Of concern is the clear indication of unmet need for VS in this population that warrants further investigation.

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CHANGING TRENDS OF OBSTRUCTIVE SLEEP APNOEA IN WESTERN AUSTRALIA FROM 1988 TO 2014

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Introduction: Obstructive sleep apnoea (OSA) is a common chronic disorder with many serious consequences. The prevalence of moderate-severe OSA is estimated at 17% and 9% of middle-aged men and women respectively, and appears to be increasing. The epidemiology and health consequences of OSA are likely to be better understood using large cohorts of well-phenotyped patients. The aim of this study was to examine the changing trends of OSA at a large hospital-based clinic in Western Australia.
Methods: The sample consisted of all patients (n~28,000) who presented to the clinic for a diagnostic polysomnogram (PSG) between 1989 and 2014. Available sleep clinic data included anthropometric measures, blood pressure, spirometry and apnoea-hypopnea index (AHI). Self-reported measures included smoking status and medications. Postcode data were matched to Socio-Economic Indexes for Areas (SEIFA) data from the Australian Bureau of Statistics. Means for key variables were calculated for 5 year epochs and linear regression was used to investigate the associations between AHI and time accounting for key demographic variables. All analyses were performed in R.
Results: Between 1989 and 2014, there were increases in mean age and body mass index (BMI), and proportion of females, and decreases in mean SEIFA scores. Mean age increased slightly from 49.6 to 50.8 years. Between 1989-1995 and 2010-2014, mean BMI increased from 30.6 to 33.3 and the percentage of females increased from 19% to 43%. Mean SEIFA scores decreased suggesting an increase in patients from disadvantaged areas. On average, AHI increased by 0.61/year (SE = 0.03, $P < 1.0 \times 10^{-8}$); this association was independent of age, BMI, sex and SEIFA index.

Discussion: Between 1989 and 2014, the characteristics of patients presenting with sleep apnoea have changed and, on average, patients are older, heavier, more disadvantaged and more likely to be female. Future work includes linking these individuals to hospital morbidity, cancer, mental health, mortality and motor vehicle accident data to investigate the effect of OSA severity on long-term health outcomes.

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IMPROVING THE QUALITY OF MULTIPLE SLEEP LATENCY TESTS BY ELIMINATING OTHER FACTORS OF HYPERSOMNOLENCE

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Aim: This pilot study was conducted to improve the diagnostic power of MSLTs conducted at our laboratory by eliminating other potential causes of sleepiness, such as insufficient sleep syndrome, circadian rhythm disorders, and poor sleep hygiene.
Design: 40 MSLT studies were prospectively and consecutively analysed, and study was designed with 2 phases. Each phase was carried out until a total of 20 subjects had attended an overnight sleep study and subsequent MSLT appointment.
Methods: Phase I represented usual care (control), and Phase II involved scientist intervention. In Phase II patients were contacted by telephone two weeks prior to the appointment. Patients were instructed to try to establish a regular sleep pattern, reminded to complete the sleep diary on a daily basis, and aim for at least 7 hours in bed each night. In Phase I, each patient received the standard appointment letter and confirmation call, but no additional contact.
Parameters included total sleep time on the preceding polysomnography (TST), % of nights patients spent 7 hours in bed (BT), % of nights where the lights out time was before 19:00 or after 01:00(CT), % of nights where lights out time was within a 2 hour window from the average lights out time in the preceding weeks (LO), and whether total sleep time in the preceding night's PSG was over 360 minutes (ST).
Results: In Phase II, TST increased by 48.4 minutes (Standard Error (SE) 27.19), BT increased by 15% (SE 12.02), LO was improved by 11.9% (SE 7.34) and ST increased by 20% (SE 9.17). CT decreased by 1.51% (SE 2.92) in Phase II.
Furthermore in Phase II, patient cancellations were reduced from 48.7% to 16.7% (fisher exact, $p = 0.54$).
Conclusion: The results of this study suggest that contacting patients two weeks prior to a scheduled MSLT appointment, and offering standardised instructions and reminders may help to eliminate other factors that affect the outcome of the test and improve general attendance. However to obtain a statistically significant result, further research with a larger sample size will be required.

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THE EFFECT OF SLEEP ON LUNG VOLUMES IN NORMAL AND OVER-WEIGHT MEN AND WOMEN

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Low lung volumes (LV's) are thought to contribute to upper airway collapse and thus obstructive sleep apnea (OSA). Supine posture and increased body weight both reduce awake LV's as does sleep in normal weight men. However, the influence of sleep on LV's in women and over-weight individuals is unknown. We measured supine and lateral functional residual capacity (FRC) during wake, NREM and REM in normal weight (NW: BMI < 25) and over-weight (OW: BMI ≥ 25) men (M) and women (F) aged 20-65 years. Standard polysomnography with a sealed, non-vented, nasal/oro-nasal mask was used for measurement of FRC via N2 washout. Preliminary analysis on 58 subjects' data is based on non-blind scored studies as blind scored data is not yet available. FRC is expressed in Litres BTPS (L) and % of seated predicted values (mean $\pm$ SEM).
These data show that FRC falls significantly (*) from wake to NREM in all groups and in both body positions with waking absolute FRC lower in the overweight. Limited data were obtained in REM (n between 4-8 in each group) but FRC was similar to NREM values in these individuals. Reductions in lung volumes may contribute to upper airway collapse in OSA while supine and with increased body weight but appear unlikely to explain the worsening of OSA in REM and in men versus women.

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MICROCLIMATE MEASUREMENTS AT THE SKIN SURFACE: IBUTTON HOLDER DESIGN AND IMPACT OF BODY POSITION

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Thermal discomfort is experienced when the microclimate temperature (T) or relative humidity (RH) fall outside of the thermal comfort zone. It could lead to poor sleep and exercise performance. Skin-

