Congress of the
International Pediatric Sleep Association
joint meeting with
Pediatric Sleep Medicine Conference
Rome 3-5 December 2010

ABSTRACT BOOK
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PEDIATRIC SLEEP DISORDERED BREATHING: QUO VADIS?

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Obstructive sleep apnea (OSA) is a more severe form of sleep disordered breathing (SDB), and is a common condition in both adults and children, with estimates that up to 3% of young children are affected. OSA is characterized by repeated events of partial or complete upper airway obstruction during sleep, which results in disruption of normal ventilation, blood gas abnormalities, and sleep fragmentation. Despite the fact that OSA and its associated manifestations were first described as long ago as 1880, it was only relatively recently that Guilleminault first recognized OSA as a clinically relevant entity in children. Indeed, Osler reported that children with “loud and snorting’’ respirations with “prolonged pauses’’ were often “stupid looking’’ and slow to respond to questions. He was the first to comment that the “influence upon mental development is striking’’, yet it took another 100 years or so before his observations on neurocognitive decrements in pediatric OSA were investigated. OSA in children is distinct from OSA that occurs in adults, particularly with respect to gender distribution, clinical manifestations, and treatment. In children, OSA is frequently diagnosed in association with adenotonsillar hypertrophy, and is also common in children with craniofacial abnormalities and neurological disorders affecting upper airway patency. In his early descriptions of pediatric OSA, Guilleminault suggested that removal of the enlarged adenotonsillar tissue will eliminate the clinical symptoms (34). However, while enlarged tonsils and adenoids are clearly a major contributor to this disorder, children with OSA also have increased upper airway collapsibility. Thus, adenotonsillar hypertrophy alone is usually not sufficient to cause OSA, since some children with “kissing tonsils’’ do not have OSA, while others are not cured after adenotonsillectomy. The primary symptom of OSA is snoring and affects up to 27% of children with a mean revolving around 10-20%. This relatively high frequency in snoring and affects up to 27% of children with a mean revolving around 10-20%. This relatively high frequency in snoring is generally considered to be benign, recent evidence from our laboratory suggests that it may in fact be associated with neurobehavioral deficits. Daytime sleepiness, behavioral hyperactivity, learning problems, and restless sleep are all significantly more common in habitual snorers. The implications of OSA and the associated hypoxemia and sleep fragmentation in children are potentially complex. If left untreated, or alternatively, if treated late, pediatric OSA may lead to significant morbidity affecting multiple target organs and systems, and such deleterious consequences may not be completely reversible despite appropriate treatment. The potential consequences of OSA in children include behavioral disturbances and learning deficits, pulmonary hypertension, systemic hypertension, and compromised somatic growth. In addition, pediatric OSA is associated with poor quality of life and increased healthcare utilization. Schooling problems have been repeatedly reported in case-series of children with OSA, and in fact may underlie more extensive behavioral disturbances such as restlessness, aggressive behavior, excessive daytime sleepiness and poor test performances. Improvements in behavior have been observed following treatment for OSA in children suggesting that at least some of the deficits may be reversible. Subjective surveys suggest that children with later, irregular bedtimes, short sleep time, and increased daytime sleepiness, have lower academic achievements than other children. However, a recent study in which 1200 students were surveyed failed to find a significant association between total sleep time and school performance. Lower school performance has also been reported in children with SDB and the reciprocal has also been shown to be true, i.e., children with poor academic performance are more likely to have sleep disturbances such as snoring and breathing difficulties. Gozal found a 6-9 fold increase in the expected incidence of OSA of first grade children who ranked in the lowest 10th percentile of their class. Moreover, a significant improvement occurred in school grades following adenotonsillectomy and resolution of OSA. However, since the optimal learning potential for these children was unknown, it is possible that long-term residual deficits may be present even after treatment. To further examine this possibility, Gozal and Pope investigated the history of snoring during early childhood in 2 groups of 13-14 year-old children who were matched for age, gender, race, school being attended, and socioeconomic status, but whose performance was either in the upper or lower quartile of their class. The investigators found that children who snored frequently and loudly during early childhood were at greater risk for lower academic performance in later years, well after snoring had resolved. These findings suggest that even if a substantial component of the OSA-induced learning deficits is reversible, there may be a long-lasting residual deficit in learning capability. The latter could represent a “learning debt’’, i.e., the decreased learning capacity during OSA may have led to such a delay in learned skills that recuperation is only possible with additional teaching assistance. Alternatively, the processes underlying the learning deficit during OSA may have irreversibly altered the performance characteristics of the neuronal circuitry responsible for learning particular skills. These studies are now the subject of intensive investigation using animal models of SDB.

Bhee DW, Gozal D. Obstructive sleep apnea and the prefrontal cortex: Towards a comprehensive model linking nocturnal upper airway dysfunction to daytime cognitive and behavioral deficits. J. Sleep Res. 2002; 11:1-16.


I - Update on childhood narcolepsy

001 CLINICAL FEATURES OF CHILDHOOD NARCOLEPSY. CAN CATAPLEXY BE FORETOLD?
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Introduction. Narcolepsy is a life-long disease characterized by abnormal regulation of the sleep-wake cycle and increased penetration of rapid eye movement (REM) sleep. In children, narcolepsy without cataplexy is more frequently seen than in adults. The aim of our study was to evaluate clinical and polysomnographic parameters to verify if cataplexy appearing later in life can be foretold.

Methods. 30 patients (12 boys), who contracted narcolepsy before the age of 18, were enrolled. All underwent clinical examination, nocturnal polysomnography (PSG), multiple sleep latency test (MSLT), HLA-DQB1*0602 testing and Epworth Sleepiness Scale (ESS) rating. The Mann-Whitney rank and Fisher’s tests were used for statistical analysis.

Results. Narcolepsy without cataplexy (NwC) was diagnosed in 40 % of the patients. The mean age at the first symptoms was 14.0±3.0, at diagnosis 15.6±3.1 years. Narcolepsy was accompanied by hypnagogic hallucinations in 15 and sleep paralysis in 12 patients. Frequent symptoms were sleep inertia during awakening, REM behavior symptoms, behavioral and serious school problems. BMI was higher in patients with narcolepsy-cataplexy (N-C) than in NwC patients (p<0.05). A high ESS score was indicative of excessive daytime sleepiness (17.1±2.5) in the both groups. Mean MSLT sleep latency was 4.0±3.1 min with 3.2±1.4 sleep onset REM periods (SOREMs) with no difference between the two study groups. HLA typing revealed no differences either. The N-C group showed a higher degree of wakefulness (p<0.05) and NREM stage 1 (p<0.001) with a lower NREM stage 3-4 (p<0.05) during nocturnal PSG.

Conclusion. Narcolepsy in childhood leaves very little scope for the prediction of cataplexy later in life. Only increased BMI and more disturbed nocturnal sleep differentiated N-C from NwC patients. Other symptoms and a psychosocial impact were present independently of the manifestation of cataplexy.

002 CLINICAL, POLYSOMNOGRAPHIC AND LABORATORY CHARACTERISTICS OF NARCOLEPSY - CATAPLEXY IN A SAMPLE OF CHILDREN AND ADOLESCENTS
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Objective. To report our findings from a sample of narcoleptic children and adolescents evaluated in our unit from 1998 to 2005.

Methods. The sample was composed of nine children (5 boys) with a mean age of 14.5 years at diagnosis. The protocol included the following: Epworth, Ullanlinna narcolepsy scale and Stanford cataplexy questionnaires; physical, psychological and neurological examinations; neuroimaging; PSG + MSLT recordings; HLA and in two cases Hert-1 level in CSF.

Results. Narcolepsy was sporadic in all cases. The first symptom was EDS with a mean age at onset of 9.4 ± 2.5 years (range 6–13 years). All patients complained of cataplexy. Other symptoms were hypnagogic hallucinations (4 children) and sleep paralysis (3 children). All the children performed poorly at school, 4 had emotional disorders with depression, 4 displayed nocturnal eating and weight gain. Mean BMI was 25.0 kg/m². One girl was diagnosed as having precocious puberty, polycystic ovary syndrome (PCOS), hyperandrogenism and insulin resistance. The MRI showed a partial empty sella. Hert-1 was undetectable in her CSF. The mean Ullanlinna score was 24.6; PSG showed disturbed nocturnal sleep and the MSLT showed a mean sleep latency of 2.1 min and 3 SOREMPs. Eight children were DR2-DQ1- positive, whereas one boy was DR2-negative but DQ1-positive. In two patients, Hert-1 was undetectable.

All children, in addition to scheduled naps during the day, were treated with modafinil or methylphenidate combined with an antidepressant and in two cases with sodium oxybate.

Conclusion. NC was sporadic in all children and associated with precocious puberty and PCOS, hyperandrogenism and insulin resistance in one case. EDS, cataplexy, disturbed nocturnal sleep, nocturnal eating, poor school performance, and emotional disorders were the principal complaints. All patients had DQB1*0602 and Hert-1 was evaluated in two cases (undetectable in both).

003 INCREASED INCIDENCE OF CHILDHOOD NARCOLEPSY IN 2010
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Introduction. Narcolepsy is a rare neurological disease with a population prevalence around 30/100 000. There are only few reports about incidence of narcolepsy in adults no reports about incidence in children.

Methods. The national hospital discharge register between 2002-2008 was used to find all incident cases of narcolepsy (ICD-10 code G47.4). Child neurologists were contacted and asked about diagnosed cases of narcolepsy in 2009 and 2010.

Results. Altogether 24 cases of narcolepsy have been diagnosed in children (≤ 16 y) in Finland in 2002 - 2009 (mean 3 new patients/y; 95% CI 1 to 5; annual incidence 0.33/100 000 children (0.16 to 0.49). By the end of October 2010 altogether 36 new cases of childhood narcolepsy have been reported. In all cases the onset of symptoms has been between Dec 2009 and April 2010. The annual incidence in 2010 (≥ 36 new cases giving an incidence of 4/100 000) is > 12 times higher as compared to earlier incidence (P<0.0001). By the end of September 81 cases have been reported in Europe. Of them 34 reports came from Sweden and 30 from...
Finland. In Finland more than 80% of children received an adjuvanted H1N1 vaccine during the vaccination campaign of the fall 2009 and winter 2010. Also in Sweden more than 60% of children were vaccinated with the same vaccine. No increase in incidence has been found among adults. **Conclusion.** In 2010 the incidence of narcolepsy has been increased by more than 12 times in Finland as compared to 2002-2009. Could some environmental trigger(s) among genetically susceptible (HLA DQB1*0602) children be a co-factor behind this phenomenon? In Finland possible environmental factors (there can be several factors combined) include H1N1-infection, another infections, the adjuvanted H1N1-vaccination or some other environmental factors. Most cases have occurred in countries where only an adjuvanted vaccine was used. It is important to know whether there are associations also to H1N1 infections (serologically proven) without vaccination and to non-adjuvanted H1N1 vaccines.

### 004 PREOCIOUS PUBERTY AND OVERWEIGHT IN CHILDREN WITH NARCOLEPSY WITH CATAPAEXY

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**Introduction.** Narcolepsy with Cataplexy (NC) is a rare central hypersomnia, due to the specific loss of hypothalamic neurons producing hypocretin-1. NC’s age of onset presents a bimodal distribution with a major peak around adolescence, nevertheless clinical observation of childhood/pre-pubertal NC onset is increasing. We presented here a NC childhood sample, carefully characterized for clinical phenotype, with special focus on two of the most relevant clinical features associated to childhood NC, the overweight and the acceleration of pubertal development; the possible concomitant diagnoses of precocious puberty and overweight until clear obesity were also examined.

**Methods.** Thirty-five consecutive children affected by NC, CSF hypocretin-1 deficiency, HLA DQB1*0602, have been enrolled. All patients underwent weight and height measurement; and, if pre-pubertal or close to puberty, lutenising hormone-releasing hormone test, wrist X-ray and pelvic ecography (for females). Retrospective data have been collected in post-pubertal patients.

**Results.** Out of 35 NC children, 27 (70.14%) showed a clear-cut overweight-obesity, versus 24% estimated in the healthy Italian paediatric population. Moreover, 5 (14.29%) presented precocious puberty (PP), whose prevalence is otherwise rare (1-2/10.000); 6/35 (17.14) are still at risk to develop PP, NC starting before the cut-off for PP; 23/35 (65.71%) do not show PP, because either they passed the cut-off of PP, still being pre-pubertal, or they presented NC after normal puberty; 2 children showed an isolated advanced bone age at X-ray (i.e. ≥2 years).

**Conclusion.** This study reports on specific endocrine alterations of childhood NC. The confirmed higher prevalence of overweight-obesity and precocious puberty with respect to the general population, supports the importance to assess these possible additional diagnoses, for the consequent risk of a severe obesity in adulthood and the growth stopping. Moreover, our data suggest that both overweight and precocious puberty could represent an additive clinical sign of a wider hypothalamic dysfunction in NC.
adjustment, and management of Narcolepsy. The groups are matched for age and ability, with age range of 13 to 16. Parents are also invited to attend. The groups are run along a psychoeducational model with opportunities for people to meet separately with the facilitators to discuss medication, lifestyle issues and ask their own questions. A break-out rest room is provided.

Results. An average of 6 young people and their carers attend each group. Issues identified as most helpful for the group were meeting other young people with narcolepsy, opportunities to gain medication information, treatments, and practical advice around driving, work, school and alcohol/drug intake. Areas for improvement related to the format of the group (increase opportunities to move around/making the group more interactive to avoid tiredness.) All attendees stated they enjoyed the group and felt they had increased their knowledge about Narcolepsy and thought other teenagers with Narcolepsy would find the group helpful.

Conclusion. Psychosocial adjustment and management of narcolepsy can be helped by such group interventions. Further formal evaluation of this work and its impact is continuing.
II. Sleep habits and sleep duration in childhood and adolescence

007 IN SEARCH OF LOST SLEEP: A META-ANALYSIS TO QUANTIFY SECULAR TRENDS IN CHILDREN'S SLEEP DURATION
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Introduction. The notion that children are sleeping less than they used to is widespread in popular media and scientific literature. This study reviewed all available data on the sleep duration of children (aged 5-18) and conducted a numerical meta-analysis to quantify secular trends in children’s sleep duration over the last century.

Methods. A systematic review was conducted to identify any reports of the sleep duration (time in bed or total sleep time) of children. No language or date limits were applied. A search of online data archives was conducted and experts in the fields were contacted to collect raw datasets. Trends in sleep were analysed using Monte Carlo simulation and linear regression.

Results. In total 230 studies and 44 raw datasets were located reporting on sleep duration in children. These covered 21 countries, 838,981 children and a 104-year span from 1905. A secular decline of 0.76 minutes per year was identified for all children included in the analysis with significant differences across age groups, sexes, regions and between schooldays and non-schooldays. The rate of decline was greatest for older children (16-18 year), boys and on non-schooldays. Region analysis revealed secular decline in Europe, the USA, Canada and Asia, while increases were found for Australia, the UK and Scandinavia. Europe experienced the greatest rate of decline.

Conclusion. This study supports the popular belief that children are sleeping less than they used to and identifies a need to determine appropriate sleep recommendations.

008 THE VARIATION IN CHILDHOOD SLEEP DURATION: A LONGITUDINAL ENGLISH COHORT
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Introduction. This epidemiological investigation was designed to investigate patterns of sleep duration throughout childhood in a large English cohort and compare the results with other published sleep data.

Methods. The ALSPAC (Avon Longitudinal Study of Parents and Children) birth cohort is an ongoing prospective longitudinal investigation of over 14,000 children born in 1991-2 (84% of all eligible infants in the study area). Parental reports of sleep duration and timing were collected at 8 time points (6,18, 30, 42, 69, 81, 115 and 140 months of age).

Results. Total sleep duration steadily fell from 13 hours and 12 minutes during infancy to 9 hours 49 minutes at 11 years old. The variation in sleep duration was very wide; from 10-17 hours in early infancy (using two standard deviations either side of the mean) narrowing to 8½-11 hours at 11yrs. The total sleep duration was significantly and positively correlated between adjacent time points (r ranging between +0.4 and +0.6) (p<0.001) although this correlation diminished as the time between measurements widened, and we did not identify significant groups of children with consistently long or short sleep duration throughout childhood. Few children (~2%) had daytime naps by 69 months. Around half of the pre-school children regularly woke at least once during the night but frequent waking (three or more times a night) peaked in infancy (10% of all infants) and steadily declined in the pre-school years. Comparison with the earlier Zurich cohort suggests these English children slept less during early childhood for both daytime and night-time sleep (around one hour) but more during later childhood (around half an hour).

Conclusion. Given the wide variation of sleep in the childhood population any recommendations on optimal or desirable sleep duration at any age must have wide confidence limits, and needs to be tailored to the individual.

009 RELATIONSHIPS BETWEEN SLEEP PATTERNS AND ELECTRONIC MEDIA EXPOSURE AMONG ISRAELI CHILDREN AND ADOLESCENTS
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Introduction. Developmental changes in sleep-wake patterns from childhood to adolescence are affected by environmental factors including electronic media exposure (e.g., television and computer).

Objective. To compare sleep patterns and electronic media exposure and their relationships in Israeli children and adolescents.

Methods. A cross-sectional survey, including 449 8th and 9th graders (mean age 14 ± 0.8) and 312 5th and 6th graders (mean age 11.0±0.72) in the normative school system, was performed. Students completed a sleep survey and an electronic media questionnaire.

Results. Adolescents went to bed an hour later than children (23:02±0:55 vs. 22:02±1:01; p<0.001), slept less (7.37±1:9 hrs vs. 8.78±1:08 hrs; p<0.001) and woke up at almost the same time during weekdays. During weekends, adolescents' sleep and wake times were nearly two hours later than children's (01:46±1:45 vs. 24:00±1:4; p<0.001 and 11:29±1:59 vs. 9:53±2:07; p<0.001 respectively), with no significant differences in sleep duration. Average electronic media exposure per weekday was significantly longer among children compared to adolescents (TV: 4.62±2.63 vs. 2.75±2.12; p<0.001; computer: 5.2±5.63 vs. 3.69±2.98; p<0.001). Among adolescents, on weekdays, later bedtime was associated with longer television (r=0.21) and computer use (r=0.24). Longer sleep duration was associated with less television (r=−0.15) and computer use (r=−0.19). On weekends, later bedtime and later wake-up time were associated with longer computer use (r=0.19, r=0.18 respectively). Among children, longer sleep duration was...
Introduction. Parenting behaviors and cognitions have an important role in the development of infant sleep. However, little is known about the role of parents in the development of sleep in older children. The main aim of the present study was to investigate early predictors of sleep patterns in pre-school age children. Specifically, we were interested in exploring whether parenting factors and sleep patterns assessed at 12 months, would predict sleep patterns in 4 years-old children.

Methods. This study was part of a longitudinal study (from pregnancy to the age of 4 years), exploring the links between parental cognitions and children’s sleep. The present study focused on data collected at 12 months and 4 years. Seventy-one families participated in this study (boys 58%). Sleep at both time points was assessed for 4 weekdays by actigraphy and daily parental reports. Maternal cognitions at 12 months were assessed by two questionnaires (Infant Sleep Vignettes Interpretation Scale and the Maternal Cognitions about Infant Sleep Questionnaire).

Results. Structural equation modeling revealed that: (a) lower sleep quality at 12 month, as measured by the number of actigraphic night-waking and sleep percent, predicted lower actigraphic sleep quality at 4 years; (b) maternal cognitions reflecting difficulties with limiting parental nighttime involvement predicted poorer sleep quality at 4 years. In addition, Pearson correlations demonstrated that poorer sleep quality, higher parental bedtime involvement, more nighttime feeding and more problematic cognitions at 12 months were significantly associated with higher levels of parental presence and involvement at the age of 4 years.

Conclusion. Early sleep patterns and maternal sleep-related cognitions during infancy are significantly associated with sleep quality of pre-school children. These findings are clinically meaningful as they suggest that addressing early parental beliefs and perceptions regarding infant sleep may help in preventing sleep problems of pre-school children.

012 TOTAL SLEEP TIME AND STARTING TIME TO SCHOOL IN BRAZILIAN CHILDREN
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Introduction. In Brazil, the starting time to elementary school is in the morning or in the afternoon. Sleep disorders (SD) can impair cognition in children and maybe it is worse in those that have sleep deprivation. Our goal is to compare sleep habits of children with sleep disorders, cognitive dysfunction, and starting time to school.

Method. We studied 5400 children, 7- to 10-years-old, in elementary public schools of Sao Paulo City, Brazil, without any genetic or neurological syndrome. From 3023 included questionnaires (Sleep Disturbance Scale for Children adapted for Brazilian Portuguese), filled in by parents, there were 640 children with SD. From 2383 children without any SD (WDS), we randomly included 640 children, stratified by gender and age. We applied the Bender Test (BT) for cognition in 1180 children that signed the consent form. We compared the total sleep time (TST) and the sleep bedtime of SD and WDS children, with and without cognitive dysfunction, gender, and starting time to school (morning 7AM and afternoon 1PM) by T-Student Test.

Results. From 542 SD children, 267 were boys, 298 studied in the morning, and 211 have cognitive
II. Sleep habits and sleep duration in childhood and adolescence

A. Oral sessions

013 SLEEP HABIT OF JAPANESE CHILDREN AND ADOLESCENTS: FINDINGS FROM TOON PEDIATRIC SLEEP STUDY

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Introduction. Sleep habits and sleep problems among children ranging from kindergartener to high school children have rarely been studied comprehensively in Japan. The aim of the study was to elucidate the sleep habits among children and adolescents in the community using a questionnaire.

Methods. This study was conducted at Toon City, a local city of Japan, and involved all school children (kindergartener; elementary school children; junior and senior high school students). Child and Adolescent Sleep Checklist (CASC) was used to identify sleep habits and sleep problems. CASC was given to all students of the schools, and was filled out by the caregivers for kindergarteners and filled out by the students. 3981 subjects (mean age: 11.1 SD 4.0) responded to the questionnaire properly (response rate: 96%).

Results. Mean bedtime and wake time delayed with age. Mean sleep duration gradually decreased with age, and almost 6.5 hours among senior high school student. Difference of sleep duration between weekdays and weekends extended with age and reached to 1.5 hours at the end of senior high school. Playing video/portable games before bedtime was very prevalent among high school students. Percentage of children who experienced sleepiness or napping during classes increased especially in high school students.

Conclusion. Both physiological and lifestyle change, with several studies showing sleep deprivation or increased health consequences.

014 A PILOT STUDY OF SLEEPINESS AND SLEEP HABITS IN PORTUGUESE SCHOOLS

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Portugal is a sleep-deprived county: people go to bed late (70% of adults go to bed after midnight) and wake up early. Children and adolescents follow the parents’ pattern, with several studies showing sleep deprivation or increased health consequences.

Objectives. In order to develop awareness raising and education programs at a national level we developed a pilot study aiming to evaluate habits and sleepiness in different school grades in several schools in different regions of the country profiting from local initiatives.

Methods. Students and/or teachers requested expert presence to explain the basics about sleep to children and adolescents. The questionnaires used were the Sleep Habits Questionnaire, the Cleveland Sleepiness Score and a reduced version of QASA (Pinto et al 2010). 3 schools were evaluated and compared. In three schools small research projects were led directly by the students (Pedro Hispano Institute- IPH - Coimbra, High School of Caneca- HSC) or by the school psychologist (S. Roque do Pico - SRP) and two of them developed didactic activities around sleep (SRP and Vila Boim- VB). Data statistical analysis used both t-test and ANOVA.

Results. The schools compared were the SRP (Azores)(59 students; mean age 10.8 +/- 1.52), the VB (Alentejo) (44 students; mean age 12.3 +/- 4.09) and Miguel Torga (MT) (Lisbon) (48 students; mean age 16.7 +/- 1.28). The average of false beliefs per student was low (4.8 +/- 1.8). Wrong beliefs had higher prevalence in VB children namely in what concerns sleep length, its impact upon academic success, effect of light and exercise and impact upon accidents and disease. The CSS was equal to 32.8 +/- 8.5; in 16.5% of the students CSS was higher than 40; there were no differences among schools and no correlation with beliefs.

Conclusion. The didactic activities and research projects were important steps in raising awareness, the sleepiness prevalence was high and misbelieves were clear in important functional impacts of sleep.

Acknowledgments: Student groups of VB, IPH, MT, HSC

015 THE PREVALENCE OF SLEEP DISORDERS AND THEIR CORRELATION WITH VARIOUS RISK FACTORS IN URBAN CHILDREN FROM MUMBAI, INDIA

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Introduction. This prospective study attempts to determine the prevalence of sleep disorders and their association with age, gender and risk factors like obesity, adenoidal/tonsillar hypertrophy, and anatomical abnormalities (malocclusion, micrognathia and macrognlossia) in high socio-economic urban Indian children.

Methods. 506 children (6.5-15.3 yrs) were enrolled after due consent as a part of school health check-up. Parents were asked to complete sleep disturbance scale for children (SDSC) questionnaire after having observed their child’s sleep for one week. Each child was examined for risk factors stated above using standard Indian anthropometric charts.

Results. The percentage of children with “definite” (total SDSC score >2SD) and “borderline” sleep disorder (total SDSC score: mean to mean+2SD) was 5.3% (27/506) and 31.8% (161/506) respectively. The commonest type of sleep disorder out of the six categories was disorder of arousal. There was no association of total sleep disorder with gender or age. However, sleep wake transition disorder was commoner in males and sleep hyponoarous decreased with increasing age. 9.7% of total children were obese (BMI > 95th percentile) and 24.7% were overweight (BMI 85th-95th percentile). “Definite” (8%) and “borderline” (35%) sleep disorder...
was similar in the two groups. Obesity was found to be associated with disorder of initiating and maintaining sleep and sleep disordered breathing (SDB). No significant association with other risk factors was found. Conclusion. There are a significant proportion of children with sleep disorders. Sleep disorders are more prevalent in obese and overweight children. The percentage of children with definite sleep disorder was low compared to other studies which could possibly be due to less awareness in parents as demonstrated by the fact that borderline sleep disorder was high and was comparable with other studies.
III – Sleep and cognition in childhood and adolescence

016 SNORING AT 6 MONTHS OLD IS ASSOCIATED WITH POORER COGNITIVE DEVELOPMENT AT 12 MONTHS OLD
Kohler M., Lushington K., van den Heuvel C., Martin A., Kennedy D.
1University of Adelaide, School of Psychology; 2University of South Australia, School of Psychology; 3University of Adelaide, Children’s Research Centre; 4Women’s and Children’s Hospital, Children’s Youth and Women’s Health Services, Australia

Introduction. Sleep Disordered Breathing (SDB) is a common paediatric sleep disorder. Snoring is a cardinal feature of SDB and it is estimated that around 5-10% of school-aged children snore 3 or more nights a week. Mounting evidence shows that even mild snoring is associated with a range of neurocognitive deficits in older children. It is unclear however, whether the same is true in infants who snore. Sleep is important for long term memory and learning. In infancy (a period of rapid brain growth and development of neural circuits), it is crucial to determine if snoring and sleep disruption is associated with poorer cognitive development.

Methods. A total of 19 frequent snorers (snoring ≥3 nights a week), 10 infrequent snorers (snoring 1-2 nights a week) and 82 healthy control infants (reported to never snore in the absence of a cold) completed the study at 6 and 12 months of age. Infants were assessed with Bayley Scales of Infant and Toddler Development Edition III. Parents completed sleep surveys and the National Adult Reading Test.

Results. Frequent snorers scored significantly lower in cognitive ability compared with infrequent snorers and controls at both 6 and 12 months old. There were no significant differences between frequent snorers, intermittent snorers and controls for language, motor and social emotional development at 12 months of age. Children reported to snore since birth and also reported to snore frequently at 6 months old, independent of their snoring status at 12 months old, had significantly lower cognitive development scores than controls.

Conclusion. Snoring in infancy is associated with a negative impact on general cognitive ability. Given the frequency of sleep disordered breathing and the potential for harmful long-term consequences of SDB, the current study’s findings have significant implications.

018 SLEEP-RELATED BREATHING DISORDERS AND THEIR ASSOCIATION TO THE DETERIORATION OF SCHOOL PERFORMANCE
Carrillo J., Borel C.
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Introduction. Sleep-related breathing disorders (SDB) during childhood are among the main causes the obesity and hypertrophy of lymphoid tissues and have been linked to cognitive impairment. The aim of this study was to explore the relationship between SBD and school performance.

Methods. We conducted a cross-sectional study in schoolchildren in first grade of municipal schools in a district of Santiago. We applied a pediatric sleep questionnaire to 109 parents or direct caregivers and performed a physical examination, measured height and weight. At the end of the year we collected school performance data.

Results. In the group studied, 53.2% was women, with an average age of 7.2 (± 0.52). According to the survey, 69.7% did not snore or occasionally (nR), 30.3% did so always or more than half the time (R). 42.2% of the group studied were overweight or obese (≥p85), and 17.4% were obese (≥p95). 13.8% had grade +3 or +4 tonsils. The schoolchildren R had significantly lower averages than nR: Language (5.29 ± 1.16) versus (5.73 ± 0.88) (p <0.031), Mathematics (5.32 ± 1.18) versus (5.89 ± 0.88) (p <0.007); Natural Sciences (5.86 ± 1.07) versus (6.30 ± 0.73) (p <0.012); Technology Education (6.25 ± 0.65) versus (6.51 ± 0.56) (p <0.040), Art Education (6.09 ± 0.69) versus (6.34 ± 0.57) (p <0.049), and General Average (5.89 ± 0.75) versus (6.21 ± 0.55) (p <0.012).
with longer latency in the response that reflects attention. Children sleeping less than 8 hours/night was associated with higher overweight and increased size of tonsils.

019
COGNITIVE-MOTOR INHIBITION CAPACITY IS AFFECTED IN 10-YEAR-OLD CHILDREN WHO SLEEP LESS THAN 8 HOURS PER NIGHT
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1Sleep Laboratory, INTA, U. Chile, Chile; 2Center for Human Growth & Development, U. Michigan, USA

Introduction. To inhibit an action is an important mechanism in the human behavior. As shown by fMRI studies, the underlying brain structures of this inhibitory system include the prefrontal cortex (PFC) and prefrontal-striatal circuits. Evoked-related potentials (ERPs) have been used to study the neurophysiological responses to cognitive-motor inhibition tasks. Among them, the Go-NoGo task is widely used and its responses have been supported with neuroimaging findings. Sleep deprivation or even minor sleep fragmentation could affect the inhibitory system. We hypothesized that children sleeping less than 8 hours/night would perform worse in the Go-NoGo task than those sleeping more.

Methods. As part of a longitudinal study, 61 children were drawn from a cohort studied since infancy at INTA, University of Chile. Subjects wore an actiwatch for 8 days and filled out an activity log and sleep questionnaire. ERPs were recorded in the morning of day 9, while performing the Go-NoGo task. The task consists of 2 blocks: Block 1 contained 40 Go stimuli (subjects were to press a button quickly when a letter appeared on a computer screen) and Block 2 with 80 stimuli, distributed randomly in Go and NoGo stimuli (NoGo stimulus was letter X, and the subject had to refrain from pressing). N2 amplitude and latency were analyzed since they are thought to reflect attention capacity.

Results. Subjects were equally distributed by gender; 23% slept less than 8 hours/night. Compared to children sleeping more than 8 hours, those sleeping less showed longer N2 latency to the Go response in Block 2 (371.5±42.0 vs. 348.4±35.7 ms, p<0.03). N2 amplitude was similar in both groups.

Conclusions. Our results show that amount affects cognitive-motor inhibition capacity in 10-year-old children. Sleeping less than 8 hours/night was associated with longer latency in the response that reflects attention capacity. Therefore, sleep patterns appear to modulate cognitive performance.
III. Sleep and cognition in childhood and adolescence

A. Oral sessions

022 SCHOOL AFTER FIRE: THE IMPACT OF A DUAL SCHOOL SCHEDULE ON ACADEMIC PERFORMANCE, SLEEP, AND HEALTH OF HIGH SCHOOL STUDENTS

Laberge L1, Martin JS2, Vachon P3, Arbour N1, Boivin D4
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Introduction. During the summer of 2008, the Kénogami high school, situated in Saguenay, was destroyed by fire. For the 2008-2009 academic year, Kénogami students were relocated to the Arvida high school situated 5.3 km away. Since the Arvida high school had limited number of classrooms, a dual school schedule was implemented. More specifically, school respectively started and ended at 7h40 and 13h05 for Arvida students and at 13h25 and 18h45 for Kénogami students. The aim of this study was to assess the impact of this dual school schedule on academic performance, sleep, and health of students.

Methods. Forty-eight grade 7 and 12 students (mean age=15.1 years; 47.9% boys; 50.0% Arvida students) completed the study. All students wore a wrist actigraph for ≥7 consecutive days. They answered questions pertaining to school and academic performance and filled out validated scales of self-esteem, psychological distress, daytime sleepiness, and chronotype. T-tests for independent samples were used. Informed consent was obtained from all participants and parents.

Results. Sixteen students were morning-types, 22 were intermediate-types, and 10 were evening-types. Arvida students (morning school schedule) had earlier sleep onset (22h58 vs 0h15, p<.001) and sleep offset (6h48 vs 8h39, p<.001) and had a shorter sleep duration (6h58 vs 7h50, p<.01) and higher daytime sleepiness levels (p<.05) than Kénogami students (afternoon/evening school schedule). Morning-type Arvida students had earlier sleep onset (22h34 vs 23h34, p<.05) and had lower psychological distress levels (p<.05) than Arvida evening-types. Morning-type Kénogami students had earlier sleep onset (22h59 vs 1h36, p<.01) and sleep offset (7h36 vs 9h48, p<.001) and had higher academic results (p<.05), lower daytime sleepiness levels (p<.05), and higher self-esteem levels (p<.05) than Kénogami evening-types.

Conclusion. These preliminary results suggest that evening-type students may face an increased risk for lower educational achievement and health, irrespective of school schedule and sleep amount obtained.

023 BORDERLINE INTELLECTUAL FUNCTIONING AND SLEEP: THE ROLE OF CYCLIC ALTERNATING PATTERN

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Introduction. Sleep play a key role in multiple intellectual abilities. Aim of our study was to assess the sleep macrostructure and microstructure and their relationship with IQ in Borderline Intellectual Functioning (BIF) subjects.

Methods. Our sample was composed by 12 BIF (mean age 10.33 ±1.23) and 17 healthy children (mean age 9.81 ±2.46). According to DSM-IV criteria, BIF is the intellectual performance ranging between 71 and 84 values of Total Intelligence Quotient (TIQ). Intellecitive functioning was assessed using the Italian version of WISC-R. All subjects underwent an overnight full PSG recording and macrostructural sleep and CAP analysis were performed.

Results. Table 1 and 2 show the comparisons of macrostructural and microstructural sleep parameters between children with BIF and controls. The Spearman analysis shows the correlation between time sleep duration (TID, SPT and TST) and all intellective parameters, and an inverse correlation between first REM latency and Verbal Intelligence Quotient (VIQ). The CAP total number, CAP rate S1%, CAP rate S2%, A1 index and the number of sequences are directly correlated with all parameters of intellective scales. CAP rate% is related to Performance Intelligence Quotient (PIQ) and TIQ scales. CAP rate% and CAP rate% in SWS are strictly related with PIQ. The total number of A1% is related to VIQ and TIQ; inversely related are instead the total number of A2% and the A2/A3 ratio with VIQ and TIQ. A2 index with VIQ and A1/A3 ratio is related positively with VIQ and TIQ. About the time mean duration of CAP sequences, A1, A2 and duration of cycle are inversely related with all measures of intelligence.

Conclusion. To our knowledge this is the first attempt to evaluate CAP parameters in children with BIF and to open a new door for understanding this category of subjects.
**Table 1**

<table>
<thead>
<tr>
<th></th>
<th>BIF subjects</th>
<th>Normal controls</th>
<th>M-W Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TIB-min</strong></td>
<td>495.50</td>
<td>540.11</td>
<td>48.39</td>
<td>NS</td>
</tr>
<tr>
<td><strong>SPT-min</strong></td>
<td>461.00</td>
<td>509.88</td>
<td>45.32</td>
<td>NS</td>
</tr>
<tr>
<td><strong>TST-min</strong></td>
<td>387.41</td>
<td>496.67</td>
<td>45.51</td>
<td>0.010</td>
</tr>
<tr>
<td><strong>SOL-min</strong></td>
<td>15.33</td>
<td>24.08</td>
<td>14.17</td>
<td>NS</td>
</tr>
<tr>
<td><strong>FRL-min</strong></td>
<td>152.79</td>
<td>111.35</td>
<td>35.55</td>
<td>NS</td>
</tr>
<tr>
<td><strong>SS-h</strong></td>
<td>9.99</td>
<td>5.08</td>
<td>1.58</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>FRL-h</strong></td>
<td>4.09</td>
<td>0.50</td>
<td>0.55</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>SS-h</strong></td>
<td>78.11</td>
<td>92.08</td>
<td>5.30</td>
<td>NS</td>
</tr>
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<tr>
<td><strong>FRL-h</strong></td>
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<td>0.50</td>
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<tr>
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<tr>
<td><strong>SS-h</strong></td>
<td>78.11</td>
<td>92.08</td>
<td>5.30</td>
<td>NS</td>
</tr>
</tbody>
</table>

**TIB** time in bed; **SPT**, sleep period time; **TST**, total sleep time; **SOL**, sleep onset latency; **FRL**, first REM sleep latency; **SS**, stage shifts; **AWN**, awakenings; **SE**, sleep efficiency; **WASO**, wake time after sleep onset; **S1**, sleep stage 1; **S2**, sleep stage 2; **SWS**, slow-wave sleep; **REM**, rapid eye movement sleep. *Bonferroni-corrected value.

**Table 2**

<table>
<thead>
<tr>
<th></th>
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<th>Normal subjects</th>
<th>M-W Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CAP total number</strong></td>
<td>226.75</td>
<td>428.70</td>
<td>88.13</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>CAP Rate %</strong></td>
<td>30.37</td>
<td>37.24</td>
<td>6.87</td>
<td>NS</td>
</tr>
<tr>
<td><strong>CAP Rate %S1</strong></td>
<td>7.49</td>
<td>32.70</td>
<td>21.84</td>
<td>0.024</td>
</tr>
<tr>
<td><strong>CAP Rate %S2</strong></td>
<td>11.83</td>
<td>32.60</td>
<td>9.43</td>
<td>NS</td>
</tr>
<tr>
<td><strong>CAP Rate %SWS</strong></td>
<td>39.80</td>
<td>48.00</td>
<td>8.33</td>
<td>NS</td>
</tr>
<tr>
<td><strong>Total number A1%</strong></td>
<td>35.11</td>
<td>78.42</td>
<td>8.32</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Total number A2%</strong></td>
<td>48.46</td>
<td>12.25</td>
<td>6.86</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Total number A3%</strong></td>
<td>16.43</td>
<td>9.32</td>
<td>3.10</td>
<td>NS</td>
</tr>
<tr>
<td><strong>A1 mean duration, s</strong></td>
<td>13.85</td>
<td>4.76</td>
<td>0.33</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>A2 mean duration, s</strong></td>
<td>19.16</td>
<td>7.92</td>
<td>1.76</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>A3 mean duration, s</strong></td>
<td>15.37</td>
<td>15.45</td>
<td>4.90</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>A1 index, n/h</strong></td>
<td>11.96</td>
<td>46.30</td>
<td>10.59</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>A2 index, n/h</strong></td>
<td>10.23</td>
<td>8.09</td>
<td>6.02</td>
<td>NS</td>
</tr>
<tr>
<td><strong>A3 index, n/h</strong></td>
<td>5.19</td>
<td>3.16</td>
<td>3.16</td>
<td>NS</td>
</tr>
<tr>
<td><strong>B phase duration</strong></td>
<td>20.51</td>
<td>20.85</td>
<td>4.19</td>
<td>NS</td>
</tr>
<tr>
<td><strong>Cycle duration</strong></td>
<td>37.30</td>
<td>26.65</td>
<td>4.25</td>
<td>0.006</td>
</tr>
<tr>
<td><strong>Sequences duration</strong></td>
<td>232.7</td>
<td>193.4</td>
<td>43.41</td>
<td>NS</td>
</tr>
<tr>
<td><strong>No. of sequences</strong></td>
<td>25.08</td>
<td>44.82</td>
<td>9.90</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>A1/A3 total number</strong></td>
<td>3.19</td>
<td>9.73</td>
<td>4.58</td>
<td>0.0028</td>
</tr>
<tr>
<td><strong>A2/A3 total number</strong></td>
<td>4.20</td>
<td>3.75</td>
<td>1.38</td>
<td>0.68</td>
</tr>
</tbody>
</table>

**CAP** refers to Cyclic Alternating Pattern, **CAP rate** (percentage of total NREM sleep time occupied by CAP sequences), **percentage and duration of each A phase subtype; A1 index (number of phases A1 per hour of NREM sleep, and of S1, S2 and SWS sleep stage); A2 index (number of phases A2 per hour of NREM sleep, and of S1, S2 and SWS sleep stage); A3 index (number of phases A3 per hour of NREM sleep, and of S1, S2 and SWS sleep stage); duration of B phases; number and duration of CAP sequences. *Bonferroni-corrected value.