		N	FRC_{wake} (L)	FRC_{wake} (%)	FRC_{NREM} (L)	FRC_{NREM} (%)
SUPINE	NWM	11	2.2 ± 0.12	71 ± 6	1.7 ± 0.12*	55 ± 4
	NWF	11	1.7 ± 0.10	63 ± 3	1.5 ± 0.10*	54 ± 3
	OWM	10	1.9 ± 0.17	58 ± 5	1.5 ± 0.18*†	46 ± 5
	OWF	8	1.6 ± 0.18	62 ± 3	1.1 ± 0.13*	43 ± 4
LATERAL	NWM	10	3.0 ± 0.12	93 ± 4	2.4 ± 0.22*	75 ± 7
	NWF	9	1.9 ± 0.15	71 ± 4	1.7 ± 0.15*	63 ± 5
	OWM	11	2.4 ± 0.18	72 ± 5	1.9 ± 0.17*	56 ± 5
	OWF	11	1.9 ± 0.16	72 ± 5	1.5 ± 0.21*	56 ± 7

clothing microclimate depicts the T and RH in the microspace between the skin surface and clothing. These measurements are easily detected by a wireless iButton held in a holder that prevents direct contact with skin. This study investigated the iButton holder design and the impact of body position on skin-clothing microclimates. *Comparison of iButton holder designs*: Three holder designs (D1, D2 and D3) with opening sizes of 8 mm, 12 mm and 16 mm, and height of 5 mm, 5 mm and 2 mm between iButton sensor and skin surface were investigated. iButtons housed in these holders, placed on a bench top, showed similar T and RH. The iButton in D3 showed a significantly higher RH compared to that in D1 and D2 when the holders were exposed to high humidity by placing them on a wet paper towel. The iButton in holders (D1, D2, D3) were also attached to mid-sternum and lower back in 18 participants. Participants sat in a room for 10 min at 25°C/50%RH and for another 10 min in the next room at 30°C/50%. D3 showed a significantly higher chest microclimate T for the period from 0 to 17.5 min ($p < 0.05$) than D1 and D2, and higher lower back T at 0 min of recording ($p < 0.05$) than D1. Despite no other significant findings, D3 recorded a higher microclimate T and RH than the other holders. *Impact of body position on microclimates:* iButtons in D3 were attached to mid-sternum and left and right medial thighs, and left and right lower back of a participant. The participant changed body position from supine to 30°lateral, then 90°lateral. T and RH measured on the mid-sternum were relatively stable despite changes in body positions. The T and RH on the lower back increased progressively over time when in the supine position. Changing to a 30°lateral position increased the T and RH detected by the iButton that was in contact with the mattress, but decreased when moved to the 90°lateral position. Both T and RH on the thighs increased when the legs were together, and decreased when the legs were apart. The pilot findings suggest that the D3 design detected higher T and RH compared to the others. Body positions impact directly on microclimate measurements.

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QUALITY OF LIFE ASSESSMENTS IN MOTOR NEURONE DISEASE PATIENTS ON NON-INVASIVE VENTILATION USING DISEASE SPECIFIC AND TREATMENT SPECIFIC TOOLS

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Introduction: Non-invasive ventilation (NIV) treatment is considered the standard of care for motor neurone disease (MND) patients who develop respiratory dysfunction. Previous studies have demonstrated improvement in Quality of Life (QoL) for patients who are initiated on NIV. However different tools have been used to assess QoL across studies and these have not assessed disease or treatment specific QoL.
Aims: 1. To assess QoL using disease specific [ALS Functional Rating Scale Revised (ALSFRS-R)] and treatment specific [Severe Respiratory Insufficiency Questionnaire (SRI)] measurements in patients with MND on NIV. 2) To compare the performance of these measurements to a generic Australian QoL measurement [Australian Quality of Life-eight domains (AQOL-8D)].
Methods: Prospective data from Breathe-MND 1 trial cohort, where QoL measurements are performed at baseline and four 2 monthly intervals after patients are initiated on NIV.
Results: To date 10 patients (7 males, mean ± SD age 64.1 ± 8.4 yr, BMI 28.5 ± 3.1 kg/m², FVC 68.1 ± 21.0%predicted) have completed the first 2 month follow-up after commencing on NIV. Preliminary QoL data show larger percentage reductions from baseline after the first 2 months of NIV with ALSFRS-R assessments (median [IQR] 13.9 [9.4 to 28.4]%) compared to the AQoL-8D (6.1 [−8.6 to 16.5]%) or SRI (1.7 [−7.1 to 10.5]%).
Discussion: For progressive degenerative diseases like MND, QoL measurements might not reflect improvements in QoL with non-disease modifying supportive interventions (e.g. NIV for MND). Treatment specific QoL measurements might be better suited to measure the effectiveness of these interventions in MND patients.

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HYPOPNOEAS WITH EEG AROUSALS CONTRIBUTE EQUALLY TO THE APNOEA-HYPOPNOEA INDEX IN MALES AND FEMALES

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Purpose: Obstructive sleep apnoea is a prevalent disorder with cardiovascular, metabolic and neurocognitive consequences. OSA is more prevalent in males than females and displays different characteristics in males compared to females. These characteristic differences include: more apnoeas than hypopnoeas in males, greater oxygen desaturations in males and less REM dominance of respiratory events in males. It has been suggested that females may be more susceptible to respiratory events not associated with oxygen desaturations. Thus the inclusion of hypopneas with EEG arousals may favour recognition of OSA in females. The purpose of this study was therefore to compare males and females with respect to the contribution of hypopnoeas with EEG arousals to the Apnoea-Hypopnoea Index (AHI) and as a consequence, diagnosis of OSA.
Methods: A retrospective review of 269 consecutive patients (148 men and 121 women) undertaking Type 1 polysomnography (PSG) for the suspicion of OSA was conducted. PSGs were recorded and scored according to the 2012 AASM Manual using the 2012 AASM recommended hypopnea criteria (AASM2012Rec). Hypopnoea events were scored twice and classified as either associated with a 3% desaturation or associated with a 3% desaturation or EEG arousal. The AHI was calculated in both males and females using the 3% oxygen desaturation only (AHI3) and using the 3% oxygen desaturation or EEG arousal (AHI3A).
Results: Both males and females were middle-aged (55 ± 14 vs 56 ± 15 years for males and females, respectively) and overweight (BMI median [IQR]: 32.3 kg/m^2 [28.1, 38.2] vs 34.8 kg/m^2 [29.5, 42.9] for males and females, respectively). In both males and females, the inclusion of EEG arousals significantly increased the AHI (Males: AHI3 13.8/h vs AHI3A 22.7/h, $p < 0.001$; Females: AHI3 7.7/h vs AHI3A 13.2/h, $p < 0.001$). The AHI3A increased the diagnosis of OSA by 21% in males and 30% in females. The inclusion of EEG arousals reduced the REM dominance of respiratory events in females (AHIREM:AHINREM ratio: AHI3 2.6 vs AHI3A 2.0) while maintaining the same ratio for males (AHIREM:AHINREM ratio: AHI3 1.0 vs AHI3A 1.0).

Conclusions: The inclusion of the EEG arousals in hypopnoea scoring criteria affects both males and females equally.