**Introduction.** Based on recent reports of the involvement of cyclic alternating pattern (CAP) in cognitive functioning in young adults (Ferri et al., 2008; Aricò et al., 2010), the aims of this study were: (a) to study the association between CAP and cognitive function in order to test the hypothesis that CAP rate during the night correlates with cognitive performance in children; (b) that CAP A1 subtypes are positively correlated with cognitive performance, and (c) that CAP A2 and A3 subtypes are negatively correlated with cognitive performance.

**Method.** 42 healthy, non-snoring children aged 3-12 years (mean age 7.5 y) underwent standard polysomnography and neurocognitive assessment. CAP analysis was performed following the criteria by Terzano et al. (2001), and correlations between CAP parameters and neurocognitive tasks scores were assessed.

**Results.** CAP rate % (in particular in slow wave sleep) and A1 appear to be consistently associated with fluid reasoning ability (important for general problem solving ability) while A3 is associated with reduced phonological awareness (important for language development).

**Conclusion.** These results confirm our initial hypothesis that CAP A1 is related to better cognitive functioning, whereas A3 is associated with worse cognitive functioning. This data supports the idea that slow oscillations on the EEG during sleep play an important role on cognitive processes.
IV. Insomnia in childhood and adolescence: treatment and prevention

025 THE DEMOGRAPHIC CHARACTERISTICS ASSOCIATED WITH CHILDHOOD SLEEP DURATION: A LONGITUDINAL ENGLISH COHORT

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1University of Bristol, School of Social & Community Medicine; 2Guy’s and St. Thomas’ NHS Foundation Trust; 3University of Birmingham, UK

Introduction. This investigation was designed to identify demographic characteristics associated with sleep duration throughout childhood in a large English cohort.

Methods. The ALSPAC (Avon Longitudinal Study of Parents and Children) birth cohort is an ongoing prospective investigation of over 14,000 children born in 1991-2 (84% of all eligible infants in the study area). Parental reports of sleep duration were collected at 8 time points from 6 months to 140 months. A series of linear regression models were constructed to measure multivariable associations.

Results. Despite going to bed at the same time girls slept consistently longer than boys by 5-10 minutes. Boys had slightly shorter day time sleeps but shorter total sleep duration for all but the last time-point. Maternal age was also important, independently of family size: children of younger mothers (<21 years) slept longer whilst children of older mothers (>35 years) slept less persistently throughout infancy and childhood. Children from low income families (using maternal education and paternal occupation as proxies) went to bed slightly later and woke up slightly later but there was little difference in total sleep duration. Neither was there much difference in those born pre-term or with low birthweight. Children in larger families, especially when older tended to go to bed later and hence had a shorter duration of sleep. Infants still breastfeeding at 6 months (29% of the cohort) slept around half an hour less (OR=0.63 [95% CI: 0.59-0.68]), though at 30 months had longer sleep duration. The cohort was predominantly white but the minority (<5%) non-white group (mainly Asian and Black ethnicity) slept less at night and more during the day although these differences diminished over time.

Conclusion. Sleep duration was influenced by different characteristics at different time-points but one of the strongest persistent influences appeared to be maternal age.

026 BEDTIME RESISTANCE IN A PEDIATRIC SLEEP CLINIC REFERRED POPULATION

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Introduction. Bedtime resistance affects 15% of 4-10 year-old children. A recent case series of 5 children reported an association between bedtime difficulties and Restless Legs Syndrome (RLS).

Objective. To further explore the association between bedtime resistance, symptoms of RLS (e.g., unexplained growing pains) and/or Periodic Limb Movements of Sleep (PLMS) (e.g., brief kicks while sleeping) in a large number of children referred to a pediatric sleep clinic.

Methods. Retrospective chart review of the Pediatric Sleep Questionnaire (PSQ) completed by parents of 3-17 year-old patients referred to the pediatric sleep clinic. The associations between bedtime resistance, RLS-PLMS subscale and individual RLS items were explored using chi-square tests within age groups: 3-6, 7-12, 13-17 years.

Results. Of 610 subjects with completed PSQs: 59% males; 73% Caucasian; n by age: 3-6 yr = 185, 7-12 yr = 273, 13-17 yr = 152. Bedtime resistance endorsed by age group: 3-6 yr: 40%; 7-12 yr: 36%; 13-17 yr: 33%. Among those who endorsed bedtime resistance, a significantly greater percentage endorsed elevated RLS-PLMS subscale scores compared to those who did not endorse bedtime resistance: 3-6 yr: 62% vs. 45%, X²=5.11, p=0.024; 7-12 yr: 65% vs. 47%, X²=8.08, p=0.004; 13-17 yr: 80% vs. 58%, X²=7.25, p=0.007. Individual PSQ items revealed 3-6 and 7-12 yr children with bedtime resistance endorsed both RLS and PLMS, whereas, 13-17 yr olds endorsed only RLS symptoms.

Conclusion. Bedtime resistance is significantly associated with RLS-PLMS symptoms across age groups suggesting that behavioral interventions may be unsuccessful without successful treatment of underlying RLS/PLMS symptoms.

027 PREVENTIVE EFFECTS OF A PARENT TIP SHEET ON INFANT SLEEP PATTERNS ACROSS THE FIRST 12 MONTHS: A PILOT STUDY

Henderson J1, France K2, Blampted, N3
1Department of Psychology, 2Health Sciences Centre, University of Canterbury, New Zealand

Introduction. Between 15 – 35% of infants and their parents are affected by infant sleep disturbance (ISD) in the first year of life. Management of ISD can be stressful for families and problem prevention is a better alternative. This study investigated the efficacy of a preventive intervention, consisting of a Parent Tip sheet on infants’ sleep pattern development over the first year of life, given to mothers immediately post-natally.

Methods. Primiparous mothers and their newborn infants were randomly assigned to an intervention (Tip sheet) group (n = 21), or a control group (n=30). Mothers completed diaries for 4 days at ages 1 t06, 9, and 12 months. A Sleep Behaviour Score (SBS, Richman, 1981) was computed from each diary. Reliability of parent report was assessed using videosomnography.

Results. A clinically significant difference was found between the control and intervention groups at the 9 (mean SBS 6.39 vs. 4.21) and 12 month (mean SBS 5.35 vs. 2.72) periods. The 12 month SBS difference was also statistically significant (p = .02).

Conclusion. The findings suggest a low level preventive intervention improves infants’ sleep evident towards the end of the first year. Both groups’ SBS scores were comparable and followed a normative development trend through until 5 months, when the majority of infants who are going to sleep through night will be doing so. By 9 months the control group’s mean SBS scores indicated a disturbed sleep pattern (in the SBS clinical range) that was maintained at 12 months, this trend in persistence of ISD is supported by previous research.
028

THE COMPLAINT OF DIMS IN INFANTS PLAYS A SECONDARY ROLE IN THE WELLBEING AND PARENTAL CONCEPT OF THE COMPLAINING MOTHERS

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Introduction. Mothers who complain that their infants have difficulties in initiating and maintaining sleep (DIMS) often report that their infant shows externalization behavior problems (EBP), especially in areas of irritability and opposition (Hiscock, 2007; they report also stress, exhaustion and negative mood (Meltzer, Mindell, 2007). It is unclear in which ways the mothers’ wellbeing and parental self concept are related to the infants’ DIMS and EBP.

Method. A non clinical sample of 125 mothers of infants aged 3-39 months (Mean=20.2; SD=10.2) completed scales on their infant’s wellbeing (Fekkes et al. 2000) and sleep (Bruni et al 2001), as well as scales on their own sleep (QDS, Violani et al 2004), vital exhaustion (Appels e Mulder 1988), emotional self efficacy and parental self concept.

Results. 36.5% of the mothers report that their infant had relevant DIMS. Insomnia of the mother and infant DIMS are associated (χ2 = 18.1; p < 0.01). The infants’ DIMS and EBP scores are correlated (r = .40; both are associated to exhaustion and to a poor parental self concept. Hierarchical regressions show that the mother’s VE is predicted by a low emotional self efficacy (β = -.39; p<.001) and by her insomnia (β = .24; p<.001); when entered in the regression the infant’s EBP contributes to VE (β = -.31; p<.001) but non the DIMS (β = .04). A poor parental self-concept is predicted by the mothers’ VE (β = .31; p<.05) and thereafter by the infants’ EBP (β = .26; p<.001).

Conclusions. Infants’ sleep and behavioral problems reported by the mothers are correlated, but only the latter give an independent contribution in explaining their vital exhaustion and poor parental self concept. These findings are consistent with other research but need to be assessed in further studies.

029

EFFICACY OF AN INTERNET-BASED INTERVENTION FOR INFANT AND TODDLER SLEEP DISTURBANCES

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Introduction. Although behaviorally-based interventions are highly efficacious for sleep problems in young children, most existing interventions require personal contact with a trained professional, and many children remain untreated. The use of an internet-based intervention would provide widespread access. Thus, the purpose of this study was to examine the efficacy of an internet-based intervention for infant and toddler sleep disturbances, as well as any indirect benefits to maternal sleep, mood, and confidence.

Methods. 264 mothers and their children (6-36 months; mean = 19.4 months; 50.2% males) participated in a 3-week study. Families were randomly assigned to either a control or one of two intervention groups. The first week of the study served as a baseline. Mothers in intervention group 1 then completed an online intervention (Customized Sleep Profile, CSP) in which customized behavioral recommendations (e.g., have child fall asleep independently) were provided, while intervention group 2 completed the online intervention (CSP) and were instructed to conduct a specific bedtime routine (bath, lotion, and quiet activities). The control group continued their usual sleep practices. Mothers completed the Brief Infant Sleep Questionnaire (BISQ), the Pittsburgh Sleep Quality Index (PSQI), and the Profile of Moods Scale (POMS) on a weekly basis.

Results. Both internet-based interventions resulted in significant reductions in problematic sleep behaviors. Significant improvements were seen in latency to sleep onset and in number/duration of night wakings, p<.001. Sleep continuity increased as well as mothers’ confidence in managing their child’s sleep. Improvements were seen by one week, with additional benefits by week two. Maternal sleep and mood were also significantly improved.

Conclusions. These results suggest that an online intervention for infant and toddler sleep disturbances is beneficial in improving multiple aspects of young children's sleep, as well as maternal sleep and mood.
confounders including child sex, mother’s education and socioeconomic status.

**Results.** Sixty-nine percent (225/326) of the original sample provided 6 year data, with equal attrition across groups. All outcomes [mean (SD)] were similar for intervention and control groups (Table).

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<thead>
<tr>
<th></th>
<th>Interv’n</th>
<th>Control</th>
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<tr>
<td>Emotional</td>
<td>1.8 (2.0)</td>
<td>1.8 (2.0)</td>
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<tr>
<td>Conduct</td>
<td>1.8 (1.8)</td>
<td>1.8 (1.8)</td>
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<tr>
<td>Psychosocial</td>
<td>78.9 (12.0)</td>
<td>78.3 (13.9)</td>
<td>0.7</td>
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<tr>
<td>Cortisol</td>
<td>5.6 (8.0)</td>
<td>4.9 (10.6)</td>
<td>1.0</td>
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<tr>
<td>Closeness</td>
<td>4.3 (0.2)</td>
<td>4.3 (0.3)</td>
<td>0.4</td>
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<tr>
<td>Conflict</td>
<td>2.3 (0.8)</td>
<td>2.2 (0.8)</td>
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<tr>
<td>Sleep prob</td>
<td>42.2 (6.1)</td>
<td>42.7 (8.1)</td>
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<td>Mat Depres</td>
<td>4.8 (4.9)</td>
<td>4.7 (5.9)</td>
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**Conclusions.** Behavioural sleep techniques had no adverse outcomes at child age 6. As they are highly cost-effective in reducing sleep problems and maternal depression in the short-to-medium term, health professionals should feel comfortable offering these strategies to families presenting with infant sleep problems.

### 031 SLEEP HABITS AND INSOMNIA SYMPTOMS IN COLLEGE STUDENTS

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**Introduction.** Sleep problems are believed to be prevalent in college students and can interfere with functioning. Few studies, however have examined sleep habits, including insomnia symptoms, in this population. Thus, the purpose of this study was to ascertain typical sleep habits and the prevalence of insomnia symptoms in university students.

**Methods.** A survey was administered to 245 undergraduate students (71 males and 173 females) at a small university. 86.10% of participants were Caucasian, 61.0% were African American, and 7.80% were other.

**Results.** On weekdays, participants slept an average of 6.60 hours (SD=1.28), and on weekends 7.90 hours (SD=1.50). The average weekday bedtime was 12:39 A.M and the average wake time was 8:10 A.M. On weekends, the average bedtime was 2:31 A.M and the average wake time was 10:56 A.M. Alcohol consumption was associated with bedtimes, wake times, night wakings, sleep latency, being late or missing class, and GPA (r=-.14 to .47, p<.05). GPA was also significantly correlated with bedtimes, wake times, being late or missing class, and all nighters (r=.15 to .27, p<.05). Insomnia symptoms were common with 93% of students feeling physically tired, 69.8% having trouble falling asleep, 58.5% falling asleep easily during the day, 52.6% waking frequently during the night, 39.2% waking up in the night and finding it hard to get back to sleep.

**Conclusions.** Students were sleep deprived by 1.40 hours on weekdays (compared to the recommended 8 hours). Additionally, sleep patterns and sleep hygiene were linked to GPA and alcohol consumption. College students also have high rates of insomnia symptoms. Given the relationship between sleep, daytime functioning, and health, sleep interventions that target college students should be developed.

### 032 CLINICAL SIGNIFICANCE OF SALIVARY DIM LIGHT MELATONIN ONSET (DLMO) MEASUREMENTS IN CHILDREN WITH IDIOPATHIC CHRONIC SLEEP ONSET INSOMNIA

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**Introduction.** Dim Light Melatonin Onset (DLMO) is the most reliable characteristic to diagnose circadian rhythm sleep-wake disorders. Idiopathic sleep onset insomnia in children including children with ADHD is usually associated with late DLMO. Melatonin treatment is remarkably effective if it is administered before individual DLMO. Consequently DLMO is crucial both for diagnosis and treatment of children with circadian rhythm sleep-wake disorders. If DLMO is really crucial for diagnosis and treatment of children with idiopathic sleep onset insomnia and DLMO, the treatment success rate should be remarkably high in sleep centers, where DLMO is measured routinely. In our sleep centre we routinely measure DLMO in saliva, in all patients suspected of circadian rhythm sleep disorders, using the Buhlman sleepcheck. To establish the clinical value of DLMO measurements, we studied the treatment success rate in children with insomnia and late DLMO.

**Methods.** Parents of children, treated with melatonin, complete a questionnaire measuring treatment effects and possible adverse events at internet the day before they see the sleep doctor the first time after starting melatonin treatment, administered 2-3 hours before individual DLMO.

**Results.** Parents of 200 children aged 6-12 years completed the questionnaire. 91 % were satisfied or very satisfied with the treatment effect, 6 % unsatisfied or very unsatisfied and 2 % neutral. 80 % indicated that sleep onset advanced more that 1 hour and 12 % indicated that sleep onset advanced between 30 and 60 minutes.

**Conclusion:** Measuring DLMO for diagnosis and treatment of children with idiopathic sleep onset insomnia results in remarkably high treatment success rate of childhood insomnia.

### 033 DO WE NEED MORE TRAINING ABOUT SLEEP HABITS IN CHILDREN?

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**Introduction.** Despite advancements within the Sleep Medicine field, sleep knowledge amongst other medical specialties remains limited. Since primary care physicians may initially identify sleep problems for work-up, we examined basic knowledge of pediatric sleep requirements in medical professionals at an academic medical center.

**Methods.** Anonymously-obtained answers to ten sleep-related questions were obtained from Grand Rounds attendees. Respondents were asked to complete the survey quickly and without assistance from others. Data were analyzed by count and percentage.
Results. Of 66 surveys collected, 11 were attending physicians, 16 residents, 32 medical students, and 7 other medical personnel. About snoring, 8 had no clue and 6 said it was normal. About sleep needs in newborns, 11 medical students and 2 attending physicians answered less than 12hr, 4 had no clue. About sleep needs in 2y/o children, 20 answered less than 10hr, 42 more than 10hr, 3 had no clue. Regarding sleep needs in 5y/o children, 30 answered less than 10hr, 33 more than 10hr, 4 had no clue. About sleep in 15y/o adolescents, 45 answered less than 10hr, 17 more than 10hr, and 3 had no clue. More variability appeared in answers regarding naps. Nap requirements in a 3y/o: Eleven medical students answered 1 nap, eleven 2 naps, seven 3, 1 no naps and 2 had no clue. About naps in 12y/o, 35 answered no nap, 21 one nap, 3 two naps, 1 three naps and 6 had no clue. Conclusion. In a medical school with comparatively more sleep medicine curriculum, knowledge deficits regarding pediatric sleep requirements amongst medical professionals is still evident. There appears to be specific need for standardization and targeted education in medical students and residents of all specialties, regarding snoring, total sleep requirements and naps in children.
V. Evaluation and treatment of Pediatric Sleep Disordered Breathing

034 THE AASM SCORING CRITERIA UNDERSCORE PEDIATRIC SLEEP DISORDERED BREATHING
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Differences in the criteria defining hypopnea have lead to great variability in the AHI and subsequently affected clinical interpretation of disease severity and treatment plan for individual patients. This study aimed to compare the PSG scoring results by Stanford System and by the AASM pediatric scoring rules. The major difference between Stanford Scoring System and AASM could be found in the definition of Hypopnea, which was scored independently from 3 or 4% oxygen desaturation or 3 seconds EEEG arousal. Children had pediatric evaluations, Pediatric Sleep Questionnaire medical, surgical, familial, sleep/wake and sleep medicine histories and review of systems. Patients underwent a systemic airway examination using subjective scales. Clinical impression SDB was made with agreement among two or more physicians. Children underwent polysomnography with: EEG, EOG chin and leg EMG, ECG nasal-cannula-pressure-transducer system and oral thermister, chest and abdominal Respiratory-Induced-Plethysmography effort belts, and intercostal EMG, finger pulse oximetry with photo-plethysmography-sensor, body position, and neck microphone, and biological calibrations before sleep onset. Scoring was performed by 2 technologists and again by one individual blind to the clinical status of subjects. Surgical treatment or and rapid maxillary expansion aimed to specific anatomic problems. CPAP post-treatment PSG study after surgery. Overal RDI was significantly titration. Another 44 patients returned for follow-up PSG During the study period, 45 patients completed PAP treated. On the other hand, by Stanford RDI, treatment there would be only 39 (18.7%) of patients need to be classified as having OSA. Nasal resistance [kPa*s/l] measured by ARM was 0.33 (0.15 – 0.83) in children without OSA, and 0.34 (0.14 – 0.81) in those with OSA (AUC: 0.513). The same figure for AR was 0.83 (0.36 – 21.40), and 2.28 (0.67 – 10.61), respectively (AUC: 0.748).

Conclusion. There may be a relationship between nasal resistance measured by a modified spirometric technique and the AHI on PSG, which could be used to diagnose OSA in children. However, diagnostic test accuracy may not be satisfactory, which hampers further clinical use.

035 USEFULNESS OF NASAL RESISTANCE MEASUREMENTS FOR DIAGNOSING OBSTRUCTIVE SLEEP APNEA IN CHILDREN
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Introduction. The gold standard for diagnosing obstructive sleep apnoea (OSA) is polysomnography (PSG), an expensive and time consuming assessment. In one study, nasal resistance was predictive for OSA in children. We aimed to identify the most predictive technique of measuring nasal resistance for diagnosing OSA in children.

Methods. Habitually snoring children aged 6-16 years were enrolled into a study on diagnostic test accuracy. Measurements of nasal resistance were performed using anterior rhinomanometry (ARM) and a modified spirometric technique, which determined the difference between nasal and oral resistance (∆R). PSG was performed and apnoea-hypopnoea index (AHI) determined. Spearman’s coefficient (r_s) was calculated for the correlation between measurements of nasal resistance and AHI. Measures of nasal resistance were compared between children with and without OSA using descriptive statistics, receiver operating characteristic curves, and area under the curve (AUC).

Results. Fifty patients were enrolled (28 males; median age 9.7 years). There was a weak correlation between ARM and AHI (r_s=0.15) and a moderate correlation between ∆R and AHI (r_s=0.36). Twelve patients were classified as having OSA. Nasal resistance [kPa*s/l] measured by ARM was 0.33 (0.15 – 0.83) in children without OSA, and 0.34 (0.14 – 0.81) in those with OSA (AUC: 0.513). The same figure for ∆R was 0.83 (0.36 – 21.40), and 2.28 (0.67 – 10.61), respectively (AUC: 0.748).

Conclusion. There may be a relationship between nasal resistance measured by a modified spirometric technique and the AHI on PSG, which could be used to diagnose OSA in children. However, diagnostic test accuracy may not be satisfactory, which hampers further clinical use.

036 CEPHALOMETRIC AND HOME SLEEP STUDY (HSS) EVALUATION OF PATIENTS WITH MANDIBULAR RETROGNATHIA
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1University of Ankara, School of Dentistry, Department of Orthodontics, 2Orthodontist, Private Practice, Mersin, Turkey, 3University of Ankara, School of Dentistry, Department of Orthodontics, University of Gazi, Faculty of Medicine, Department of Pulmonary Diseases, Turkey

Introduction. Mandibular retrognathia and accompanying retruded tongue position may cause upper airway obstruction in the growing patients. Therefore, the aim of this study was to evaluate and compare the cephalometric airway dimensions and areas of subjects who were snoring and had mandibular retrognathia, with a control group. The results of the home sleep studies (HSS) of the retrognathic patients were also evaluated.

Methods. Mandibular retrognathia patients, whose snoring have been determined by Brouillette questionnaire, were included in the study. All patients were consulted with an ENT specialist and 40 individuals without a respiratory problem (adenoidectomy and/or tonsillectomy) were included. At that point, HSS was applied to all patients. Control group was consisted of 17 individuals who didn’t have any respiratory disorders. Both groups were compared statistically as per their radiographic effects on airway dimensions and areas. The interaction between HSS results and cephalometric evaluation was also compared statistically for the mandibular retrognathia group.

Results. Patients who have mandibular retrognathia have (when compared with the control group): narrow posterior airway space (PAS), higher hyoid position (MP-H; p<0.05) and AHI>1. When radiographic and
HSS results were correlated, AHI had correlation both with PAS and MP-H (p<0.01). Moreover, BMI had correlation both with AHI and MP-H (p<0.01).

Conclusion. Mandibular retrogнатia patients, especially who were snoring should be examined for their Sleep Disordered Breathing (SDB), cephalometric PAS and MP-H measurements at orthodontics clinics. If needed, they should be referred to a specialists such as ENT, pediatrician or sleep specialist.

037 CRANIOFACIAL ARCHITECTURE IN A GROUP OF CHILDREN WITH SLEEP-RELATED BREATHING DISORDERS
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Introduction. The skeletal craniofacial morphology is the functional reflection of nearby structures and functional conditions to which it is subjected. Obstruction of the upper airway is common in children and is a cause of sleep-related breathing disorders. Some studies suggest that altered respiratory patterns induce changes in craniofacial architecture. The aim of this study is to compare the craniofacial anatomy between children with sleep-related breathing disorders and healthy children.

Methods. 63 patients were selected as study group. Their ages were between 5 and 12 years old. They were diagnosed with sleep-related breathing disorders based on an ENT review and the Pediatric Sleep Questionnaire survey. The control group included 33 healthy children of the same age range. They were selected based on their history and the results of the same survey. Each child underwent an architectural and structural analysis drawn over a cephalometric radiograph and the results were compared.

Results. The study group showed a protrusion of the upper half of the face and a greater height of the cranial vault compared to the control group.

Conclusion. The children studied showed changes in their craniofacial skull base architecture presenting morphological characteristics that suggest a genetic factor. This, coupled with adverse environmental factors, can determine a morphology that stabilizes identified obstructive disorders.

038 CHILDREN WITH CLEFT LIP AND/OR PALATE HAVE SMALLER TONSILS AND MORE CENTRAL APNOEAS THAN NON-CLEFT CHILDREN WITH SLEEP COMPLAINTS
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Introduction. Children with cleft lip and/or palate are known to have a higher risk of sleep disordered breathing (SDB) but whether the presenting features and severity of OSA is similar to non-cleft children is unknown. The aim of this study was to compare the presentation and polysomnography results between children presenting for sleep assessment in cleft clinic and children presenting to a general sleep clinic.

Methods. Clinic charts and polysomnography were reviewed for all children presenting for sleep complaints to cleft clinic and all children presenting to a general sleep clinic for the same 2 year period. Children under 6 months of age were excluded.

Results. Clinical reviews were available for 56 with cleft and 113 non-cleft children. Age at review was similar (6.6±4.1 vs 6.8±4.0 years) as was sex distribution (64.6% vs 58.4%) and the percentage of children with syndromes or significant medical conditions (12% vs 16%). Snoring was the reason for referral in 59% of children with cleft and 69% of non-cleft children (p=ns). A history of OSA was more common in children with cleft (107%) compared to non-cleft (3.5%) though this result did not reach statistical significance (Chi-square 3.5, p=0.063). The only presenting feature that differentiated children with cleft from non-cleft children was a lower incidence of tonsillar enlargement (33% vs 79%, Chi-square 30.4, p<0.001). Polysomnography showed similar sleep efficiency (86±9% vs 80±13%), arousal index (10.0±5.4 vs 9.8±4.5 events/h) and apnoea-hypopnea index (6.2±6.9 vs 7.9±7.1 events/hr) but a higher number of central apnoea in children with cleft (1.5±1.5 vs 1.0±1.0 events/hr, p=0.017).

Conclusions. Clinicians should consider SDB in children with cleft and typical symptoms regardless of tonsillar size. Children with cleft have similar severity of SDB compared to non-cleft children but a higher number of central apnoeas which may indicate differences in ventilatory control.

039 IMPACT OF NONINVASIVE NOCTURNAL RESPIRATORY SUPPORT AND WEIGHT LOSS ON METABOLIC PARAMETERS OF OBSESE CHILDREN WITH OBSTRUCTIVE SLEEP APNEA
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Introduction. Both obstructive sleep apnea (OSA) and obesity contribute to insulin resistance. In adults, both weight reduction and treatment of OSA with positive airway pressure (PAP) improve insulin resistance. The impact of weight loss and OSA treatment on metabolic parameters in children has not been well studied. There are no studies evaluating the impact of PAP treatment on insulin resistance in children.

Methods. A retrospective cohort study of seven children age 11-18 years, with obesity (BMI > 95th %ile) and moderate-severe OSA diagnosed on polysomnogram (AHI > 10 events/hr), who were prescribed PAP therapy was undertaken. Four were admitted to hospital for weight management with a protein sparing diet and exercise program, as well as monitored OSA treatment with PAP. The three children not admitted to hospital were non-compliant with diet and PAP therapies. All children had BMI, fasting glucose and insulin measurements at baseline (the time of admission in those admitted) and approximately one year later. Homeostasis model of insulin resistance (HOMA-IR), the primary
outcome, was calculated and compared at baseline and one year. **Results.** All individuals admitted to hospital for intensive weight management and OSA treatment had a decrease in HOMA-IR (mean, SD -5.1 ± 2.18), fasting glucose (-0.53, 0.25) and BMI (-10.75, 3.86). These parameters were unchanged in those not admitted to hospital. Differences in the change over one year in these parameters between the two groups approached statistical significance ($p=0.057, 0.629$ and 0.057 respectively). **Conclusion:** A combined approach of intensive weight management and PAP therapy improved insulin resistance and BMI in children with concurrent OSA and obesity, compared to untreated children, in this pilot study. A larger study is needed to confirm these preliminary observations and the relative contributions of OSA treatment with PAP and weight loss to this outcome remain to be determined.

**040 SUCCESSFUL USE OF AUTO-CPAP FOR HOME TITRATION IN CHILDREN**

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**Introduction.** Access to pediatric nocturnal polysomnography (NPSG) is limited. Alternative strategies to supplement this limited resource must be investigated for children requiring positive airway pressure therapy. The aim of this study was to compare the results of home auto-continuous positive airway pressure (CPAP) titration to single night in-laboratory titrations.

**Methods.** All children who had undergone a home auto-CPAP study for pressure determination were identified. Clinic and sleep laboratory records were reviewed to extract baseline characteristics, diagnostic NPSG, in-laboratory pressure determination, auto-CPAP titration, as well as complications and adverse events.

**Results.** Twenty-two children with a mean age of 12.1±4.5 years were identified. All children had obstructive sleep apnoea (OSA) and 41% had previously undergone adenotonsillectomy and/or tonsillectomy. The minority of children had uncomplicated OSA (32%) and 32% were obese. Additional diagnosis included congenital myopathy, Duchenne muscular dystrophy, fetal alcohol syndrome, Pierre Robin syndrome, Tourette syndrome and epilepsy. Apnea-hypopnea index (AHI) on diagnostic PSG was 9.4±8.0 events/h with a REM AHI of 21.5±28.3 events/h and a minimum oxygen saturation of 84.6±7.4%. CPAP pressure on in-laboratory titration ranged from 3-17 cmH₂O with an optimal pressure of 10.0±2.6 cmH₂O with a range of 6-15 cmH₂O. Machine types for auto-CPAP were determined by the family’s choice of supplier. Auto-CPAP trials were completed over 20.3±21.6 days (range 4-83 days) with an average nightly use of 8.1±2.7h. Pressures range from 4-20 cmH₂O with an mean pressure of 7.7±2.6 cmH₂O (range of 4-12 cmH₂O) and peak average of 8.8±3.2 cmH₂O (range 4-15 cmH₂O). No complications or adverse events were reported. All children were prescribed single pressure after auto-CPAP titration.

**Conclusions.** Auto-CPAP was well tolerated and resulted in similar pressure to in-laboratory titration. Advantages include the ability to access tolerance and efficacy data over multiple nights as well as home use. Auto-CPAP should be investigated further as an alternative to in-laboratory CPAP titration.

**041 COMPLICATIONS AND FAILURE RATE OF SURGICAL TREATMENT FOR OBSTRUCTIVE SLEEP APNEA SYNDROME IN YOUNG INFANTS**

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**Introduction.** Little is known about the outcome of adenotonsillectomy (TA) and adenoidectomy (ADE) in young infants with obstructive sleep apnea syndrome (OSAS). We have previously shown (Slovik Y et al., Int J Pediatr Otorhinolaryngol. 2002;67:847-51) a relatively low incidence of peri- and postoperative respiratory complications in children younger than 2 years of age who undergo TA for OSAS.

**Purpose:** To measure the prevalence of adverse events and the failure rate of operative OSAS treatment in infancy.

**Methods.** Retrospective analysis of sleep questionnaires and polysomnographic (PSG) data of infants ≤ 1 year of age with OSAS. Retrospective analysis of the medical charts from the pediatric ward and a computerized search of the HMO files in order to explore late complications and need for repeated interventions.

**Results.** 66 infants with PSG diagnosis of OSAS (mean age at test 9.1 ± 2.6 months) underwent ADE or TA (mean age at operation 13.2 ± 3.3 months). Mean apneahypopnea index (AHI) was 18.9±16.34 events/hour (range 3.5-99.8). 36 infants (54%) underwent ADE, and 30 (45%) TA. The mean hospital stay was 2.07±1.12 (range 1-7) days. The following complications were reported: fever-13 infants (19.7%); pulmonary edema-2 infants (3%) one of them was admitted to the pediatric intensive care unit; stridor-1 infant (1.5%); hypoxemia-1 infant (1.5%); post tonsillectomy bleeding-2 infants (6.6%) Both required only conservative care. 10 infants (15%) were treated with antibiotics and 5 infants (7.5%) were treated with parenteral fluids. Ten infants were operated again: 5 of those who underwent ADE (needed TA), and 2 needed re-ADE following TA. The average age at the second operation was 23.7±7.94 months and the average lag between the operations was 11.6±7.34 months. One infant was operated three times.

**Conclusions.** The adverse events and the failure rate of operative OSAS treatment in young infants in our center are comparable to older age groups. Adenoidectomy is a reasonable choice at this young age, when carefully chosen.

**042 PARASOMNIA DURING NREM SLEEP AND CENTRAL SLEEP APNEA SECONDARY TO CHIARI I MALFORMATION TREATED SUCCESSFULLY WITH SURGERY**

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We herein report the case of a 14 year-old male who developed parasomnias in the preschool age, but did not
resolve and in fact the frequency of his sleep disturbances increased by early adolescence. Episodes typically developed during the first 45-90 minutes of sleep during which he was incoherent, non-responsive, and seemed confused and anxious. There were no symptoms of aggressive behavior, restless legs syndrome, snoring or witnessed apneas but he had excessive daytime tiredness and sleepiness. Benign parasomnias in childhood can usually be diagnosed based upon clinical findings. Most cases tend to resolve by adolescence. Due to the atypical disease trajectory and other symptoms, he underwent comprehensive sleep evaluation. Polysomnography revealed central sleep apnea. All behavioral episodes arose out of slow wave sleep. Cranial MRI uncovered an unanticipated Chiari type I malformation with a cervical spinal cord syrinx. Decompression surgery led to resolution of the parasomnia, improvement of sleep disordered breathing and reversal of other symptoms including vocal cord dysfunction. Protrusion of ‘cone-shaped projections’ of the cerebellum through the foramen magnum and into the spinal canal of children and adolescents was initially described by Hans Chiari in 1891. Clinical manifestations can generally be linked with alterations of cerebrospinal fluid dynamics such as increased intracranial pressure or with brainstem dysfunction leading to specific neurologic deficits particularly involving the lower cranial nerves. Consequently, the presenting symptoms can be broad and confusing. Our case underscores the importance of polysomnographic evaluation of patients with a parasomnia particularly when the symptoms do not follow the expected natural history of resolution with age. This case also illustrates the importance of considering an underlying neurologic disorder such as Chiari malformation when there are multiple confusing symptoms possibly associated with brainstem dysfunction such as sleep apnea for which typical risk factors may not be obvious.
I. Newborns

043
SUDDEN INFANT DEATH SYNDROME: EPIDEMIOLOGY IN SOUTHERN ITALY
Tedeschi G, Rana M, Tranchino V, Alabrese C, Semeraro L, Brunetti L
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Introduction. Sudden Infant Death Syndrome (SIDS) is the most common cause of death during the first year of postnatal life, with a peak incidence between 2-4 months of age. Its precise etiology and pathogenesis remain unknown. The aim of this study was to determine the SIDS mortality rate in Puglia, a region of the Southern part of Italy, and to compare our findings to the national average death rate data collected in a period ranging from 1998 to 2001.

Methods. We sought information about unexpected death of children under one year of age and putative risk factors for SIDS in Puglia from archives of the National Institute of Statistics, hospital dismissing and autopsy reports.

Results. We found 442 deaths (215 females, 227 males) in children whose age ranged from 2 weeks and 1 year. The slot has been further restricted to 111 cases, by ruling out from our analysis all the deaths due to well known causes. The SIDS average yearly rate in Puglia was 0.27 cases out of 1.000 infants, very close to the overall national SIDS death rate.

Conclusions. The difference is significant, which suggests a lower incidence of SIDS in Puglia compared to the national average.

045
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Introduction. Neonatal Individulised Development Care and Assessment Program (NIDCAP) aims to improve the hospital care of preterm infants hospitalized in an intensive care (NICU).

Methods. We compared sleep development of preterm infants (NICU). We compared sleep development of preterm infants (GA <31wks, birthweight <1500g) during their first year of life in relation to the neonatal care received: NIDCAP versus classic care. Forty-three children born between 1999 and 2003 participated in this study. Twenty children who benefit from NIDCAP care at St. Pierre Hospital, Brussels, were compared to 23
children from the NICU of Brussels Children’s Hospital where classical neonatal care was applied. The infant were select on the basis of their visits to the Children’s Hospital Sleep Unit. Only children with more than one polysomnography were select to participate in the study. These children were then matched for sex, gestational age and birthweight with children who also had more than one polysomnography and who had sojourned at the NIDCAP unit in St. Pierre’s Hospital.

**Results.** Adjusted for post-conceptional age, NIDCAP treatment was associated with decrease AS density (p=0.009), increase QS density (p<0.001), decrease % AS and increase QS% (p<0.001), decrease arousal index (0.003) and decrease sleep stage shifts (p=0.011). These differences decreased with post-conceptional age. NIDCAP was associated with earlier cross-over of AS/QS%.

**Conclusion.** The treatment of extremely premature infants hospitalized in a NICU intensive care unit by NIDCAP promotes less disturbed sleep and favors a normal maturation of sleep.

**046 EVALUATION OF A NEW VIDEO MONITORING SYSTEM FOR AUTOMATIC DETECTION OF INFANT’S SLEEP/AWAKE STATUS IN THE HOME Eto H, Horiuchi S St. Luke’s College of Nursing, Tokyo, Japan**

**Introduction.** For young infants, it would be optimal to use a non-intrusive tool to observe infants’ body and extremity movement for detecting sleep-wake states. We developed a home-monitoring system of recording and analyzing infant movement using image processing during nocturnal co-sleep. In this study, we examined whether this system was robust for recording and detecting three infant states: quiet sleep, active sleep and awake.

**Methods.** The equipment for the video monitoring system was: (1) digital camera (Watec WAF-902B, S/N = E1A W82E 22812); (2) Vari-zoom-lenses (Fujinon DV5x33.6R4B-2); (3) near infrared LED (Light Emitting Diode); (4) Image Recording Tool (NoruPro Light Systems. 640×480 Pixel, 10fps, monochrome), which included a computer to record infant’s state, and (5) Video Analysis Viewer (NoruPro Light Systems.) for automatic analyses. Digital video picture trends were produced at one-minute intervals to detect image differences. We used this data to establish the interrater-reliability of detecting infant sleep-wake states between the video monitoring system and the observation and scoring by a trained and experienced researcher.

**Results.** It was possible to record stable images even in the dark nighttime situation using near infrared LED. Changes in light quality did not influence the image differences. The ranges of interrater agreements of each infant’s state over two nights were: quiet sleep (0.69-0.81) active sleep (0.55-0.62) and awake (0.50-0.92).

**Conclusion.** This newly developed video monitoring system shows great promise as a robust system able to automatically detect infant-sleep wake state.

**047 FEWER SPONTANEOUS AROUSALS IN INFANTS WITH APPARENT LIFE THREATENING EVENT**

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**Objectives.** A deficit in arousal process has been implicated as a mechanism of Sudden Infant Death Syndrome (SIDS). Compared with control infants, SIDS victims showed significantly more subcortical activations and fewer cortical arousals than matched control infants. Apparent life threatening event (ALTE) is often considered as an aborted SIDS event. The aim of this study was to study the arousal characteristics of ALTE infants during the first months of life.

**Methods.** 35 ALTE infants were studied with nighttime polysomnography at 2-3, 5-6 and 8-9 months of age. 18 of the infants had mothers who smoked. The infants were born full-term and were usually supine sleepers. Sleep-state and cardiorespiratory parameters were scored according to recommended criteria. Arousal were differentiated into subcortical activations or cortical arousals, according to the presence of autonomic and/or electroencephalographic changes. The results were compared with those of 19 healthy infants with non-smoking mothers.

**Results.** During NREM sleep, the ALTE infants had fewer total arousals, cortical arousals and subcortical activations at 2-3 and 5-6 months (p < 0.001) than control infants. ALTE infants with smoking mothers had more obstructive apnea (p = 0.009) and more subcortical activations during REM sleep at 2-3 months of age (p < 0.001) than ALTE infants with non-smoking mothers.

**Conclusions.** Spontaneous arousals were differently altered in ALTE infants than in SIDS infants, suggesting an entity different from SIDS. ALTE infants with smoking mothers had arousal and respiratory characteristics that were similar to future SIDS victims, suggesting some common abnormalities in brainstem dysfunction.