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A VALIDATION STUDY OF AUTOMATED SLEEP APNOEA DETECTION USING ALERTE DIGITAL HEALTH'S ARTIFICIAL INTELLIGENCE SYSTEM

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Introduction: Sleep Apnoea is a condition that is estimated to affect 4% of men and women in Australia. The condition often goes undiagnosed, which can reduce the quality of sleep and cause long term health issues. Alerte has developed an automatic classification algorithm which can operate using a small number of signals (Heart rate, SPo2, ECG, EMG and Sound) and recognise Apnoea with a statistically significant level of confidence.
Methods: 38 patients with varying levels of Central and Obstructive Apnoea were chosen from a database of scored sleep data. 30 second windows of data in steps of 5 seconds were sampled from each patient's recording. If a Sleep Apnoea event existed in the sample window, the window was labelled as "Sleep Apnoea," otherwise it was labelled as "Not Apnoea." An equal number of Not Apnoea and Apnoea samples were sampled from the set randomly. A 70/30 cross validation method was used, resulting in a total of 14,940 training samples and 6,404 samples for evaluation.
A deep learning artificial neural network (ANN) was simultaneously trained on the training set and evaluated against the evaluation set. A sample window from the evaluation set is pushed through the ANN, which produces a probability outcome of either Apnoea or Not Apnoea. The predicted label was compared against the actual label for all examples in the evaluation set to calculate how accurate the model was. The performance of the ANN was measured by its accuracy on the evaluation set, to ensure it did not overfit to the training set.
Results: The system was able to classify both Obstructive and Central Apnoea examples with an average accuracy of 86%. On Obstructive Apnoea alone, it obtained an accuracy of 87%. On Central Apnoea alone, an accuracy of 84%.
Conclusions: The algorithm can provide a reasonable level of accuracy for detecting Sleep Apnoea events. It could prove to be useful in screening for Sleep Apnoea using only a small wearable device, and indicate that an individual may want to undergo a full PSG study.

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AHI DETERMINED BY CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP) DEVICE ALGORITHM UNDERESTIMATES HYPOPNEAS AT LOWER PRESSURES

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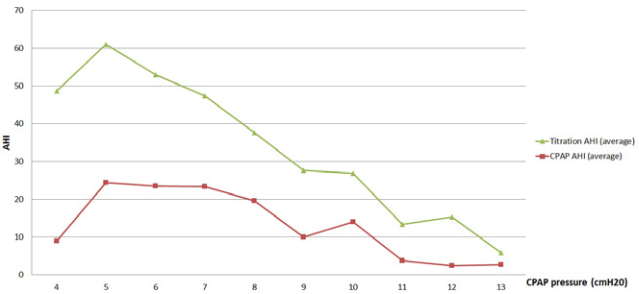
Objectives: The aim of this pilot study is to compare the AHI determined by a CPAP device with that determined by manual scoring during laboratory-based titration polysomnography (PSG).
Methods: Consecutive patients undergoing a CPAP titration study using ResMed S9 after a prior diagnostic PSG were studied. Airflow signals measured off the CPAP mask were used to score the PSG. Respiratory events were scored manually according to AASM 2012 guidelines. Comparison was made between the manually scored AHI and the machine AHI read at every pressure during the titration study.
Results: 10 patients with mean AHI 55.95 ± 37.35 events/hour were studied. Overall AHI measured by the machine and by scoring was similar (avg machine AHI vs avg scored AHI). However, there was a convincing difference between the Automated vs Scored AHI when CPAP pressures were lower.
Discussion and conclusion: Automated analysis of CPAP detects hypopnea by 50% reduction in flow alone whilst manual scoring from the titration study used the AASM guideline of 30% reduction in flow with 3% oxygen desaturation and/or arousal. Even when the automated AHI is read as low, there may still be significant hypopneas that are not detected by the machine, especially at lower CPAP pressures. This suggests that clinicians should exercise caution in using machine-derived AHI to monitor OSA patients, and a low residual AHI on machine data may mask significant residual events, especially if delivered CPAP pressures are low.



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WHAT ACTIGRAPHY CAN TELL US ABOUT CONDUCTING A BETTER MULTIPLE SLEEP LATENCY TEST

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Introduction: The validity of the Multiple Sleep Latency Test (MSLT) as a means of diagnosing narcolepsy relies on the patient achieving at least 6 hours of sleep on their preceding polysomnogram (PSG). However a recent analysis of studies from our lab found that the average preceding PSG total sleep time (TST) for these patients was only just reaching this duration at 6.4 hours on average, with 40% of patients sleeping for less than 6 hours.
We hypothesised that the patients usual sleep times would vary from those allowed by the standard laboratory protocols and that this may be contributing to short TST's during the PSG.
Methods: We analysed actigraphy data collected for the days leading up to the PSG to investigate these patients typical sleep duration and timing at home. We excluded those who skipped a night's sleep and those whose urine testing confirmed amphetamine use. For TST analysis naps during the day were excluded and only sleep onsets occurring after 6 pm were included. Total sleep time was calculated in 1 min epochs from onset to last period of sleep for patients who had two or more nights of data.
Results: The 65 patients analysed showed an average home sleep onset of 00:03 (SD, 01:28) with a range from 20:38-02:50 and an average wake time of 08:21 (SD, 01:42) with a range from 05:33-

12:28. The average home TST was 06:53 hours (SD, 01:14) with a range of 02:25 to 09:04 hours. In total 88% of these patients (53/65) had an actigraphy derived total sleep time of 6 hrs or more.
Discussion: These results suggest that valid MSLT results arising from a preceding PSG TST of 6 hours or more was achievable for this group of patients. However the standard testing times during which the PSG studies were conducted were a limiting factor given the average home sleep onset and wake times exhibited by this group of patients. Consideration will be given to adjusting our procedures as result.

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IMPACT OF DATA PROCESSING ON OXIMETRY RESULTS IS SIGNIFICANT IN PATIENTS WITH SLEEP DISORDERED BREATHING

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Introduction: The impact of analysis algorithms on oxygen desaturation indices (ODI) has not been extensively described. This study aims to assess the impact of different algorithms on the oxygen dissociation index of >=3% (ODI3) using a single oximeter with data recorded and analysed on two different systems.
Methods: Seventeen patients free of PLMS symptoms, in whom SDB was suspected, underwent full PSG (Compumedics, Melbourne, Australia) whilst connected to a Rad 7 (Masimo, Irvine, CA, USA, 2 sec averaging time, 0.5 Hz storage rate,) oximeter. Two measures of ODI3 were generated for report time; one after auto analysis through the Compumedics software; another was generated when the Rad 7 data was downloaded and ODI3 (events per hour [eph]) analysed automatically using Visi (Stowood Scientific, Oxford, UK). The two ODI3 scores were compared.
Results: Comparing ODI3 scores in 17 patients. Compumedics mean ODI3 = 20.8 $\pm$ 5.7 compared to Visi mean ODI3 = 31.6 $\pm$ 7.0 ($P < 0.0001$). There was no difference in lowest SpO_2 or time with desaturations under 88% for the 2 systems. The correlation between the 2 ODI3 measures was $1.22x + 6.16$, $R^2 = 0.98$.
Discussion: The automated ODI3 calculated from the Compumedics Profusion 4 system is significantly less than the value calculated by the Visi system. Oximetry metrics can be significantly influenced by differences in recording and analysis systems. This is likely to impact on the clinical interpretation of the test. Further studies comparing these values to manual analysis, ie the gold standard, are required.

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DIAGNOSTIC UTILITY OF STOPBANG AND BERLIN QUESTIONNAIRES FOR MIDDLE-AGED AUSTRALIANS

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Introduction: We aimed to validate STOPBang and Berlin questionnaires and compare their performance as screening tools for obstructive sleep apnoea (OSA) using a population-based sample of middle-aged Australians.
Methods: A random sample of 772 from the 3608 participants surveyed for the 55-year follow-up of the Tasmanian Longitudinal Health Study was invited for type-3 home sleep studies using ApneaLink® (ResMed, Australia) devices. All 772 completed STOP-Bang and Berlin questionnaires but only 406 completed sleep studies.
Results: Participants' mean age was 53 (SD = $\pm$0.8) years, and 49.1% were female. Oximetry data for $\geq$4 hours were available for 349 and nasal flow measurements for $\geq$4 hours for 302 participants. STOPBang and Berlin questionnaires identified, respectively, 61% and 42% of the sample, as being at high risk of OSA (defined as a score $\geq$3 for STOPBang and $\geq$2 positive categories for Berlin questionnaire). The STOPBang also detected more participants with any OSA (defined as oxygen desaturation index [ODI] $\geq$ 5) than the Berlin questionnaire (sensitivity = 70% [95% CI 64%-75%] and 49% [43%-55%], respectively), although its specificity was lower (62%; 95% CI 50%-72% and 75%; 95% CI 64%-84%, respectively), resulting in only slightly greater discrimination (diagnostic odds ratio = 3.6; 95% CI 2.2-6.2 Vs 2.8; 95% CI 1.7-5.1). At the ODI threshold of $\geq$15 (moderate-severe OSA), the sensitivity of both tools increased (82%; 95% CI 73%-89% for STOPBang and 70% %; 95% CI 60%-79% for Berlin questionnaire) but their specificity decreased (46%; 95% CI 39%-52% for STOPBang and 67%; 95% CI 61%-73% for Berlin questionnaire). Diagnostic utilities of the questionnaires measured against the apnoea-hypopnea index (AHI) did not significantly differ from those measured against the ODI.
Conclusions: Using a type 3 sleep study as the gold standard, the diagnostic utility of the STOPBang and Berlin questionnaires are suboptimal for a general population sample. People with any OSA as well as moderate-severe OSA were more likely to be missed by the Berlin questionnaire, while those who did not have any OSA (or moderate –severe OSA), were more likely to be misclassified as being at risk by the STOPBang questionnaire.

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A PILOT STUDY CHARACTERISING HEAD FLEXION/EXTENSION DURING SLEEP AND ITS RELATIONSHIP WITH SLEEP APNEA SEVERITY

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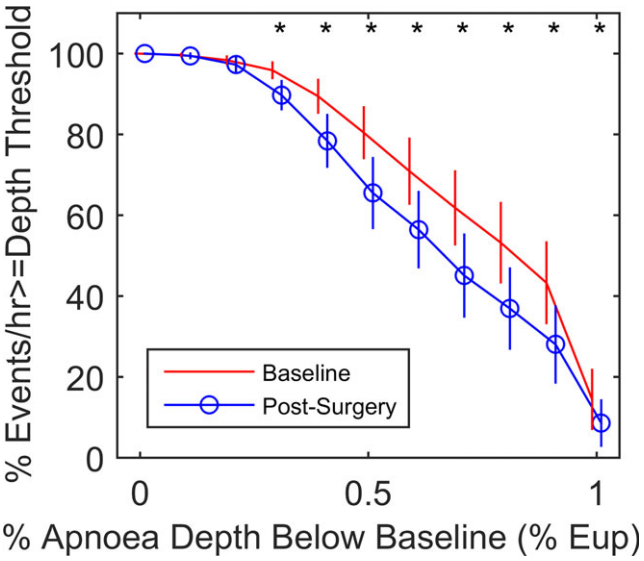
Introduction: Flexion/extension of the head has a significant negative/positive impact on airway collapsibility during general anaesthesia. However, relatively little is known about the relationship between head flexion/extension and obstructive sleep apnoea (OSA) severity – mainly due to current limitations in sensor technology (i.e. capacity to measure head position during sleep). The aim of this pilot was to quantify the relationships between degree of head flexion/extension and the severity of OSA.
Methods: We developed a customised sensor to measure head posture as degrees of flexion/extension from a calibrated reference neutral position in supine sleep (defined using a separate torso rotation sensor). 15 participants attending a sleep clinic for suspected OSA were studied by overnight polysomnography with the additional customised sensor firmly affixed to the torso and forehead. Ten participants had at least 40 minutes of sleep in supine position with adequate signal quality and were included in further analysis. During supine sleep (0 $\pm$ 30 degrees torso rotation) head flexion/extension was classified into four bins: 15-30°

flexion (F2); 0-15° flexion (F1); 0-15° extension (E1); and 15-30° extension (E2). Sleep duration and apnoea-hypopnoea index (AHI) were calculated for each bin. Between-condition comparisons were performed using one way ANOVA on ranks.

Results: There was a large inter-subject variability in the degree of head flexion/extension during supine sleep. On average, patients spent approx. 75% of the night with the head in flexion ($p < 0.05$). Only one patient had ≥5 mins of sleep in each of F2 and F1 and E1. The six patients that had ≥5 mins of sleep in F2 and F1 showed a near significant trend for increased AHI with increased flexion (32.7 ± 26.6 vs. 20.1 ± 26.6 events/hr, $p = 0.056$).

Head Posture	*%TST*
F2	34.3 ± 33.1*
F1	43.0 ± 36.1*
E1	12.8 ± 23.5
E2	0.4 ± 1.3
Other	9.5 ± 22.4

*$p < 0.05$ vs all postures;



Discussion: Patients with suspected sleep apnoea demonstrate a variety of distinct head postures that are unclassified by existing polysomnographic systems. Use of this customised sensor might allow identification of patients who could benefit from prevention of head flexion as a potential therapy for their OSA.

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MAKING A BETTER AHI: STEP 1 IN A METHOD TO QUANTIFY APNOEA-HYPOPNOEA EVENT SEVERITY

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Introduction: The apnoea-hypopnoea index (AHI) simply quantifies the frequency of respiratory events in obstructive sleep apnoea (OSA), but provides no information about the *severity* of the events. In this study we present a clinically applicable method for quantifying the reduction of ventilation associated with each event (as one key measure of severity); and a visualisation that allows the comparison between individuals and study groups. We demonstrate this method in its application to characterise the treatment-response to upper-airway surgery for OSA.

Patients and Data: 46 OSA patients were studied with full overnight polysomnography at baseline and then following clinically indicated upper-airway surgery (median of 124 [91 to 170] days follow-up).