**048 THE INFLUENCE OF SHORT-TIME MASSAGE THERAPY ON REST-ACTIVITY CYCLE IN FULL-TERM NEWBORNS**

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**Introduction.** Circadian rhythm of rest-activity is one of the earliest expressed circadian rhythmicities in primates. Analysis of rest-activity patterns may therefore provide the earliest index of developing circadian rhythm in neonates. Several studies have shown pacifying and stress reducing effects of massage therapy in newborns. In the current study, we evaluated the influence of massage on the circadian rest-activity rhythms of full-term newborns.
to investigate the effect of short-time massage intervention on rest-activity cycle of full-term newborns.

**Methods.** Thirteen healthy full-term newborns were subjected to massage therapy for 15-min daily on 3 consecutive days. Rest-activity cycles were assessed by means of actigraphic recording in 3-day periods before and after massage intervention. For the analysis of the diurnal distribution of activity 24-hour actigraphic data were divided into six successive 4-hour intervals and day-night activity ratios were calculated from the absolute numbers of movements.

**Results.** After massage intervention a pronounced diurnal variation of activity, as expressed by significantly higher day-night activity ratio (2.09 ± 0.73 vs. 1.40 ± 0.53, p = 0.035; t-test) was observed. Values of the activity counts were significantly higher during the whole daytime period as compared to the pre-test values with the peak of activity being observed in the late afternoon as compared to the morning peak of activity before the intervention. Nocturnal effect of massage intervention was less pronounced with overall lower values of activity counts as compared to the period before the intervention, however the nadir of activity was observed in the same time interval between midnight and 4 a.m.

**Conclusions.** Our results indicate that a short-time protocol of massage therapy can influence newborns' rest-activity cycle by enhancing daytime alertness and possibly promoting better quality of their nocturnal sleep.

**049 TESTING FRANCE AND BLAMPIDIE'S (1999) DEVELOPMENTAL MODELS OF PATHWAYS TO INFANT SLEEP OUTCOMES IN THE FIRST YEAR OF LIFE**

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**Introduction.** The development of infant sleep patterns is influenced by the interaction of biological, environmental and behavioural factors on multiple levels. This study tested some central assumptions of France and Blampied’s (1999) first two explanatory models which describe the complexity of variables purported to control the development of sleep patterns over the first year life.

**Methods.** Participants were 75 (52 at 1 month) healthy and typically developing infants and their parents. Sleep diaries were completed for 6 days and nights each month over the first 12 months. Accuracy of parent report was objectively validated by videoonnomography.

**Results.** Discriminant Function Analysis indentified one infant (night awakening) and two parent variables (presence at sleep onset, state infant placed in cot) to predict sleep outcome at 6 months (when Infant sleep Disturbance is first defined). A repeated measures analysis demonstrated the same variables at 1 month to also predict membership to a sleep disturbed group of infants at 12 months of age.

**Conclusion.** The findings of the present study support and extend certain assumptions of France and Blampied’s (1999) first two explanatory models. At 1 month of age an infant’s high constitutional vulnerability characterized by frequent night awakenings, together with the interaction of overly simulating parent behaviours and lack of appropriate cues for sleep self-initiation (parental presence at initial sleep onset, placing infant into crib asleep) predicted membership at 6 months in either a self-regulated or non-self regulated sleep group. Further evidence of the role of these variables in sleep outcome was demonstrated again at 12 months.

**050 POLYSOMNOGRAPHIC FEATURES IN PATIENTS AFFECTED BY CONGENITAL CENTRAL HYPOVENTILATION SYNDROME (CCHS)**

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**Objectives.** CCHS is a rare neurocristopathy characterized by abnormal automatic ventilation control and absent response to hypocapnia and hypoxia. Early diagnosis and evaluation of the disease severity may help to define treatment strategies in order to optimize ventilation and improve outcome. The aim of the study is to analyze the sleep patterns in patients affected by CCHS and correlate these findings with disease severity, evolution and treatment.

**Methods.** The cohort included 9 patients (5 females and 4 males), age 1-17 years old, 4 with tracheostomy, and 5 on non-invasive ventilation (NIV). OPTILEX GX520 system was used for polysomnography; data were automatically analysed, revised and graphically elaborated by the neurologist and statistician, and compared with published data.

**Results.** In the 3 patients in the range of age from 1 to 5 years sleep macrostructures is preserved. In the 3 patients in the range of age from 6 to 12 years, with higher interindividual variability, abnormal values compared to healthy subjects matched for age were found. In 4 patients in the first and second range of age with preserved macrostructure, Arousal Index (AI) was calculated and correlated to the ongoing treatment. In patients with tracheostomy AI was increased and greater than in patients on NIV.

**Conclusions.** Matching the sleep macrostructure with normal sleep macrostructure for age we observed that, in absence of environmental influence and with a good clinical management, both with NIV and tracheostomy, sleep organization appear to be better preserved in younger patients. This observation needs to be confirmed by further study on larger cohort of case.

**051 NONLINEAR HEART RATE DYNAMICS AND HEART RATE VARIABILITY IN INFANTS WITH FUTURE SUDDEN DEATH**

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**Introduction.** We have previously reported that victims of SIDS have a decreased arousability during sleep with fewer cortical arousals and more frequent subcortical activations suggesting an incomplete arousal process. Prematurity or incompleteness of the autonomic nervous system may account for the pathogenesis of their decreased arousability. To examine this hypothesis, we
evaluated the heart rate variability and dynamics in future victims of sudden death of infants.

**Methods.** Fifteen infants died of SIDS some days or weeks after a night-time polysomnographic recording (PSG). The PSGs of these infants were compared with those of fifteen matched controls. Heart rate variability and nonlinear heart rate dynamics by detrended fluctuation analysis (DFA) during the whole night were analysed.

**Results.** Average recording length was 483.6 min in SIDS infants and 484.7 min in controls. No significant difference was observed between the SIDS infants and controls in mean normal-to-normal R-R (N-N) interval or standard deviation of all N-N intervals (SDDN). The SIDS infants, however, showed a greater root mean square of successive differences (RMSSD) of N-N intervals (43.1 ms vs. 22.7 ms, p<0.001) and a lower short-term (4-11 beats) scaling exponent (alpha 1) of DFA (0.7 vs. 1.1, p<0.001), while the long-term (>11 beats) scaling exponent (alpha 2) did not differ.

**Conclusion.** RMSSD reflects beat-to-beat heart rate regulations and DFA alpha 1 primarily reflects the influences of autonomic and respiratory interactions on heart rate dynamics. The increased RMSSD and decreased alpha 1 in SIDS infants may reflect their beat-to-beat heart rate instability caused by impaired autonomic neural regulations of the cardiorespiratory systems.

**052 EVALUATION OF NEONATAL SLEEP STATES VIA DAYTIME EEG STUDY OF SYMPTOMATIC INFANTS**

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**Introduction.** Neonatal sleep patterns consist of active (AS), quiet (QS) and transitional sleep (TS) states. There is typically an extremely short latency to AS in newborn infants, with AS considered to be a precursor of stage REM sleep. Characterization of AS in the daytime sleep of symptomatic neonates has not been well described.

**Methods.** We retrospectively reviewed 30 consecutive routine scalp daytime EEGs ordered by the neonatal ICU at our institution over the past year for suspected paroxysms or neurologic insults. Twenty-one-channel portable bedside XLTek EEGs were performed with EEG and EKG monitoring. We defined: QS as a discontinuous sleep pattern with stable cardiac rhythm, paucity of body and eye movements and mixed-frequency EEG pattern; AS as a continuous pattern of unstable cardiac rhythm, phasic eye movements, and mixed-frequency EEG pattern; and TS as a continuous pattern of mixed-frequency EEG, and a variable hybrid of elements from both AS and QS.

**Results.** Thirty EEGs were reviewed (19M,11F,corrected gestational age 35-44 weeks; average 40 weeks, EEG duration 30-110 minutes). Ninety percent of infants had suspected paroxysms, and 10% had documented hypoxic neurologic insult. Sixteen EEGs were abnormal (2 had electroclinical seizures, 10 had abnormal interictal epileptiform discharges, 3 had excessive discontinuity, and 4 had an undifferentiated sleep EEG pattern). While 86% and 73% of the studies demonstrated TS and QS states, respectively, AS was recorded in only 3%.

**Conclusion.** There was a conspicuous paucity of AS during these daytime EEG recordings of symptomatic infants, many of whom present with marked neurologic compromise. Potential contributing factors may be related to the presence of neurologic compromise, the diurnal influence of infant sleep patterns, and the relatively brief duration of these electroencephalographic studies. A comparative evaluation of these daytime sleep EEG findings with those from more prolonged overnight polysomnograms is suggested.
The sleep macrostructure in newborns: a twin study

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Introduction. Genetic underpinnings of sleep architecture in newborns are largely unknown. One of the first findings on the genetics of REM sleep in newborns was by Gould et al. at 1978. Here we report on the results of classical twin study in monoygotic (MZ) and dizygotic (DZ) pairs examine the sleep macrostructure during the first three months of life.

Methods. Polysomnographic recordings were obtained in Children’s Sleep Laboratory, University Hospital Split. 15 pairs of MZ and 15 pairs of DZ twins were included, all born prematurely, first recorded at the 37th (range 36–38) postmenstrual age (PMA), second at the 44th (range 44–45) PMA and third at 52th PMA. Visual analysis and spectral analyses were made for every PSG recording.

Results. Correlations of total sleep time (TST) between MZ pairs among three measures ranges from $r=0.09$ to $r=0.6$ whereas on DZ pairs from $r=-0.02$ to $r=0.37$. Sleep efficiency (SF) showed higher correlations between MZ pairs (0.02 to 0.5) then DZ pairs (-0.15 to -0.35). In active sleep (AS), MZ pairs showed similar correlations (-0.22 to 0.73) as in DZ pairs (0.04 to 0.74). There was no significant difference between correlations of MZ and DZ pairs (p<0.05) in quiet sleep (QS) time at the 52th PMA whereas on the 37th and 52th there was inconsistency. These preliminary study showed higher correlations between MZ pairs then DZ pairs only at sleep efficiency parameter and lots of inconsistency in other parameters of sleep macrostructure.

Conclusion. Our study indicates that visual sleep state scoring during first three months can reveal only limited information about sleep physiology of the newborns, and to obtain more detailed insight, spectral analyses of the EEG signal is needed.

056 DEVELOPMENT OF AUTONOMIC HEART RATE AND BLOOD PRESSURE CONTROL IN INFANTS Yiannoulou SR, Sands SA, Walker AM, Horne MW, Reinecke M
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Introduction. Assessment of beat-to-beat variations in blood pressure (BP) and heart rate (HR) provide an important tool for understanding autonomic cardiovascular control. Impaired autonomic control may be a consequence of preterm birth that plays a role in Sudden Infant Death Syndrome. However, to date there is limited information on the normal development of both BP variability (BPV) and HR variability (HRV) during sleep in infancy.

Aim. To assess the effects of postnatal age (PNA) on HRV and BPV during sleep within the first six months of life.

Method. Daytime polysomnography, including measurement of systolic BP was performed on 31 term infants at 2-4 weeks, 2-3 months and 5-6 months PNA during quiet (QS) and active sleep (AS). Baseline measurements of R-R interval and systolic BP were recorded during each state. Using spectral analysis, 2min BP and R-R interval epochs were used to establish BPV and HRV indices, respectively. Low frequency (LF, reflecting sympathetic-parasympathetic activity), high frequency (HF, reflecting parasympathetic activity) and the LF/HF (reflecting sympathovagal balance) spectral indices were calculated.

Results. HRV LF power, total power and the LF/HF ratio decreased between 2-4 weeks and 5-6 months during QS, p<0.05. In contrast HF power increased between 2-4 weeks and 5-6 months PNA during QS, p<0.05. There were no postnatal age differences identified during AS. The BPV LF/HF ratio decreased between 2-4 weeks and 5-6 months during AS, p<0.05. There were no postnatal differences during QS.

Conclusion. This is the first study to describe the maturational changes of autonomic control on both HR and BP during sleep in infants. The data confirms that parasympathetic dominance on HR control increases and additionally shows that sympathetic dominance on BP control decreases with PNA. Normative data on both HRV and BPV might serve as reference values in autonomic studies for pathological states where autonomic dysfunction has been implicated, such as in preterm infants.
THE EFFECT OF INFANT PREMATURITY ON BAROREFLEX SENSITIVITY DURING SLEEP IN INFANCY
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Objective. Preterm infants are at increased risk for Sudden Infant Death Syndrome (SIDS). Baroreflex control of blood pressure has been proposed to be impaired in SIDS victims and baroreflex sensitivity (BRS) increases with postnatal age in term infants across the first 6 months of infancy when most SIDS occur. However, little is known about the effects of preterm birth on BRS during sleep after reaching term-equivalent age. This study aimed to examine the effects of preterm birth on BRS during quiet (QS) and active (AS) sleep across the first 6 months after term-corrected age (CA).

Methods. Preterm (n=25) and term (n=30) infants were studied at 2-4 weeks, 2-3 months and 5-6 months CA using daytime polysomnography. Blood pressure was recorded in both QS and AS using photo-plethysmography (Finometer™). Cross-spectral analysis was performed between 1-2 minute epochs of systolic blood pressure and R-R interval changes to provide an estimate of BRS. Within the preterm group, the effects of sleep state and age were compared using a paired Student’s t-test and a one-way RM ANOVA, respectively. The effects of group (term/preterm) and age were compared using two-way ANOVA.

Results. In preterm infants there was no effect of postnatal age on BRS. BRS was lower in QS compared to AS at 2-3 months; there were no sleep state differences at 2-4 weeks or 5-6 months CA. Comparison of preterm and term infants identified that BRS was higher at 2-4 weeks (ms/mmHg, p<0.05), but lower at 5-6 mo CA in preterm infants (5ms/mmHg, p<0.05) during QS.

Conclusions. In contrast to term infants, BRS does not increase across the first 6 months of term corrected age in preterm infants. Notably, at 5-6 months CA BRS is significantly lower in preterm than term infants. Lower BRS in preterm infants at this age may increase the vulnerability to cardiovascular instability during sleep and potentially to SIDS.
II. Development

058 POSTPARTUM FEEDING METHODS AND MATERNAL SLEEP DISTURBANCE
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Introduction. Because of its well-established benefits for both infant and mother, any perceived disadvantage of breastfeeding should be carefully evaluated. Sleep disruption, which is known to negatively impact maternal functioning and mental health, may be perceived as a potential disadvantage of breastfeeding. Our purpose was to explore objective maternal actigraphically-measured sleep, subjective sleep reports, and daytime functioning based on current feeding method status during postpartum weeks 2 through 12.

Methods. Participants in a longitudinal postpartum sleep study (n=61 during postpartum weeks 2-13, n=19 during weeks 9-15) were retrospectively interviewed about their feeding methods. Nocturnal sleep period (sleep onset to final morning awakening), total sleep time, sleep efficiency, and sleep fragmentation were objectively measured with wrist actigraphy. Sleep measures were averaged within postpartum weeks and compared among 3 groups at each week: breast-feeding, formula-feeding, and a combination of the two.

Results. We did not find differences between women who were exclusively breastfeeding, exclusively formula feeding, or using a combination of the two methods on: objectively measured total sleep time, sleep efficiency, or fragmentation; subjectively reported number of nocturnal awakenings, total nocturnal wake time, or sleep quality; or sleepiness/fatigue measured using the visual analog of fatigue scale, Stanford Sleepiness Scale, or Epworth Sleepiness Scale.

Conclusions. Efforts to encourage women to breastfeed should include information about sleep. Specifically, women should be told that choosing to formula feed does not equate to improved sleep. The risks of not breastfeeding should be weighed against the cumulative lack of evidence indicating any benefit of formula feeding on maternal sleep.

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059 PARENTING AT MIDNIGHT: PRELIMINARY VALIDATION OF THE NIGHT-WAKING VIGNETTES SCALE
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Introduction. Self-report measures of parents’ settling behaviors have advanced our understanding of infants’ sleep. No comparable measures exist specifically for use with parents of preschool-aged children. The Night-waking Strategies Scale (NWS), a self-report measure of what parents do when their preschool-aged child wakes during the night, was developed to fill this need.

Methods. Items were created based on literature review, parent interviews, expert review, and clinical experience. 203 mothers (M age = 32 years, SD = 5.1) of preschool-aged children (M age =3.4 years, SD = 1.0) completed the NWS and measures of: parents’ agreement with night-waking strategies (Night-waking Vignettes Scale, NVS), parenting, and night-waking. Factor analyses (CFA) were conducted. Convergent validity of the NWS subscales with parenting measures and the NVS was examined, as were associations between NWS subscales and children’s night-waking.

Results. The NWS measures 5 night-waking strategies: Limit-setting (e.g., ignore request), active comforting (e.g., let sleep in my bed), rewards (e.g., lots of praise), punishment (e.g., scold), and routines (e.g., bed time routine). CFA supported the NWS structure: Satorra-Bentler χ² = 340.38 (df = 199, p < .001), CFI = .86, robust RMSEA = .06. Internal consistency statistics were adequate to good (α = .61 - .79, mean inter-item r= .29 -.48). Convergent validity with measures of parenting was established (e.g., laxness was correlated with NWS routines, r = -.37, p < .001). Parents’ night-waking strategy use was correlated with their agreement with those strategies (r = .26 -.46, p < .001). Predicted associations between NWS subscales and children’s night-waking were observed (e.g., active comforting was correlated with night-waking frequency, r = .33, p < .001).

Conclusion. The NWS hold considerable promise as a measure of the night-waking strategies of parents of preschool-aged children. Potential clinical and research implications will be discussed.

Support. This research was funded through a research grant provided by the Children’s Health Research Institute. Ms. Coulombe was supported by a Social Sciences and Humanities Research Council of Canada doctoral research award, and by the Canadian Institutes of Health Research strategic training fellowship as part of the Transdisciplinary Understanding and Training on Research- Primary Health Care (TUTOR-PHC) program.

060 PARENTING AT MIDNIGHT: PRELIMINARY VALIDATION OF THE NIGHT-WAKING VIGNETTES SCALE
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The University of Western Ontario, London, Canada

Introduction. Thoughts and feelings about children’s sleep may be important determinants of parenting behaviour when children wake at night (“parents’ night-waking strategies”). Agreement with night-waking strategies may also determine strategy use. We created the Night-waking Vignettes Scale (NVS) to measure agreement with four night-waking strategies (Limit-setting, active comforting, rewards, and punishment). The NVS was designed for parents of preschool-aged children.

Methods. The NVS consists of 8 night-waking vignettes created based on literature review, parent interviews, expert review, and clinical experience. Each vignette is followed by items describing a limit-setting behaviour, an active comforting behaviour, a reward behaviour, and a punishment behaviour. Parents indicate their agreement with each behaviour on a 6-point scale (“No, definitely disagree” to “Yes, definitely agree”). Agreement scores are parents’ mean agreement with the 8 behaviours representing each strategy (e.g., Agreement with limit-setting = mean of mothers’ agreement with the 8 limit-setting behaviours). 203 mothers (M age = 32 years, SD = 5.1) of preschool-aged children (M age =3.4 years, SD
Parents’ agreement with night-waking strategies. Clinical Conclusion.

Support. This research was funded through a research grant provided by the Children’s Health Research Institute. Ms. Coulombe was supported by a Social Sciences and Humanities Research Council of Canada doctoral research award, and by the Canadian Institutes of Health Research strategic training fellowship as part of the Transdisciplinary Understanding and Training on Primary Health Care (TUTOR-PHC) program.

061 PREDICTING MATERNAL PERCEPTIONS OF INFANT SLEEP PROBLEMS
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Introduction. While sleep researchers have proposed various criteria to distinguish normal infant sleep behaviours from problematic ones, some studies have found parents report a greater prevalence rate of infant sleep problems than would be expected (e.g., Karraker & Young, 2007; Morrell, 1999). Although these findings suggest that parents may be using different and/or additional criteria to identify infant sleep problems, we know little about what these criteria may be. In this study, we assess the utility of research criteria, as well as additional infant and maternal factors, in predicting mothers’ perceptions of infant sleep problems.

Methods. 305 mothers of infants 6 to 12 months of age completed an on-line questionnaire as part of an internet-based study of Canadian parents of infants and toddlers. Variables in this study include research criteria for infant sleep problems, infant negativity, maternal limit setting cognitions, maternal daytime functioning, maternal sleep quality, and the use of soothing behaviours to encourage infant sleep.