Technical Methods and Analysis: Respiratory events (obstructive apnoeas and hypopnoeas) were scored using conventional AASM criteria. Square root transformed nasal pressure was used as a surrogate of flow, and a computerised routine was developed to estimate eupnoea as the mean of 7 minute sliding windows. The nadir depth of each event as a percent reduction in ventilation from eupnoea was calculated. Data are presented as a cumulative frequency plot of event-depth vs. event-frequency (as a percentage of total AHI) for each patient. Grouped data are displayed by showing mean curves with 95% confidence intervals.

Results: In addition to a reduction in the AHI with surgery (39.1 ± 4.2 vs. 26.5 ± 3.6 events/hr; $p < 0.005$), our novel analysis showed a reduction in event depths as elucidated by the left-shifted post-surgery curve in Figure 1.

Conclusion: This novel tool captures a more detailed description of the severity of respiratory events. Other applications include the analysis of epidemiological data to ascertain OSA characteristics most associated with detrimental health outcomes.

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BISPECTRAL INDEX AND NATURAL SLEEP IN INDIVIDUALS WITH TREATED AND UNTREATED OBSTRUCTIVE SLEEP APNOEA

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Introduction: Measuring sleep in clinical environments (*e.g.* ICU) is challenging. Actigraphy-based or subjective assessments lack specificity as motionless wakefulness is often reported as sleep. Alternative methods are required. Bispectral index (BIS) is used to quantify depth of sedation and anaesthesia through simplified electroencephalographic frequency analysis; a metric ranging from 100 (fully awake) to 0 (isoelectric) provides a measure of conscious state. Previous studies have suggested that BIS may also reflect depth of natural sleep although its use in individuals with obstructive sleep apnoea (OSA) where interrupted airflow and frequent arousals occur is yet to be examined.

Methods: A bilateral BIS sensor (Aspect Medical Systems) was applied to the forehead of consenting patients undergoing split night polysomnography (PSG) *i.e.* half of the night diagnostic (*i.e.* untreated) and half CPAP (*i.e.* treated). PSGs were scored according to AASM 2012 criteria. Mean BIS levels and arousal frequency were calculated from each 30s epoch for each individual in each condition and sleep stage. ANOVA identified differences in BIS between sleep stages and conditions. Regression analysis examined the relationship between BIS and arousal frequency.

Results: To date 10, patients with OSA (AHI = 47.9 ± 30.1 events/hr) have been studied. Regardless of condition, BIS tended to decrease with increasing depth of NREM sleep, markedly so during N3, and increase during REM to levels similar to those observed during N1 and wakefulness. There was a tendency for BIS to be lower in all sleep stages when CPAP was used compared to when OSA was untreated, although this was only statistically significant during N2 sleep (66.2 ± 7.6 vs 73.8 ± 5.2 events/hr, respectively; $p < 0.05$). Arousal frequency was lower during CPAP therapy (47 ± 31 vs 66 ± 43 /hr, $p < 0.05$) and BIS scores decreased with decreasing arousal frequency ($r = 0.64$, $p < 0.05$).

Conclusion: BIS may be a useful tool to discriminate sleep (particularly NREM) from wake. In patients with OSA, BIS tends to be lower when OSA is treated with CPAP, likely due to a reduction in arousal frequency. BIS may not have sufficient sensitivity to discriminate sleep from wake in untreated OSA patients although additional data and analyses are required to confirm this.

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PREVALENCE OF OBSTRUCTIVE SLEEP APNOEA SYMPTOMS IN A LIVERPOOL HOSPITAL SURGICAL COHORT

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Background: The prevalence of Obstructive Sleep Apnoea (OSA) is increasing and has been associated with an increased risk of peri-operative complications. One of the best validated screening tools of OSA is the STOP-Bang questionnaire. In a surgical population, a high STOP Bang score of 5-8 has been found to be useful in identifying patients with a high probability of moderate/severe OSA. The aim of this study was to calculate the prevalence of high STOP Bang scores in an Australian surgical cohort.

Methods: A retrospective review of STOP-Bang questionnaires was performed in the Liverpool Hospital elective surgery pre- anaesthetic clinics. Adults were surveyed from 4 May to 10 June 2016. A total of 502 patients were asked to complete a STOP-Bang questionnaire with complete data obtained from 465 (93%). Patients using a CPAP machine (n = 27) were excluded from the study. Patients with a high STOP-Bang score ≥5, or a score of 2 or more out of 4 STOP questions plus one other high risk feature of either male gender, BMI > 35 or enlarged neck circumference, were considered to be at high risk for moderate to severe OSA.

Results: A total of 438 patients were included in the study. The study was evenly divided in gender (48% female, 52% male) with a median age of 62 years (range: 18-97 years). The mean BMI was 29 (± 6). A total of 122/438 (28%) of patients were found to have a high probability of moderate/severe OSA. Of these 122 patients, 84/122 (69%) scored 5 or more based on the STOP-Bang questions, and 38/122 (31%) had a score of 2 or more out of 4 STOP questions plus one other high risk feature.

Conclusions: A substantial 28% of this cohort were found to be at high risk for moderate to severe OSA based on their STOP-Bang scores. Whilst several studies have documented the prevalence of symptoms of OSA in surgical cohorts based on a STOP- Bang score ≥ 3, this is the first study to document that a substantial proportion of an Australian surgical cohort are at high risk for moderate to severe OSA. Further research is required into developing better models of care for objectively identifying patients with severe OSA and clarifying their optimal peri-operative management.

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TOTAL SLEEP TIME DOES NOT INFLUENCE THE EFFECTIVENESS OF ANTIHYPERTENSIVE MEDICATIONS IN OBSTRUCTIVE SLEEP APNOEA

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Introduction: Both Obstructive sleep apnoea (OSA) and sleep restriction are known to adversely affect cardiovascular health, particularly through the development of hypertension (HTN). In patients with OSA and HTN, we sought to determine whether short sleep duration negatively impacted the effectiveness of a once daily ACE inhibitor (ACEi) anti-hypertensive in patients with moderate-severe OSA and Grade I-II hypertension.

Methods: The analysis utilized data collected from a recently published randomised controlled trial that tested the efficacy of morning (AM) versus evening (PM) ACEi treatment.[1] Total Sleep Time (TST) was estimated from actigraphy data acquired during 24-hour ambulatory blood pressure monitoring visits at baseline and then after AM and PM ACEi treatment. As there were no differences in TST between Baseline, AM, and PM ACEi visits, data were pooled to provide a mean TST for each patient.

Results: Mean TST min (± SD, Range) was: Baseline (402 ± 92, 12-693), AM ACEi (408 ± 100, 150-705), PM ACEi (409 ± 75, 252-617). The original trial demonstrated significant reductions in sleep and wake BP (SBP drop ~8-10 mmHg/ DBP drop ~4-5 mmHg) with both AM and PM ACEi. Despite this, mean TST was not associated with any BP reduction. AM ACEi: Sleep SBP r = −0.004, Sleep DBP r = −0.03, Wake SBP r = −0.078, Wake DBP r = 0.058; PM ACEi: Sleep SBP r = 0.036, Sleep DBP r = −0.143, Wake SBP r = −0.007, Wake DBP r = 0.048; all $p > 0.2$. Intra-individual variation in TST between baseline and AM or PM ACEi was not associated with the magnitude of BP reduction. AM ACEi: Sleep SBP r = −0.113, Sleep DBP r = −0.138, Wake SBP r = −0.078, Wake DBP r = −0.006; PM ACEi: Sleep SBP r = −0.196, Sleep DBP r = 0.016, Wake SBP r = −0.05, Wake DBP r = 0.062; all $p > 0.1$.

Conclusions: In hypertensive OSA patients, TST did not change after ACEi treatment and was not associated with the BP lowering efficacy. Future research should seek to gather a broader base of sleep duration data to develop a more comprehensive picture of its impacts on health outcomes in OSA patients.

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PILOT EVALUATION OF N-CPAP MACHINE DURING SLEEP THAT APPROXIMATES THE NASAL CYCLE – PRELIMINARY RESULTS

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Introduction: The Rest-Activity Cycler (RACer) breathing system delivers pressurized air to the nose in a manner that approximates the normal physiological nasal cycle during sleep. This could reduce adverse nasal symptoms and improve sleep quality. The aim of this pilot study was to ensure that PAP applied using RACer technology was at least non-inferior to nCPAP in terms of effective suppression of OSA and was tolerated by subjects.
Method: Three n-CPAP tolerant obstructive sleep apnoea patients treated at pressures of 10 cm H_2O, 12 cm $H_2O$and 14 cm H_2O underwent two overnight in laboratory polysomnograms. Night 1: Fisher & Paykel Icon+ Auto device (with humidification) to acclimatize and check adequacy of current pressure. Night 2: RACer at 90% night one APAP pressure (without added humidification). RACer allows the pre-setting of both the nasal cycle duration time and the degree of airflow partitioning between each naris. Sleep and respiratory measures and adverse upper airway symptoms were compared.
Results: With the exception of one participant who had no change in dry throat severity between treatments, all participants reported reductions in dry nose, mouth and throat, and nasal congestion severity when using the RACer compared to APAP. AHI (apnoea/hypopnea index), was equivalent between nights for all patients. Arousal index (AI) was within night to night variation for all 3 participants between nights. Two participants experienced a 27.6% improvement in sleep efficiency, while one showed no change.
Discussion: This pilot study of RACer technology appears to reduce the severity of nasal symptoms associated with APAP over a one night trial. Indices of effective OSA treatment were equivalent between devices. A randomised, controlled study comparing conventional n-CPAP with RACer therapy is currently underway.

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VALIDATION TRIAL OF A PATNEY PROTOTYPE OPEN AIRWAYS DEVICE (OAD) FOR SNORING / MILD OSA

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Introduction: The Patney OAD is intended to replace a person's usual pillow and is hypothesised to reduce snoring by specifically positioning the head (providing elevation and support) to maintain an open airway during lateral and supine sleep. The study aim was to provide an independent report on the subjective effectiveness of the Patney OAD in reducing snoring in a population of snorers with or without mild Obstructive Sleep Apnoea (OSA).
Method: Suitable adult subjects (n = 20, 55% female, mean age; 51.5 ± 6.4 years, weight range; 58 – 103 kg) were recruited from the WellSleep database and social media. Each subject had documented episodes of snoring and had a partner who slept in the same bed. Pre-trial demographic data was collected from participants. Following practical instructions, subjects were given a Patney, matched to their weight, to use for 1-2 weeks at home. Subjective feedback from both the subject and their partners measured by an in-house questionnaire during and following the completion of the trial. Mean scores for comfort and snoring were determined from a 0-100 scale where 50 was representative of no change.
Results: Overall, 80% (16/20) of bed partners subjectively rated that subjects snoring reduced when using a Patney, as compared to when subjects used their usual pillow. Furthermore, of those who had reduced snoring, 14/16 reduced their snoring by average of 54%. Half of the subjects indicated that their sleep quality was better with a Patney, while 65% of partners reported they had less interference during their sleep when subjects were using a Patney. Two subjects did not complete the trial and a further 2 declined the offer of a 2nd trial with a softer Patney. No differences were found between subjective ratings of the Patney for male vs female subjects, and between >90 kg and <90 kg subjects.
Discussion: In a relatively small population of adults who snore and/or have mild OSA, the Patney was effective at reducing bed partner rated subject snoring, while also mildly improving sleep quality in those who tolerated the Patney. Sleep quality in the bed partners of subjects while using the Patney was modestly improved. From a patient and bed partner point of view, the Patney was an effective solution for snoring over a 1-2 week period.

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LONG-TERM EFFECTS OF PARENT EDUCATION ON CHILD SLEEP SELF-REGULATION IN AN RCT: EXAMINING PARENTING CONSISTENCY

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Introduction: Randomized controlled trials (RCTs) have demonstrated that educating caregivers about appropriate levels of interaction with children at bedtime can improve children's sleep. However; the mechanism/s by which these interventions might influence children's ability to self-regulate sleep over the long-term remains unclear. This study used data from a longitudinal RCT to investigate if the *consistency* with which parents implement the intervention strategies in early infancy is a potential mediating mechanism for influencing child sleep self-regulation in later development.
Methods: Prior to intervention assignment, data were collected on participant characteristics including family deprivation level, maternal depression, maternal parity, maternal age, and maternal education. The sleep intervention involved educating parents (during the third trimester and third week postpartum) about strategies to encourage healthy sleep habits in infancy. A parenting index related to parent's consistent use of strategies to encourage infant sleep self-settling (putting baby to bed awake, minimal contact while baby falls asleep, consistent sleep place, own bed space) was developed (reliability coefficient 0.73) from data collected when infants were 4 and 6 months of age. At 3.5 years of age, children's sleep self-regulation was measured through a 7-item scale assessing child bedtime behaviour (reliability coefficient 0.73).
Results: Regression model analyses indicate that, compared to the control group (n = 209), parents assigned to receive the sleep intervention (n = 196) had significantly higher odds (1.65; 95% CI

1.16 - 2.36) of using more settling intervention strategies on a consistent basis; each one-unit increase in consistent strategy use was associated with a significant ($p < .001$) 3.3% decrease in children's difficulties with sleep self-regulation at 3.5 years of age. Further analyses indicated that these outcomes were not moderated by baseline characteristics.