Results. A hierarchical logistic regression was conducted with maternal perception of problematic infant sleep as the outcome variable. In the first block, the infant sleep variables that comprise the research criteria were entered and accounted for 26% of the variance. By adding infant negativity and other maternal factors, 45.5% of the variance was accounted for and the model correctly classified 84.6% of the mothers reporting an infant sleep problem. Significant predictors of maternal perceptions of infant sleep problems were two of the research criteria (co-sleeping and being awake for 20 minutes or more).

Conclusion. The results of this study indicate that mothers are going beyond infant sleep behaviours when assessing sleep problems in their own infants. Clinicians and researchers should take these additional variables into account in their assessment and treatment of infant sleep problems.

062 EARLY SLEEP AND MATURATION OF CIRCADIAN RHYTHMS AS PATHWAYS TO HEALTH AND WELLBEING
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Introduction. In early childhood, the development of sleep-wake states is under rigorous neural control, but yet many environmental factors can affect it as documented in several small and mostly cross-sectional studies. However, prenatal and genetic factors can also contribute to development of sleep. No prior studies have attempted to construct a comprehensive developmental model taking into account the genetic, biological, and environmental factors simultaneously.

Methods. The CHILD-SLEEP study recruits systematically 4300 babies from a large tertiary birth hospital in Tampere, Finland. Parental questionnaires will be collected prenatally, at 3, 8 and 24 months of age. A subsample of 520 infants will be randomly assigned into two objective sleep registration groups (ACG and PSG). For the genetic analyses, umbilical cord blood will be collected at birth.

Results. The CHILD-SLEEP consortium will 1) examine the development of sleep and circadian rhythms in infants using both objective methods and questionnaires 2) investigate trajectories to disturbed sleep taking into account environmental, and biological factors as well as their interactions and correlates 3) study the long-term health and developmental consequences of early sleeping difficulties.

Conclusions. Prevention of the negative consequences of sleeping difficulties would be invaluable, but the current paucity of information on factors that control the early development of sleep-wake rhythms and facilitate healthy sleep practices impedes development of effective interventions. The CHILD-SLEEP consortium will shed light on early sleep development and factors that modulate normal sleep development.

Support. The CHILD-SLEEP consortium is funded by the SKIDI-KIDS program of Academy of Finland, Signe and Ane Gyllenberg Foundation, Arvo Ylppö Foundation and Foundation for Pediatric Research.

063 RELATIONSHIPS BETWEEN SLEEP AND DEVELOPMENTAL OUTCOME IN 12-MONTH-OLD INFANTS
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Introduction. Well-regulated sleep is thought to enable the infant to attend, process and communicate in an efficient way, but, few studies to date have considered the impact of sleep duration on development past the first few months of life. The aim of this study was to examine the extent to which objectively and subjectively recorded sleep duration in 6 month old infants predicted cognitive development at 12 months old.

Methods. 58 infants (48% male) wore an actigraph (Actiwatch 2 Mini Mitter Company Inc, USA) for 7 nights, while parents completed a day-sleep-wake diary for recording sleep schedules. At both 6 and 12 months old, infants were assessed with the Bayley Scales of Infant and Toddler Development Edition III and parents completed previously validated sleep surveys.

Results. There were no significant relationships between parental-reported infant night and day sleep duration and cognitive, language, motor or social-emotional development. Longer sleep duration recorded by the actigraph at 6 months old was significantly and modestly associated with higher scores for cognitive development at 12 months old ($r= .41; p<.01$). After controlling for demographic factors, sleep duration accounted for 10% of the variance in cognitive ability. Reduced motor activity during sleep at 6 months old was also significantly, and weakly associated with language development at 12 months old ($r= .28; p<.05$). After controlling for demographic factors reduced motor activity accounted for 6% of the variance in language ability.

Conclusion. These results indicated that if sleep quality and duration is disrupted during a time when the formation of synapses occur maximally in the cortex then this may have significant impacts on cognitive and language development.

064 RELATIONSHIP BETWEEN THE AUTONOMIC NERVOUS SYSTEM (ANS) TONE AS A FUNCTION OF SLEEP-WAKING STAGES AND BODY MASS INDEX (BMI) IN HEALTHY PRESCHOOLERS

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Introduction. Previous studies have shown that alterations in sympathetic and/or vagal tone during sleep are independent factors for cardiovascular risk. Information for children is limited. Our purpose was to assess the relationship between the ANS tone as a function of sleep-waking stages and BMI in healthy preschoolers.

Methods. 25 preschoolers (BMI >p15 and <95) were drawn from a cohort studied since in infancy at INTA, University of Chile. They underwent nighttime polysomnographic recordings between 4 and 5 years of age. Sleep-waking stages (non-REM sleep stages I, II, and SWS, REM sleep and waking) were coded visually based on EEG, EOG and EMG patterns. Heart rate (HR) and heart rate variability (HRV) high- (HF, estimates vagal tone) and low-frequency (LF, reflects a combination of sympathetic and parasympathetic activities) and the sympathovagal balance indexed by the LF/HF ratio were assessed for each sleep-waking stage episode throughout the sleep period time (SPT). A mean value for HF, LF and LF/HF ratio for each sleep-waking stage was then calculated for the SPT. BMI was determined with height and weight for each subject.

Results. During SPT, in REM sleep, non-REM sleep stage 2, and waking a positive correlation was observed between BMI and LF ($R= .42, .41, .598, p<.05$, respectively), and correlated negatively with HF ($R=- .42, -.41, -.597, p<.05$, respectively). Finally, a negative correlation was observed between BMI and mean R-R in REM sleep ($R=-.405, p<.05$) and LF/HF ratio in waking ($R=-.602, p<.01$).

Conclusions. These preliminary results indicate that HRV patterns correlate with BMI in pre-school children. Higher BMI within the normal range showed both lower vagal tone and higher sympathetic tone in REM sleep, non-REM sleep stage 2, and waking. ANS tone might be disrupted by BMI during sleep and waking even in the absence of obesity. [Support: NIH HD33487 grants and Fondecyt 1070668].

065 INFLUENCE OF NOCTURNAL FEEDING IN PARASOMNIAS IN SCHOOL CHILDREN: PRELIMINARY DATA

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Introduction. Parasomnias are recurrent episodes of behavior, experiences, or physiological changes that occur during the sleep, and the prevalence is found at children aged from 4 to 16 years old. The kind and time of meal can influence metabolic concentration, utilization of substrates and production of hormones. The aim of this study is to investigate the association between nocturnal feeding and sleep disorders, mainly parasomnias.

Method. Transversal study conducted with children, 7 to 8 yo, both gender, sample calculated of 200 children. The Sleep Disturbance Scale for Children (adapted and validated to the Portuguese language) was applied with a survey of feeding habits, including kind and quantity of food, divided in stimulants and non-stimulants. The children were divided in 2 groups: children with sleep and without sleep complain. Statistical analysis was based on qui-square test to compare the kind of food between groups, considering $p<.05$ significant.

Results. At this moment 180 children (84 boys) were evaluated, showing an average of 70% questionnaires answered, being 43.7% with sleep complain. The majority of children sleep between 9PM and 9:59PM (42.6% with sleep complain), 75.6% eats mixed feeding during the evening, and 45.9% present sleep complains. Out of the children that used to eat stimulant foods (37.9%), 54.1% has complains related to sleep. There were no differences between groups in this preliminaries data.

Conclusion. Despite majority of children presents nocturnal feeding with stimulant foods, and many of them has sleep complains it was not possible to find association between this variables in our preliminary data. It is necessary to continue the evaluation of children until the inclusion of desired sample to this research.

066 BREAST MILK IS BEST IN REGULATING BABY’S SLEEP

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Introduction. The kind and time of meal can influence metabolic concentration, utilization of substrates and production of hormones. The aim of this study is to investigate the association between nocturnal feeding and sleep disorders, mainly parasomnias.
Introduction. Breast milk is considered the perfect infant food because it contains a good combination of nutrients that babies need especially during the first few months of their lives. Its composition changes during the breastfeeding, daytime and even each feed. Most of mothers who freeze the breast milk bottles do not consider these variations. Until now little is known about the circadian patterns and its causes in the human milk. The aim of our studies was to investigate the possible circadian rhythm and between-day variations of the human milk’ substances (amino acids, proteins, nucleotides and antioxidants) and to give an explanation about it.

Method. Breast milk samples were expressed by 77 healthy lactating women (between 6-8 samples/woman, i.e. a sample each 3-4 hours). We analyzed the content of some components of the human milk during a 24-h period. After that we realized a chronobiological study (Cosinor method).

Results. The most important results were: significant variations in the antioxidant activity and proteins between night and diurnal human milk samples, and a circadian rhythm of some amino acids and nucleotides.

Conclusion. According with these results it is concluded that breast milk should be given to the baby at the same time of day it is expressed. Thus, the baby would be adjusting his circadian pattern in harmony with his environment (day / night), crucial for the proper functioning and synchronization of all systems in the human body.

Introduction. This study evaluates parental knowledge and understanding of their childrens sleep behavior.

Methods. The 36-question Pediatric Sleep Questionnaire (PSQ) was administered to 97 parents of second grade students in three elementary schools in Tartu Estonia. The PSQ collects information on the sleep time variables of breathing, movement, parasomnias, falling asleep, and maintaining sleep.

Results. Parents generally failed to correctly identify the symptoms of poor sleep. 53% of parents recognized leg jerks as a symptom; recognition of other symptoms fell between 11% to 33%:

- Of 33 parents reporting their children snored or had heavy breathing, only 7 (21%) considered this a sleep difficulty;
- 19 parents reported leg jerks during their children’s sleep but only 10 (53%) reported sleep problems;
- 34 parents reported their child waking up and coming out of bed during night, only 9 (26%) reported it as a problem;
- 9 parents mention enuresis, only 1 (11%) considered it as a sleep problem.
- 42 parents reported restless sleep, but only 14 (33%) considered it as a sleep problem

Conclusion. This study reveals parental failure to identify symptoms of poor sleep among their children. Parental education on pediatric sleep health is indicated by this study but further research is required to identify the exact scope and modalities of this public health education need.
III. Adolescents

068

INSomnia IN ADOLESCence AND ADULTHOOD RELATED TO MILD SEXUAL HARASSMENT IN CHILDHOOD

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Sexual aggression is currently considered as a cause of post traumatic stress, depression and psychiatric abnormalities in both genders in later life. The effects of mild and occasional sexual aggression in children are less well known.

Objectives. To describe clinical cases of females which were molested once or few times during childhood and to relate these events with insomnia in adolescence and early adulthood

Methods. The cases of 6 young females requiring support in the Sleep Medicine Center due to chronic insomnia complaints are described

Results. Patients’ age ranged from 17 to 40 years, being most of them below 24, and sexual aggression has occurred by the age of 6 to 16, most of them below 10 years. In half of the cases the complaint and description of the sexual harassment was expressed by the first time in their life; in the other cases a complaint to the mother has been formulated by the children. In all cases the mother had one of the following attitudes: she did try to hide the fact, she considered it was a lie or she did not took care. In all cases except one the harassment has been mild and occurred only once, and was perpetuated by a relative (grandfather, stepfather, uncle). Nevertheless the patient attitude towards the fact was either guilt or anger. The consequences were severe: patients had chronic insomnia complaints, together with depression with suicidal ideas one patient, clear difficulties in sexual and affective life.

Conclusion. Mild sexual harassment should be considered among the precipitating factors of insomnia in females.

069

PORTUGUESE ADOLESCENTS’ SLEEP: HOW DO THEY FEEL, WHAT DO THEY KNOW AND WHAT DO THEY DO ABOUT IT?

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Introduction. Sleep deprivation has become a serious risk to their development and to public health. This work aimed to explore relations between self-perception as sleepers, sleep habits and current information about sleep in a sample of Portuguese adolescents, using a previously developed questionnaire: Questionnaire About Sleep for Adolescents (QASA).

Methods. QASA was applied to a sample of 400 Portuguese adolescents, of both genders, attending 9th and 11th grade in two different schools. Results were analysed using SPSS, Inc.

Results. 1) Self-perceptions: Adolescents tend to consider themselves as good sleepers, although 60% assumed an insufficient sleep duration. Sleep constitutes an important issue, but most adolescents don’t worry about it when it comes to future health. 2) Sleep habits and routines: Adolescents show a significant sleep deprivation and irregular patterns when comparing weekdays with weekends. Girls tend to reveal worst sleep hygiene. Parent involvement in sleep routines usually decreases with age. 3) Information about sleep: Age seems to improve the current information about sleep. In general, adolescents show better knowledge regarding dimensions as biological rhythms and consequences of sleep deprivation. Most participants don’t recognize several sleep hygiene factors, particularly the adequate sleep length for adolescence. 4) Relations between variables: Adolescents who worry about sleep issues reveal better information and sleep routines. Sleep hygiene is positively associated to perceived sleep quality, and sleep duration. Information and sleep routines don’t show significant relations.

Conclusions. In what concerns sleep routines, this work is in line with published data while demonstrating the negative and worrying situation of Portuguese adolescents, which is more severe in older groups. Adequate information about sleep was in some way related with better routines, suggesting self-perceptions as mediators of sleep related behaviours. These data reveal an urgent need to promote sleep education in Portugal.

070

CULTURE VS. BIOLOGY: SLEEP PATTERNS IN ARAB AND JEWISH ADOLESCENTS IN ISRAEL

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Introduction. Sleep is a biologically driven developmental process modified by culture. While biological changes in adolescent sleep patterns have been investigated extensively, including gender differences, the contribution of culture to sleep practices has received attention primarily in infants and young children. Our aim was to compare sleep patterns in male and female Israeli Arab and Jewish adolescents.

Methods. In a cross sectional survey, the School Sleep Habits Questionnaire (Wolfson & Carskadon, 1998) was completed by 137 Arab (mean age: 14.7±0.5; 46 males) and 124 Jewish (mean age: 14.6±0.5; 58 males) 9th grade adolescents in normative Arab and Jewish high-schools in Israel. Bedtimes, sleep latencies (minutes), wake-times and total sleep times (TST) were assessed. Two-way MANOVA was performed, to assess CULTURE and GENDER differences on weekday and weekend sleep patterns.

Results. For weekday, main effects for CULTURE were found in bedtime (Arab: 22:38±01:13, Jewish: 22:58±0:41; F(1,248)=3.8, p=0.05) and sleep latency (Arab: 43.47±39.57; Jewish: 22:48±20.40; F(1,248)=2.10, p<0.001) and main effects for GENDER were found in bedtime (male: 23.00±6.98, female: 22.39±1.00; F(1,248)=5.73, p=0.017) and wake-time (male: 6:52±0.32, female: 6:43±0.29; F(1,248)=4.28, p=0.04). For weekend, main effects for CULTURE were found in bedtime (Arab: 23:55±2:41, Jewish: 01:21±1:32; F(1,248)=23.20, p<0.001), sleep latency (Arab: 52.11±51.00, Jewish:
14.99±14.97; F(1,243)=51.60, p<0.001) and wake-time (Arab: 10:26±1:52, Jewish: 11:13±1:41; F(1,243)=11.19, p=0.001) and a main effect for GENDER was found in TST (male: 9.69±2.26, female: 10.35±1.73; F(1,243)=5.93, p=0.016). No CULTURE*GENDER interactions were found.

Conclusions. Earlier bedtimes may explain longer sleep latencies in Arab compared to Jewish adolescents, possibly demonstrating a conflict between cultural and biological factors affecting sleep. The lack of cultural differences in TST indicates that sleep need is biologically determined. Gender differences (i.e., earlier weekday bed and wake times and longer weekend TST for females) are in line with previous reports.

071
EFFECT OF EARLY SCHOOL TIMINGS ON MOOD AND PERFORMANCE OF STUDENTS
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Introduction. Early school start times along with delayed sleep phase causes adolescents to lose sleep during the school week. Studies have attributed insufficient sleep as one of the factors contributing to poor school performance of students. Sleep deprivation can impair memory and concentration making it difficult for students to learn. Irritability, lack of self confidence and mood swings are often common in teenagers, but sleep deprivation makes it worse. This study compared the academic performance, sleep habits and mood changes in Indian student attending same school but having two different shifts.

Methods. A questionnaire based cross sectional study was conducted among 834 students of VI to X standard attending different shifts [shift I (7:00 am to 1:10 pm) & shift II (11:30 am to 6:00pm)]. The questionnaires evaluated the student for their sleep pattern, duration, napping, sleep quality and mood. Daytime sleepiness was scored using Epworth Sleepiness Scale. Performance was calculated by their percentages in respective subjects and a total score was taken for their overall performance during the academic session.

Result. On comparison we found that the students of shift II had significantly greater total sleep time and only 19% of them were sleep deprived ( total sleep time<8hrs) compared to 58% of shift I. Their overall performance was better than shift I performing significantly better English (P=0.001) and Mathematics (P=0.003).

Sleepiness, anxiety, and depression all were reported more in shift I students.

Conclusion. This study shows that students of morning shift are significantly sleep deprived during the school week and register greater sleepiness which may be a cause for their lower academic performance. Sleep problems negatively affect behavior, quality of life and performance in various fields. If schools start later, students will get more sleep, thereby reducing sleep debt and increasing their ability to be effective learners.

072
IS DAYTIME NAPPING A HEALTHY HABIT IN ADOLESCENTS?
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Introduction. Napping is a commonly observed phenomenon, seen due to increase in daytime drowsiness and is usually perceived as a part of circadian rhythm dip in level of alertness. Whether such brief periods of sleep are just a habit, a sign of sleep deprivation or underlying mood disorder is a matter of debate. This study was conducted to see the relationship of napping with various aspects of mood & performance

Method. One hundred first year medical students were assessed for sleep habits by means of a validated questionnaire. Mood disorders were scored using the depression, anxiety, stress scales (DASS). Performance was calculated based on their overall grades during the academic session.

Result. We found that non-nappers were significantly (59.3%) more regular in their sleep routines, followed early to bed and early to rise routines and had ≥7Hrs of sleep at night on weekdays compared to nappers. Nappers reported significant sleep disturbances and mood changes though there was no significant difference in the academic performance of the two groups. We also found that with increasing length of nap there was significant increase in various sleep disturbances and mood changes though these changes were minimal in those napping either for 30mins or 90mins.

Conclusion. From this study it appears that napping may not always be a healthy habit and in fact could be a marker of an underlying sleep deprivation, a psychiatric or psychological disturbance in some individuals. Further studies with larger sample size are needed to confirm these observations.
IV. Methodology

073 PREDICTION OF OBSTRUCTIVE SLEEP APNOEA USING THE PAEDIATRIC SLEEP QUESTIONNAIRE
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Introduction. The Paediatric Sleep Questionnaire (PSQ) is increasingly used to screen for obstructive sleep apnoea (OSA). We aimed to investigate i) the diagnostic test accuracy of a German version of the PSQ for predicting OSA on polysomnography (PSG), and ii) the test-retest reliability of this version.

Methods. Habitually snoring children aged 6-16 years were enrolled. Parents completed the PSQ at home upon receipt of the PSQ (PSQ1) and in hospital just before PSG (PSQ2). In addition, PSG was performed and apnoea-hypopnoea index (AHI) determined. PSQ total and subscale scores were calculated and compared with the AHI using Spearman’s correlation coefficient (r_s). In addition, PSQ scores were compared between children with and without OSA using receiver operating characteristic curves and area under the curve (AUC).

Results. Fifty children completed the study (28 males; median age 9.7 years). There was no correlation between the AHI on one hand and the total scores of PSQ1 and PSQ2 on the other hand (r_s = 0.01 and -0.05, respectively). PSQ1 and PSQ2 subscale scores showed only weak correlations with the AHI (e.g., PSQ1: r_s = 0.25 for snoring subscale; r_s = -0.07 for inattention subscale; r_s = -0.33 for sleepiness subscale). Twelve patients were classified as having OSA (i.e., AHI > 1). PSQ1 total score (mean ± standard deviation) was 0.35 ± 0.18 in children without OSA and 0.38 ± 0.19 in those with OSA (AUC = 0.552). Similar results were found for PSQ2. The correlation coefficient between total scores of PSQ1 and PSQ2 was 0.81.

Conclusion. This German version of the PSQ may not have satisfactory diagnostic test accuracy for predicting OSA on PSG. This is in contrast to results for the original English version, which may be due to translation problems. However, the test-retest reliability of this German version may be acceptable.

074 INTER-OBSERVER AGREEMENT OF ARTEFACT IN PAEDIATRIC HOME PULSE OXIMETRY STUDIES
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Introduction. Home pulse oximetry is used to screen children for sleep disordered breathing. Manual rejection of apparent artefactual data is recommended. Inter-rater reliability was tested and compared with automated analysis.

Methods. Referrals for 2-night home oximetry (Bitmos with Masimo probes) with possible OSA over the last six months were reviewed by three technologists and the five highest and lowest 4% dip rate studies were selected from 137 studies. Bland and Altman’s method was used to compare agreement between technologists and automated software (VISI download v021109). To estimate effects on clinical conclusions, pragmatic ‘normal’ limits were used: baseline saturations >98%, nadir >90% and 4% Oxygen Desaturation Index (ODI4%) <5 events/h.

Results. Technologists estimated an average of 14 hours 3 minutes of artefact-free recording time versus 14 hours 55 minutes estimated by VISI. The 95% limits of agreement for artefact-free recording time were ± 15½ minutes. 29 of 30 manual measurements lay within these limits. VISI systematically underestimated artefact. Seven of ten VISI measurements lay outside the limits of agreement. There were no differences between the technologists and VISI classifying patients as abnormal on baseline and ODI4%: all ten had baseline>95% and five had ODI4%<5/h. However, using VISI, three patients had nadir saturations less than 90% occurring solely during periods accepted by VISI analysis but rejected as artefactual by the technologists.

Conclusion. Agreement between trained technologists is good when rejecting periods affected by artefact. Analysis software can underestimate artefact which may give false positive results that could effect subsequent clinical management.

075 OXIMETRY PRIOR TO ADENOTONSILLECTOMY FOR OBSTRUCTIVE SLEEP APNOEA
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Introduction. Clinical history and examination are poor predictive factors in identification of children at high risk of suffering complications of adenotonsillectomy for Obstructive Sleep Apnoea (OSA). Complications include respiratory distress from oedema and pulmonary haemorrhage. Recurrent desaturations to SaO2<80% have been proposed as an indication of a “high risk” group which should be nursed on a HDU in a paediatric centre. The aim of this review was to retrospectively identify any clinical features in children referred for pre-operative oximetry to identify a “high risk” group.

Methods. Retrospective case notes review of children undergoing adenotonsillectomy for obstructive sleep apnoea.

Results. 67 notes were identified. Of these, 58% had an oximetry prior to surgery. 16% had repeated desaturations to SaO2<80%, indicating a “high risk” group. Indications for referral from the ENT team included: witnessed apnoeas, parental concern about breathing difficulty, daytime sleepiness and large tonsils. There was no correlation between depth of desaturation and clinical features.

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Of the patients suffering peri- or post-operative complications, 8 had an abnormal oximetry, of which 5
had been identified as “high risk”. 4 had not had a pre-operative oximetry requested. No peri- or post-operative complications occurred in children with normal pre-operative oximetries.

**Conclusion.** Children at risk of complications from adenotonsillectomy for OSA are difficult to identify. Those with normal pre-operative oximetries are unlikely to suffer complications and therefore could be operated on in a district general hospital setting. Further work is needed to identify which children should be referred for oximetry prior to surgery.

**076 CHALLENGES IN THERMAL IMAGING BASED RESPIRATION RATE MONITORING**

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**Introduction.** Respiration rate is an important physiological measure. Current respiration rate monitoring methods are contact based, i.e. the sensing device is attached to the subject's body. These methods create discomfort and in some cases affect the value of the respiration rate.

**Methods.** We have developed a noncontact respiration rate monitoring device that measures the temperature of an area centred on the tip of the nose. The method has been clinically evaluated on 20 children. A thermal camera (model: Flir A40) with a thermal sensitivity of 0.08 degree Kelvin was used for this study. Fifty thermal images were recorded per second for two minutes for each child. The images were processed to generate a respiration signal (see Fig.1). The respiration rate values were obtained by automatically determining the number of cycles in this signal.

**Results.** There was a very close correlation between the respiration rate values obtained using our thermal imaging and those obtained using the contact based nasal thermistor approach (see Fig.2).

**Conclusion.** There remain a number of challenges before this method can be used in routine clinical practice. Large head movements caused ineffective tracking of the tip of the nose, and thus distortion of the respiration signal. The method assumed nasal breathing only, not allowing for the possibility of mouth breathing. The algorithm is being modified to identify the most appropriate facial area for temperature monitoring. We are currently developing a handheld infrared sensing device specifically for respiration monitoring. The effectiveness of this device will be reported in future.

**077 THE PUPILLOGRAPHIC SLEEPINESS TEST: FEASIBILITY, PRELIMINARY REFERENCE VALUES, AND AGREEMENT WITH SUBJECTIVE MEASURES OF EXCESSIVE DAYTIME SLEEPINESS**

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**Introduction.** The Pupillographic Sleepiness Test (PST) is a simple and valid method to assess excessive daytime sleepiness (EDS) in adults. However, experience and reference values for children are lacking. In addition, agreement between PST parameters and subjective measures of EDS is unclear in children.

**Methods.** Participants were recruited in 2 public schools in Tuebingen, Germany. The PST was performed in schools under standardized conditions; the Pupillary Unrest Index (PUI) – an objective measure of EDS - was determined. The subjective level of EDS was assessed using the following questionnaires: Paediatric Sleep Questionnaire (PSQ), Sleep Disturbance Scale for Children (SDSC), parent and child versions of the Epworth Sleepiness Scale (ESS), Paediatric Daytime Sleepiness Scale (PDSS), and Stanford Sleepiness Scale (SSS). The natural logarithm of the PUI (lnPUI) was the primary study variable. Feasibility, influencing factors, and agreement with subjective measures of EDS were assessed using simple regression and correlation analysis.

**Results.** The PST was successfully performed in 154 out of 163 children (94%; 76 boys; age 6.6-17.8 years). LnPUI decreased with age (beta: -0.027; p-value: 0.015) and was significantly higher in boys (mean [95% confidence interval]: 2.1 [2.0-2.3] vs. 1.9 [1.8-2.0]; p-value = 0.001). There were no correlations between the lnPUI and subjective measures of EDS (e.g., PSQ-EDS scale: r = -0.09; SDSC-EDS scale: r = -0.11; ESS-parent version: r = -0.09; ESS-child version: r = -0.05; PDSS: r = -0.02; SSS: r = -0.07).

**Conclusion.** The PST may be feasible in school-aged children. The LnPUI seems to depend on age and gender,
which requires age- and gender-specific reference values. There may be no agreement between the InPUI and subjective measures of EDS. It remains to be determined whether this is due to reduced suitability of questionnaires for assessing EDS in children, or reflects limitations of the PST in children.

**078 DEVELOPMENT AND VALIDATION OF THE CHILD AND ADOLESCENT SLEEP CHECKLIST (CASC)**

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**Introduction.** As characteristics of sleep changes dramatically both in quality and in quantity during childhood, assessment of sleep using a single questionnaire for children with a wide range of ages requires special considerations. The aim of this study was to develop the Child and Adolescent Sleep Checklist (CASC) for the screening of sleep problems among children and adolescents.

**Methods.** CASC is consisted of 36 questions commonly used from kindergartener up to high-school students. CASC has three versions; for caregivers, for elementary school children (6-11 years of age), and for high-school students (12-18 years of age). Caregiver version is used commonly for all age groups, elementary school version is to be filled out by the students under the instruction of teachers or caregivers, and high-school version is to be filled out by the students themselves. To evaluate the appropriateness of these questions, preliminary testing was conducted for 12 caregivers of children, and additional validation was conducted using conventional sleep questionnaires.

**Results.** Percentage of valid response to the questions was 98.8%. Questions were slightly modified for the caregivers related to the appropriateness of the questionnaire items. CASC questions showed good correlation with conventional sleep questionnaires.

**Conclusion.** CASC has its advantage in making cross sectional screening of sleep problems in wide range of ages by using both parental and self report. CASC can be especially useful in interventional or cohort study as this questionnaire allows to use same question items throughout the study period.

**079 ASSESSMENT QUESTIONNAIRE OF CHILDREN WITH SLEEP APNEA (TUcASA): TRANSLATION AND CULTURAL ADAPTATION**

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**Introduction.** The Tucson Children’s Assessment of Sleep Apnea Study (TuCasa) was developed in Tucson, USA in 2003 by Goodwin et al. It is a questionnaire with 13 questions and frequencies answers to assess the sleep-related symptoms associated with Sleep Disordered Breathing (SDB) in children 04 to 11 years of age. The great impact of SDB in children is essential to place the translation and cultural adaptation to facilitate the implementation of epidemiological studies for prevalence in our midst by providing adequate treatment. The aim of this study was to translate and culturally adapt the TuCASA questionnaire for Brazilian Portuguese.

**Method.** The study was conducted in two phases: Phase 01: translation (two independent translators), Synthesis of the translations (versions compared by experts in sleep), back-translation (two other translators) and review committee (all versions compared). Phase 02: Pretest (the questionnaire application in order to check the understanding of each item in the questionnaire). This phase was conducted with 30 children, both gender, accompanied by their parents and/or guardians at the Neuro-Sono Outpatient Clinic, Department of Neurology, UNIFESP (São Paulo - SP) and UNILAVRAS (Lavras - MG) in Brazil.

**Results.** The scale instructions and its items were adjusted, taking into account the semantic equivalence, conceptual, experiential, cultural, and language. Visual communication has also been adjusted for the population preference and habits, resulting in a questionnaire with clear instructions and easy recognition of questions and possible answers. The pretest was demonstrated 100% agreement about the instrument adapted to Portuguese in Brazil.

**Conclusion.** The questionnaire to evaluate children with sleep apnea has been translated and adapted for Brazilian Portuguese with good understanding of this population, and it is ready for validation. Supported by FAPESP and CNPq.
receiving the most positive responses were in the domains of workload 94%; vocational skills 97%; feedback 100%. While those with most negative responses were in the domains of student effort 9%; student motivation 6%; presentation 6%.

Conclusion. The flexibility inherent in the on-line delivery allows students to integrate a course within their work and other commitments, whilst providing ample resources and opportunities for learning.

081
SETTING UP AND EVALUATING A HOME PAEDIATRIC SLEEP STUDY SERVICE (PHSS)
Princess Margaret Hospital, University of Western Australia (UWA), Perth, Australia

Introduction. While laboratory polysomnography (PSG) remains the gold standard for the diagnosis of childhood sleep apnoea, the demand for diagnostic services far exceeds the capacity. In order to meet the growing demand alternative diagnostic pathways need to be investigated. Following a pilot study a metropolitan wide home sleep study service was introduced in 2008 for children referred with suspected Obstructive Sleep Apnoea (OSA).

Objective. To evaluate the success of a PHSS for children referred for investigation of OSA. Method: Children ≥5 years without co-morbidities, referred for investigation of OSA were studied. Sleep studies were unattended using a Somte Ambulatory system (Compumedics, Melbourne, Australia). Set-up was at home and equipment retrieved the following morning by hospital in the home paediatric nurses trained by sleep laboratory staff. PSGs analysis: staging, arousals scoring and respiratory scoring were performed according to current laboratory guidelines.

Results. To date, 69 children have been studied (55% male), median age 10.5 years (4.5-17). The median wait time to sleep study for these children is 2 months compared to the standard referral process wait time of 8 months, and saves 60 overnight hospital bed stays. 9 (13%) of studies needed to be repeated in the laboratory due to technical difficulties or diagnostic uncertainty. OSA was diagnosed in 44% of children

Conclusion. The feasibility of unattended PSG in the home as an adjunct to standard sleep study laboratory services has been demonstrated. The majority of children do not need to proceed to laboratory PSG. Widespread implementation of such services could reduce the demand for laboratory-based PSG, diversify service delivery; improve waittimes and free up hospital beds.

082
THE DESIGN, IMPLEMENTATION AND EVALUATION OF TWO SLEEP EDUCATION CAMPAIGNS TARGETING PARENTS AND THREE AND FOUR YEAR OLD PRESCHOOL CHILDREN
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This project aims to examine the impact of promoting healthy sleep behaviour to preschool children and their parents. Sleep duration varies considerably between children and is known to impact upon health, behaviour and academic performance. More recently sleep duration has been found to be a predictor of coexisting and future obesity, especially in young children (Reilly et al, 2005 British Medical Journal. 330:1357). This study compared two interventions and a control group. One intervention was designed via participatory research by parents for parents and was delivered through children’s centres. It aimed to encourage small changes in bedtime practices through the use of materials such as displays and leaflets. The other intervention targeted children in nursery directly through stories, role play and activities. Evaluation included parent questionnaires pre and post intervention, beliefs concerning their own children’s sleep, and knowledge regarding healthy sleep practices. Interviews were also conducted post intervention. Results highlight the lack of knowledge about certain aspects of good sleep practices, such as exposure to natural light soon after waking, and not watching television prior to sleeping. Participatory research proved to be a successful practice for designing a sleep education campaign that appealed to parents in the local community. Findings from the nursery intervention suggest that delivering sleep interventions directly to young children may prove to be a promising technique for reaching the whole family. This research is Economic Social Research Council (ESRC) CASE funded in collaboration with Sure Start Children’s Centres.

083
RELATIONSHIP BETWEEN SLEEP PROBLEMS AND BEHAVIOR PROBLEMS: A SURVEY USING THE CHILD AND ADOLESCENT SLEEP CHECKLIST (CASC) AND STRENGTH AND DIFFICULTIES QUESTIONNAIRE (SDQ)
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Introduction. Sleep problems are known to affect behavioral development of children. The aim of the study was to identify the relationship between sleep problems and behavior problems among kindergartener, elementary and high-school children using sleep and behavioral questionnaires.

Methods. Child and Adolescent Sleep Checklist (CASC) and Strengths and Difficulties Questionnaire (SDQ) were given to all students of the schools in a local city of Japan. Both of these questionnaires were filled out by the parents for kindergarteners, filled out by the students for elementary and high-school students. 3643 subjects who responded to the questionnaire properly (response rate: 86%) were included in the analysis. Total and subscale scores of CASC were used as sleep parameters. SDQ total and subscale scores were used as behavior measures. Relationship between CASC scores and SDQ scores were investigated for each school age group.

Results. Subjects with elevated CASC total sleep problem score showed significantly (p<0.01) disturbed SDQ total score (12.4 vs 7.1) and emotional (2.8 vs 1.3), conduct (3.0 vs 1.8), hyperactivity (4.5 vs 2.7) and peer problems (2.2 vs 2.5) subscales scores. This relationship was equally observed in all school age groups. In addition, subjects with elevated CASC subscale scores on bedtime, nighttime or daytime showed significantly disturbed SDQ scores respectively.

Conclusion. Sleep problems were related to behavior
problems, and the relationship was observed regardless of the age groups. Screening and management of sleep problems should also be included in making intervention for children with behavior problems.

**084 DEVELOPMENT OF A NEW QUESTIONNAIRE TO EVALUATE ADOLESCENTS’ SELF-PERCEPTIONS, ROUTINES AND INFORMATION ABOUT SLEEP**

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**Introduction.** Recent studies emphasize the need to look at adolescents’ sleep from a social, psychological and behavioural approach, collecting data to support adequate therapies and interventions. Given the lack of instruments available in Portugal to evaluate adolescents’ sleep from a multidisciplinary perspective, this work aimed to develop a new self-report questionnaire to explore adolescents’ attitudes towards sleep. We called it Questionnaire About Sleep for Adolescents (QASA).

**Methods.** 1) Pilot study to develop QASA, which involved: a) a review of related instruments; b) item construction and its evaluation by sleep experts – QASA includes personal data, self-perception scales, sleep routines, information and knowledge about sleep. Variables are quantified in Likert scales; besides qualitative answers are possible, in order to allow future improvements; c) administration to a pilot sample of 19 subjects; d) reformulation for field application 2) QASA application in a sample of 400 Portuguese adolescents, attending 9th and 11th grade in two different schools (one public and one private). Statistical analysis of the obtained results.

**Results.** 1) The pilot study allowed improvements in item formulation, restructuring of questionnaire dimensions and graphic presentation. 2) Field application contemplated 219 female adolescents (54.6%) and 181 male (45.4%), from 13 to 18 years old. Although adolescents view themselves as good sleepers, they know they have a smaller amount of sleep, due to worries, school and social factors. Adolescents revealed poor knowledge about sleep and bad sleep hygiene. These data permitted new awareness of what adolescents think of their own sleep, suggesting that current information is not enough for adopting healthy sleep habits.

**Conclusions.** QASA proved to be an efficient and adequate tool. The three dimensions of QASA provided a new type of data, since they were not used in prior studies. Collected data supports the need for interventions of sleep education in Portugal.

**085 THE SLEEP OF SCHOOL CHILDREN – A GUIDE AND A DVD**

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It is an information guide and an 8 minutes DVD aimed at parents, teachers and children, containing basic information on normal sleep and some of its main disturbances. Sleep directly influences school performance; it is necessary that the individuals have healthy habits and avoid situations which can cause serious disturbances. We also suggest that this guide should be used by children, once the pictures found in these pages (to be painted) partially turn the concepts of the expressed dysfunction into words. By coloring the pictures, and seeing the DVD, the children will be expressing their feelings, showing their natural tendency to handle the problem, with growth, order and integration. The information from the text and DVD can be enhanced through additional readings from other books. Sharing this information is not enough to replace medical consultations or dental, psychological and/or guidance from other professionals for a detailed follow up. This guide and DVD were made to help children, parents and teachers, to understand a little more about the questions of sleep; and it is up to them to decide what have to be done; and which conclusions they have to come to according to the information found here.

**086 SLEEP PROBLEMS IN CHILDREN AND ADOLESCENTS USING THE SLEEP QUESTIONNAIRE**

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**Objective.** We assessed the frequency of childhood sleep problems at Seoul and Kyonggi province.

**Method.** 936 unselected children and their parents who visited 9 primary pediatric outpatient clinic completed a Pediatric Sleep Questionnaire.

**Results.** Habitual snoring was reported in 152 (16.9%) of the children. Sleep disordered breathing was found in 120 (13.3%) of the children. Insomnia was reported in 263 (29.2%) of the children. The prevalence of sleepwalking, night-torror, and bruxism, and nocturnal enuresis were 1.6%, 19%, and 21.1% respectively. Snoring was associated with sleepwalking, night-torror, bruxism, nocturnal enuresis. Age was associated with sleep disordered breathing, insomnia, and snoring (P<0.05). Insomnia was more in infants(50%) and toddlers (34%) than in older children (23%). Snoring was more prevalent in boys than girls. Logistic regression analysis revealed higher rates of insomnia among younger children (P<0.05).

**Conclusions.** Sleep problems such as sleep disordered breathing, insomnia, and snoring are frequent among children in Korea. Primary clinician should ask the parents about children's sleep problems.

**087 I-GER Q: STATISTICAL ANALYSIS OF PAEDIATRIC GASTROESOPHAGEAL REFLUX DISEASE QUESTIONNAIRE**

Vigo A, Malorgio E, Noce S

Centro SIDS Regione Piemonte - Italy

**Introduction.** Paediatric gastroesophageal reflux disease (GERD) is common in infants and children and it’s considered one of the most relevant triggers of Apparent Life Threatening Event (ALTE) in infants. Diagnosis of
GERD is often based on symptoms presentation. Kleinman reviewed psychometric characteristics and approaches to validation of currently available paediatric GERD questionnaires and demonstrated that the Infant GER questionnaire (I-GER Q) is a reliable, valid and clinically responsive measure of infant GERD symptoms. However, some clinical trials obtained perplexing results of using the I-GERQ-R for diagnosis. Our study evaluated the validity of I-GER Q as a diagnostic questionnaire for GERD in a population of infants affected by previous ALTE comparing questionnaires with pH monitoring results.

**Methods.** An observational, cross-sectional study was conducted. 262 infants (median age 10 weeks) affected by previous ALTE underwent 24 hour pH monitoring (Ph-day, Memphis). Caregivers of all infants were submitted to I-GERQ. The comparison between pH monitoring results and questionnaire included:

1. study of correlations between pH-index, number of reflux >5 and >15 seconds and I-GER Q score
2. association between pH index>5, proximal reflux events and I-GERQ score ≥7.