Discussion: Infant sleep self-settling is a possible early marker for imprinting good-self-regulatory behaviours. These results highlight that an important factor influencing children's ability to self-regulate sleep at 3.5 years of age is the consistency with which parents implement appropriate bedtime strategies in infancy. Whether these early parenting practices around sleep influence other self-regulatory behaviours is yet to be determined.

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THE USE AND EFFICACY OF ADAPTIVE SERVO-VENTILATION

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Introduction: Adaptive servo-ventilation (ASV) is a treatment option for patients with central sleep apnoea (CSA). In patients who have heart failure (HF) with reduced ejection fraction (<45%) and predominant CSA, ASV was associated with increased mortality in the SERVE-HF trial, leading to a safety warning (2015). Little is known of the use and efficacy of ASV in other forms of CSA. The aims of this study were to determine (a) the clinical and polysomnograpic (PSG) characteristics of patients prescribed ASV, (b) the efficacy of ASV in controlling sleep apnoea and its symptoms, and (c) compliance with ASV therapy.

Methods: Historical cohort study of all patients who trialled ASV at the West Australian Sleep Disorders Institute until the end of 2015. Patients were identified and data extracted from electronic medical records and departmental databases, including indication for ASV, co-morbidities, PSG findings, and outcomes with CPAP and ASV therapy. Data are expressed as mean±SD, and CPAP and ASV outcomes compared using paired t tests.

Results: We identified 174 patients; 77% male, age 60.1 ± 13.7 years, BMI 37.3 ± 11.9 kg/m^2. The main (non-exclusive) indications for ASV therapy were CPAP-emergent CSA (63.2%), opiates (25.9%), atrial fibrillation (20.7%), heart failure (14.9%) and chronic kidney disease (9.8%). There was a high prevalence of co-morbid hypertension (66.1%), hypercholesterolemia (52.3%), chronic pain (51.1%), diabetes mellitus (38.5%), coronary artery disease (27%), stroke (12.6%) and valvular heart disease (10.9%). On average, patients had severe sleep apnoea (apnoea hypopnoea index (AHI) 51.0 ± 29.9 per hour) and were moderately hypersomnolent (Epworth score 12.7 ± 6.1). Sleep apnoea and daytime sleepiness improved with CPAP (AHI 20.5 ± 13.4, ESS 9.8 ± 5.8) and ASV (AHI 8.7 ± 8.3, ESS 7.6 ± 4.8). In 125 patients, a trial of CPAP preceded ASV therapy; in these patients, AHI and ESS were lower on ASV ($p < 0.0001$ for both). At the end the trials of therapy, 108 patients (62.1%) accepted ASV; in these patients, symptoms improved in 83.3% and satisfactory compliance (average >4 hours per night) was achieved in 72.2%.

Conclusion: Most patients treated with ASV do not have HF. ASV appears to have a useful role in controlling CSA and its symptoms in a range of clinical situations.

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NASOENDOSCOPIC EVALUATION IN ADULT OSA TO PREDICT OUTCOMES IN MANDIBULAR ADVANCEMENT SPLINT USE

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Introduction: This study evaluated clinical effectiveness and efficacy of MAS in adult SDB.

Methods: 71 patients seen in the clinical practices of ENT Surgeon, Sleep Physician and Dentist, were screened and prior to fitting of twin block titratable Somnomed MAS, underwent

1. Completion of Epworth Sleepiness Score, Snoring Severity Score, FOSQ-10
   (a) Detailed history
   (b) Examination including nasoendoscopic evaluation with dynamic manoeuvres including (i) normal jaw position (ii) maximum jaw thrust and (iii) 70% George Gauge directed position.

Results: Patient exclusions (eg inadequate dentition or desire for alternative OSA treatments-positioning device, CPAP, surgery) were recorded, along with key clinical effectiveness measures (ESS, SSS, FOSQ-10, side effects) and efficacy measures (AHI, ODI, nadir oxygen saturation and Dentitrack downloads compliance). Factors predicting clinical effectiveness and efficacy were identified. These results will be presented.

Discussion: MAS for SDB is well validated. However, this is the first study using simultaneous nasoendoscopic and George Gauge dental assessment variables to predict both clinical effectiveness and efficacy outcomes. Trends suggest a simple clinical manoeuvre (jaw thrust) with nasoendoscope in situ predicts the likely airway improvement with a maximally titrated MAS.

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FIXED VERSUS AUTOMATIC POSITIVE AIRWAY PRESSURE THERAPY FOR POSITIONAL OBSTRUCTIVE SLEEP APNOEA - A DOUBLE-BLIND, RANDOMISED TRIAL

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Background: Positional obstructive sleep apnoea (OSA) is commonly defined as AHI of ≥5 events/h sleep with a > 3 fold increase in supine vs. non-supine AHI. There are major differences in upper airway anatomy and physiology with changes in body position. Thus, the optimal treatment approach for supine OSA may be quite different compared to non-supine OSA. Specifically, PAP requirements are likely to be less non-supine compared to supine in people with OSA. Thus, compliance with positive airway pressure (PAP) therapy may be higher with auto (APAP) versus fixed PAP due to lower PAP delivery non-supine.

Aim: To determine if PAP therapy compliance is greater with APAP compared to CPAP for positional OSA.
Methods: 20 patients with positional OSA (AHI>15 events/h sleep with a ratio of supine to non-supine OSA>3 were recruited for a double-blind, randomised, cross-over trial after an in-lab CPAP titration study. Participants received APAP or CPAP for 30 days each and undertook a home sleep study on day 30 with each treatment modality. Objective compliance (machine downloads), patient preference, ESS and HADS were quantified at baseline (as appropriate) and day 30 of each arm.
Results: 19 mostly obese (6 female) patients (BMI range 25-40 kg/m^2), aged 22-72 years, with predominantly severe OSA (total AHI=39 $\pm$ 22, supine AHI=74 $\pm$ 28 events/h sleep) completed the study. Both APAP and fixed CPAP were efficacious in returning the AHI to the normal range (5.6 $\pm$ 6.1 vs. 6.8 $\pm$ 8.6, events/h sleep, p = 0.45) and yielded similar improvements in sleepiness (ΔESS=2.8 vs. 2.2, p = 0.67), anxiety (ΔHA 3.9 vs. 4.4, p = 0.57) and depression scores (ΔHADS= 0.8 vs. 1.4, p = 0.83). However, PAP compliance was not different between APAP versus fixed CPAP (6.0 $\pm$ 1.9 vs. 6.1 $\pm$ 2.0 h/night, p = 0.46). Patients tended to prefer APAP over fixed CPAP (6.6 $\pm$ 1.8 vs. 7.6 $\pm$ 1.5) on a 10 point scale of preference, p = 0.06).
Conclusions: Contrary to our hypothesis, both auto and fixed PAP yield similar improvements in OSA severity and related symptoms with comparable objective compliance in patients with positional OSA. However, these patients tend to prefer auto over fixed CPAP therapy.

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ROLE OF POSTURE ON NASAL RESISTANCE AND OSA SEVERITY WITH A NOVEL MANDIBULAR ADVANCEMENT DEVICE

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Introduction: Mandibular advancement splints (MAS) are an alternative to CPAP for obstructive sleep apnea (OSA) therapy. However, treatment efficacy varies and high nasal resistance (NR) is associated with treatment failure. The physiological effects of changes in posture and mandibular advancement on NR in people with OSA are unclear. We have recently shown that a new MAS device that allows oral breathing directly to the pharyngeal airway (Oventus, O_2Vent T) minimises pharyngeal pressure swings during sleep. This may benefit OSA patients including those with high NR. Thus, the aims of this study are to: 1) assess the effects of posture and mandibular advancement on NR in OSA and 2) study the efficacy of the O_2Vent T device in OSA patients including in those with high NR.
Methods: To date, 7 individuals with OSA (AHI range 5.4-63.3 events/h) have been studied (4 males, aged 35-78 years, BMI: 24-35 kg/m^2). Participants were instrumented with a choanal pressure catheter (Pcho), nasal mask and pneumotachograph to measure NR using gold standard methodology. Awake NR (Pcho/flow@200 ml/s) was measured during 5 mins of quiet nasal breathing in 5 positions (order randomised): seated and supine (with and without MAS) and lateral (without MAS). A standard split night in-laboratory PSG was then performed with and without MAS therapy (order randomised).
Results: Awake NR tended to increase from seated, to supine, to the lateral posture (2.5 $\pm$ 0.7, 3.6 $\pm$ 1.2, 4.3 $\pm$ 1.6 cmH_2O/ml/s, respectively). Mandibular advancement did not systematically change NR in either the seated (3.1 $\pm$ 0.9 cmH_2O/ml/s) or supine postures (4.7 $\pm$ 2.1 cmH_2O/ml/s). MAS therapy reduced the median supine non-REM AHI from 34.4 [5.1, 55.0] to 7.0 [3.1, 22.7] events/h sleep, p = 0.03). Two participants had high NR (>3 cmH_2O/ml/s). The non-REM supine AHI reduced by 33% in one of these participants and by 40% in the other. This is consistent with the changes in AHI for the group overall.
Conclusions: Initial findings show NR is posture dependent in OSA. Increases in NR of 33 $\pm$ 17% from seated to supine in OSA patients are greater than those reported in healthy people without OSA (<10%). The novel MAS device with built-in oral airway significantly reduced OSA severity including comparable reductions in people with high NR.

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THE EFFECT OF A NOVEL ORAL APPLIANCE THERAPY ON OBSTRUCTIVE SLEEP APNEA: PRELIMINARY RESULTS

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Introduction: Oral appliance (OA) therapy is ineffective in some individuals with obstructive sleep apnea (OSA). The reasons for this are unclear, but may relate to disproportionate collapsiblity of the velopharyngeal airway or high nasal resistance. This study assessed the effect on OSA severity of an OA device that addresses such possibilities by providing a built-in airway that permits oral breathing (Oventus O2Vent T).
Methods: Participants were recruited from those already using an OA for treatment of OSA. Each underwent 3 polysomnography (PSG) studies. PSG #1 was undertaken to determine baseline OSA severity (AHI, apnea hypopnea index) without the OA device. The new OA device with oral route OPEN was titrated during PSG #2 to determine optimal advancement. This degree of advancement was used in PSG #3 to determine the effect oral route OPEN vs CLOSED on AHI (half night under each condition, order randomised).
Results: Preliminary data have been obtained in 3 male participants aged 61.3 $\pm$ 5.7 yrs and BMI 27.0 $\pm$ 1.0 kg.m^{-2} (see Table). OSA severity was decreased in all individuals with the OA device and oral route CLOSED. Further marked decreases in OSA severity were seen in two of the three individuals when the oral route was OPEN.
Conclusions: Provision of an oral route of breathing in an OA device further reduces OSA severity in some individuals using OA therapy, suggesting bypass of nasal or nasopharyngeal obstruction. These mechanisms and the characteristics of individuals who may benefit from such a device require further elucidation. Studies are ongoing.
Support: This study was supported by Oventus Medical Ltd.

			AHI		
Gender	Age	BMI	PSG #1 (no OA)	PSG #3	
				Oral Route CLOSED	Oral Route OPEN
	yrs	kg.m^{-2}	events.hr^{-1}	events.hr^{-1}	events.hr^{-1}
M	66	26.1	92.2	46	5.3
M	63	28.0	74.2	33.8	38.4
M	65	26.8	43.9	23.5	7.9

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ADAPTIVE SERVO-VENTILATION (ASV) THERAPY IMPROVES LONG-TERM PROGNOSIS IN PATIENTS WITH COMPLEX SLEEP APNEA SYNDROME (COMP SAS) BETTER THAN CHEYNE-STOKES RESPIRATION (CSR)-CENTRAL SLEEP APNEA (CSA)

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Introduction: Cheyne-Stokes respiration (CSR) is frequently seen in patients with heart failure and it increases mortality. CPAP has been shown to improve CSR by about 50%, but adaptive servo-ventilation (ASV) effectively suppresses CSR and Complex sleep apnea syndrome (Comp SAS). There have been no prospective randomized trials to compare the patients with CSR-CSA and Comp SAS for more than two years by ASV therapy.

Purpose: To compare the acceptability and prognosis in patients with CSR-CSA and Comp SAS by long-term use of the ASV therapy.

Methods: A total of 19 consecutive patients with stable CSR (15 males and 4 female, 64.6 $\pm$ 15.3 y.o., CSR-CSA/Comp SAS 10/9 cases, NYHA 2.5 $\pm$ 0.7, EF 45.7 $\pm$ 20.8%) were evaluated in this study from January 2008 to October 2009. All patients were fully medicated by cardiologists. Three consecutive nights polysomnography (PSG) was performed to all patients at the Fukuoka University Hospital. Baseline PSG was performed at first night. Manual ASV titration or CPAP titration was performed at second or third night randomly. All patients during manual ASV titration had disappeared CSR and all patients were introduced ASV therapy because of decrease of AHI better than CPAP significantly ($p < 0.01$). The endpoint was hospitalization of heart death and heart failure.

Results: In the patients with Comp SAS, the use days of ASV therapy and the survival rate for five years were more and higher significantly than in patients with CSR-CSA (1647.8 $\pm$ 1136.3 days, 588.6 $\pm$ 627.6 days, $p = 0.034$; 100%, 40%, $p = 0.018$, respectively).

Conclusions: ASV therapy for long term is better and more useful in patients with Complex SAS than CSR-CSA. It may also improve hospitalization of heart death and heart failure in patients with Comp SAS.

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