**Results.**

1. **Correlation matrix**

<table>
<thead>
<tr>
<th></th>
<th>pH index&gt;5</th>
<th>reflux &gt;5 s</th>
<th>reflux &gt;15 s</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-GER Q</td>
<td>-0.107</td>
<td>0.07</td>
<td>0.1</td>
</tr>
<tr>
<td>pH index&gt;5</td>
<td>0.268*</td>
<td>0.316*</td>
<td></td>
</tr>
<tr>
<td>n. reflux &gt;5 s</td>
<td>0.883*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* P <0.001

2. **Associations**

<table>
<thead>
<tr>
<th></th>
<th>pH diagnosis</th>
<th>normal</th>
<th>pathological</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-GER Q</td>
<td>normal</td>
<td>57 (72.2%)</td>
<td>22 (27.8%)</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td>pathological</td>
<td>161 (88%)</td>
<td>22 (12%)</td>
<td>183</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>218 (83.2%)</td>
<td>44 (16.8%)</td>
<td>262</td>
</tr>
</tbody>
</table>

**Conclusion.** The comparison between I-GER Q and pH monitoring results demonstrates that I-GER Q is not a valid instrument to diagnosis GERD.
Background. Pediatric cardiomyopathy is a rare, serious condition with a high mortality rate despite intensive medical management. Sleep disordered breathing (SDB) may contribute to cardiac dysfunction, yet the prevalence and severity of SDB in a paediatric population with cardiac disease is not well documented. The aim of this prospective cross-sectional study was to evaluate the prevalence and severity of SDB in children with primary cardiomyopathy and further, its relationship to cardiac function.

Results. Nineteen patients (16 males) were recruited. Specific diagnoses were hypertrophic cardiomyopathy (n=7), dilated cardiomyopathy (n=6), restrictive cardiomyopathy (n=3), left ventricular non-compaction cardiomyopathy (n=2) and combined hypertrophic and dilated cardiomyopathy (n=1). The median age was 11.6 years and the median body mass index Z score was 1.1. The median left ventricular ejection fraction was 57% (range 9-82%). 11/19 (58%) patients had a history of snoring, and 6/19 patients (32%) had evidence of SDB. Of these, 4/6 children had mild obstructive sleep apnea (OSA) with an obstructive apnea/hypopnea index [OAIH] between 1.5 and 5 events/hour. One child had severe OSA (OAIH >10 events/hour) and one child had Cheyne Stokes Respiration. There were no significant differences between children with SDB and children with normal PSG in terms of baseline characteristics, parent reported questionnaires, and otolaryngology and cardiac assessment results.

Conclusion. Children with cardiomyopathy have an increased prevalence of SDB that cannot be predicted by a history of snoring and was not related to adenosinergic hypotropy.

089 SLEEP DISORDERS IN CHILDREN WITH ATOPIC DERMATITIS: A QUESTIONNAIRE-BASED STUDY

Children’s Hospital and Department of Neurology, Sao Paulo Medical School, University of São Paulo, São Paulo, Brazil

Introduction. Atopic dermatitis (AD) is a chronic inflammatory skin disorder which severity can be assessed by the Scoring Atopic Dermatitis (SCORAD) index. For evaluation of sleep disorders in this population the Sleep Disturbance Scale for Children (SDSC) questionnaire was used, which is able to screen 26 sleep problems, resulting in 6 sleep disorder subscales: difficulty in initiating and maintaining sleep (DIMS), sleep breathing disorders (SBD), arousal disorders (DA), sleep-wake transition disorders (SWTD), disorders of excessive somnolence (DOES), sleep hyperhydrosis (SHY). It has been validated for Brazilian Portuguese.

Methods. SDSC questionnaire was applied to parents of 27 children with AD; age ranged from: 2.5 to 16.2 years (15 boys and 12 girls); mean age: 10.5 (± 3.5) years. Bruni et al. indicate that a T score of 55 is a good cut-off for clinical significance. Patients with SCORAD ≥ 55 (mild DA) were excluded.

Results. On the SDSC, 51.8% of the children obtained a total score higher than the clinical cut-off of a T score of 55, considered significant for sleep disturbances. Looking at the subscales, the highest score was 37% for DIMS, and the other scores were 25.9% for SBD, 18.5% for SHY, 3.7% for DA, 0% for SWTD, 0% for DOES. Their SCORAD index ranged from 18.5 to 70.8 (mean: 49 ± 14.7).

Conclusion. The results suggest that sleep-related disorders are common in children with AD (51.8%). Sleep disruption may occur in children with AD by the itch and scratch response, with increase of symptoms severity and periods of flare-up coinciding with higher frequency of sleep disturbance, especially difficulty in maintaining sleep. The recognition and treatment of sleep disturbances in these children is important for improvement of their quality of life.

090 RESPIRATORY INSUFFICIENCY IN CONGENITAL MYOTONIC DYSTROPHY

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Introduction. Respiratory complications are common in neonates with congenital myotonic dystrophy (CMD) due to diaphragmatic, intercostal muscle weakness, aspiration pneumonia and failure of cerebral respiratory control. Respiratory insufficiency is the major cause of mortality while prolonged invasive mechanical ventilation is linked to poor prognosis. We report two cases of CMD who were successfully supported with non-invasive ventilation (NIV) at their infancy.

Case report. These 2 cases of CMD were genetically confirmed to have around 2000 CTG repeats, suggestive of severe phenotype. Both had severe respiratory depression at birth requiring intubation and mechanical ventilatory support. For the first case, the patient could be extubated to nasal Continuous Positive Airway Pressure (nCPAP) within 1 day. Chest X-ray (CXR) showed elevated diaphragm. Despite nCPAP, her respiratory effort was shallow with CO2 retention, hence Bilevel Positive Airway Pressure (BiPAP) support was commenced since day 12 of life. She made good progress with the rehabilitative training and weaned off daytime BiPAP by 5months old.

The neonatal course of the second case was complicated by pneumothorax and repeated atelectasis. Extubation was achieved on day 23 of life to nCPAP. He weaned off nCPAP at 5 months but remained oxygen-dependent via nasal cannula. He decompensated at 10 months of age during an episode of aspiration pneumonia. Blood gas pattern was suggestive of acute-on-chronic respiratory failure. CXR showed chronic lung changes due to recurrent aspiration. Sleep study revealed nocturnal
hypventilation with desaturations. BiPAP support was initiated and continued at home. He weaned off BiPAP support at 28 months and his respiratory status remained stable. Repeated nocturnal SaO2 monitoring showed no desaturation.

**Conclusion.** NIV facilitated early weaning from mechanical ventilation in CMD, thereby minimizing the morbidity associated with prolonged intubation and the need of tracheostomy. BiPAP support might be more effective in managing these cases.

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**091 SLEEP DISTURBANCE AND EXECUTIVE FUNCTION IN CHILDREN WITH CYSTIC FIBROSIS**

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**Introduction.** Children with cystic fibrosis (CF) may be at greater risk from sleep disturbance due to nocturnal respiratory problems. Few studies have examined sleep disruption in this population. Sleep quality and sleep quantity have been shown to be correlated with neuropsychological performance, particularly tasks measuring Executive Functioning (EF). It is unknown whether children with CF have increased sleep disturbances compared to typically developing children, and subsequently experience greater EF deficits. The present study explored whether CF increases the risk of EF deficits related to sleep disturbance.

**Methods.** The sample consisted of 25 CF and 53 typically developing (TD) children aged 6-13 years. CF children were studied when free from respiratory exacerbations. Sleep was measured for one week using wrist-worn actigraphs (AMI). Neuropsychological tests were administered measuring attention, working memory, planning, verbal fluency, and inhibition. An aggregate score of EF (AEF) was calculated from standardised residuals to measure the overall effect of sleep disturbances on EF.

**Results.** A hierarchical multiple regression model was calculated with mothers education, sleep minutes, and group (CF or TD) as predictors. Sleep minutes made a significant contribution to the prediction of AEF, after controlling for mothers education ($R^2=.05$, $p=.04$). Group did not significantly add to the prediction of EF ($R^2=.00$, $p=.93$). Neither sleep minutes ($t(74) = 0.91, p > .05$) nor sleep efficiency ($t(74) = 0.81, p > .05$) were significantly different between the two groups.

**Conclusion.** Children with CF in this study were not at risk of increased sleep disturbance compared to TD children. Less sleep, as measured by actual minutes spent asleep, is a risk factor for poorer EF performance. The presence of CF did not increase this risk. However, disease severity was not measured in this sample and can vary considerably from patient-to-patient. Further research is needed to determine if disease severity affects the relationship between sleep and EF.

_Funded by The Gerald Kerkut Charitable Trust_

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**092 NOCTURNAL HYPOXAEIA IN CHILDREN WITH SICKLE CELL DISEASE REFERRED TO A PAEDIATRIC SLEEP SERVICE**

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**Introduction.** Nocturnal hypoxaemia is common in children with Sickle Cell Disease (SCD). Nocturnal oxygen therapy has been suggested if nocturnal oxygen saturations are less than 94%.

**Methods.** Overnight oximetry data on children with SCD referred to us were anonymised and examined to see how many children had mean oxygen saturations in sleep less than 94%; and to see if daytime hypoxaemia predicted nocturnal hypoxaemia or intermittent desaturation.

**Results.** Overnight oximetry data were available on 117 children over a five-year period. Median age was 7.5 years (range 1.4 to 17.6). Mean nocturnal oxygen saturation was less than 94% in 28 of 117 patients referred (24%). Daytime oxygen saturations were less than 95% in 10 of 93 patients (11%). The distribution of oxygen saturation data, age and 4% Oxygen Desaturation Index (ODI) were skewed. Data were transformed before modelling. Multiple linear regression demonstrated nocturnal hypoxaemia increased with age ($p<0.05$) and ODI ($p<0.001$), and decreased in line with daytime oxygen saturation ($p<0.001$). Daytime O2 less than 95.5% predicted mean nocturnal sO2 less than 94% with a sensitivity of 99% and a specificity of 91%; daytime O2 less than 93.5% predicted mean nocturnal sO2 less than 90% with a sensitivity of 100% and a specificity of 97%. Although daytime O2 was strongly correlated with ODI, it was a less useful predictor of intermittent desaturation (area under ROC 0.784, abnormal defined as ODI ≥ 5/h).

**Conclusion.** Nocturnal hypoxaemia is common in children with SCD referred to our service. Daytime hypoxaemia is predictive of nocturnal hypoxaemia but is less useful in screening for intermittent desaturation.
Radical). Iron status was assessed by transferrin saturation and averaged steady state hematology indices from the previous year.

**Results.** Higher transferrin saturation, but within the normal range and adjusted for age and alpha thalassemia deletion, was associated with lower nocturnal mean hemoglobin oxygen saturation (SpO\textsubscript{2}) (p=0.013, r\textsuperscript{2}=0.41). Higher transferrin saturation was also associated with higher delta-12s index, a measure of SpO\textsubscript{2} variability (P=0.004, r\textsuperscript{2}=0.23) and with the number of SpO\textsubscript{2} dips per hour of more than 3% from baseline (P=0.008, r\textsuperscript{2}=0.19). In addition, iron deficiency (transferrin saturation <16%) was associated with an increase of 2.2% in nocturnal mean SpO\textsubscript{2}.

**Conclusions.** These data suggest that higher iron availability, assessed by transferrin saturation, is associated with nocturnal chronic and intermittent hypoxia. Whether transferrin saturation is aetologically related to or simply a marker of the observed hemoglobin oxygen desaturation remains to be determined. The longer term consequences of iron status and hemoglobin oxygen desaturation in SCA warrant further detailed investigation.

**Support.** This research was supported by Wellcome Trust, UK; project grant 080025 and a WT Student Elective Fellowship (VL) 503831115.

094 SLEEP CHARACTERISTICS IN CHILDREN WITH GH DEFICIENCY

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**Introduction.** Growth hormone (GH) is preferentially secreted during slow-wave sleep (SWS) and the interactions between human sleep and the somatotropic system are well documented although only few studies have investigated the sleep EEG in children with GHD. The aim of this study was to evaluate sleep structure of children with dysregulation of the GH/insulin-like growth factor axis.

**Methods.** Laboratory polysomnographic sleep recordings were obtained from 10 children affected by GH deficiency (GHD) (3 males; mean age: 5.4 ± 3.6 SD, range: 2 - 10.1 years) and 20 normal healthy children (10 males; mean age: 6.3 ± 2.5 SD; range: 2.11 - 10.4 years). The classical sleep parameters were evaluated together with sleep microstructure by means of the cyclic alternating pattern (CAP) in GHD patients and compared to an age-matched control group.

**Results.** GHD children showed a significant decrease in total sleep time, sleep efficiency, movement time and in NREM sleep stage 2. Although some indicators of sleep fragmentation were increased in GHD children, we found a general decrease in EEG arousability represented by a significant global decrease in CAP rate, involving all CAP phase subtypes.

**Conclusion.** This study is the first that evaluates sleep microstructure by means of CAP in children with GHD. The apparent paradox of increased sleep fragmentation associated with a decrease of NREM sleep instability can be explained by the hypothesis that sleep fragmentation might lead to an increased homeostatic drive, leading to the decreased arousability. We hypothesize that the reduction of transient EEG slow oscillations (A1) is probably linked to an impaired GH secretion supported by both animal's models. The main result of this research was the demonstration of a "reduced arousal instability" as expressed by the significant reduction of CAP parameters.

095 EFFECTS OF OXYGEN THERAPY ON CENTRAL SLEEP-DISORDERED BREATHING IN AN INFANT PRADER-WILLI SYNDROME COHORT

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**Introduction.** Children with Prader-Willi syndrome (PWS) are known to have sleep-disordered breathing. In addition to hypersomnolence and obstructive sleep apnoea, central respiratory control abnormalities may be present from infancy. The aims of this study were to describe breathing patterns in infants with PWS, and the effects of supplemental oxygen in these infants.

**Methods.** Children with PWS attending a tertiary sleep clinic underwent full polysomnographic studies as a result of persisting neonatal oxygen requirement, or as screening for sleep-disordered breathing. Continuous oxygen saturations (SpO\textsubscript{2}) and transcutaneous carbon dioxide (tcCO\textsubscript{2}) were recorded. Central and obstructive events were defined in accordance with the American Academy of Sleep Medicine (AASM) 2007 scoring rules. Children who had significant hypoxia associated with central events were started on supplemental oxygen during sleep and followed at 3-monthly intervals with split-night studies (periods in both air and supplemental oxygen). Paired t-tests were used to compare data in air and oxygen arms for our subject cohort.

**Results.** Thirty split-night studies on 10 infants (8 female) aged 0.06-1.79 (mean 0.79, sd 0.44) years were undertaken. At baseline (i.e. air), children with PWS had a mean (sd) central apnoea index (CAI) of 6.9 (6.3) per hour, with accompanying falls in SpO\textsubscript{2}. Oxygen therapy led to statistically significant reductions in CAI, as well as improved SpO\textsubscript{2} (Table 1). No change in the numbers of obstructive events was noted.

**Table 1:** Effect of oxygen therapy on sleep-disordered breathing in infants with PWS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Air</th>
<th>Oxygen</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>%study with SpO2 &lt;90%</td>
<td>1.52 (1.8)</td>
<td>0.2 (4)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Lowest SpO2 (%)</td>
<td>77 (0)</td>
<td>89 (0)</td>
<td>0.06</td>
</tr>
<tr>
<td>Longest central apnoea (s)</td>
<td>10.3 (4.2)</td>
<td>9.8 (3.7)</td>
<td>0.68</td>
</tr>
<tr>
<td>Maximum tcCO2 (mmHg)</td>
<td>56.5 (7.5)</td>
<td>55.3 (6.5)</td>
<td>0.58</td>
</tr>
<tr>
<td>Central apnoea index (CAI)</td>
<td>6.9 (6.3)</td>
<td>3.7 (4.2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Obstructive event index (OEI)</td>
<td>3.9 (4.1)</td>
<td>5.4 (8.7)</td>
<td>0.37</td>
</tr>
</tbody>
</table>

*paired t-test

**Conclusion.** Infants with PWS have sleep-disordered breathing, which is predominantly central in origin, and cause significant hypoxia in some patients. Improvements in both central event indices and oxygenation were noted on oxygen therapy. Longitudinal work with this patient group would help to establish
Timing of onset of obstructive symptoms. Whether early recognition of central hypoventilation, and correction with oxygen alter the evolution of respiratory dysfunction and excessive daytime somnolence in later life remains to be seen.

096 DEXAMETHASONE THERAPY FOR ACUTE LYMPHOBLASTIC LEUKEMIA INCREASED SLEEP DURING THE NIGHT AND DURING THE DAY IN YOUNG CHILDREN
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Dexamethasone (Dex) is a mainstay in the treatment of Acute Lymphoblastic Leukemia (ALL). It has long been recognized that dexamethasone affects both daytime behavior and night-time sleep. An actigraph was used to evaluate sleep and wakefulness of patients with ALL during maintenance chemotherapy. Patients treated with Dex were evaluated at 3 windows: Dex-on days (1-5), Dex-washout days (6-15) and Dex-off days (16-28). Daytime wake and nighttime sleep parameters were analyzed from aggregated patient data for all three windows using the median and range. The non-parametric Friedman test was used to compare these parameters over the three windows, and the Wilcoxon Signed Rank Test was used for paired comparisons (used Bonferroni correction). During the 5 days of Dex treatment there was: lower daytime activity mean, greater numbers of naps (>5 minutes), earlier sleep onset time, increased nighttime sleep minutes, higher sleep efficiency, fewer nighttime awakenings from sleep (>5 minutes) compared to Dex-washout days (6-15) and Dex-off days (16-28). The effect of dexamethasone on wake and sleep was greatest during the 5 days of treatment, was intermediate during the 10 day washout window and was least during the 13 days at the end of the treatment cycle. These findings suggest young children with standard risk ALL experience increased sleep both during the day and night during dexamethasone treatment. The increase in daytime sleep in these children cannot be attributed to night-time sleep disruption; in fact these children went to sleep earlier and slept with fewer awakenings during dexamethasone treatment. The mechanisms for these changes in daytime and nighttime sleep are not understood.

097 TEMPERATURE DYSREGULATION AS AN EXPLANATION FOR POOR SLEEP IN CHILDREN WITH ECZEMA
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Introduction. Thermoregulatory capacity plays an important role in sleep initiation and maintenance. The onset of sleep is presaged by heat loss at the distal periphery and a consequent fall in core body temperature. This heat exchange is mediated by arteriovenous anastomoses in the hands and feet. Impaired thermoregulatory capacity is thought to underlie the poor sleep of some disorders, such as vasospastic syndrome, and is likely to play a role in other that have a thermoregulatory deficit. A potential but unexplored disorder with a temperature dysregulatory component is eczema. Eczema is characterised by heat intolerance and poor sleep but whether temperature dysregulation underlies the poor sleep remains unexplored.
Methods. Temperature data (hands and clavicle) was collected using a Mini Logger Series 200 (Respironics, Oregon USA) recording device connected to YSI 400 series thermistor probes from 14 controls (10.0y) and 18 children with eczema (11.3y) while they attended an overnight polysomnographic study. Patients were recruited from the hospital eczema clinic and controls through requests to patients for peers who might volunteer as participants. Sleep was collected using standard montage and scored by a technician who was blinded to subject group.
Results. The overnight hand temperature values were significantly lower at sleep onset in patients with eczema and remained depressed until the second half of the night. No group differences were evident in clavicle temperature and the distal-proximal gradient. Patients with eczema had significantly more nocturnal wakefulness. Lower hand temperatures were associated with a greater number of spontaneous arousals.
Conclusion. These preliminary findings suggest that thermoregulatory deficits may contribute to poor sleep in children with eczema, and raises the possibility that strategies for promoting thermoregulatory capacity may have therapeutic benefits in children with eczema.

098 SOCIOCULTURAL FEATURES AND CONSEQUENCES IN THE MEDICAL CARE OF A PATIENT WITH PRADER WILLI SYNDROME (PWS) IN THE PEDIATRIC SLEEPING LABORATORY
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Introduction. The case report points out the complex coherence of familiar structures in the problematic handling of a young turkish boy with all the difficulties of PWS with a background of his turkish culture. Children with a PWS often have an OSAS because of their hypotonia. Therefore regular polysomnographia is recommended. The anabolic metabolism demands a consequent diet poor in calories to avoid an adiposities, which can boost the OSAS.
Casuistry. In this paper we show the development of a six year old turkish boy with PWS. With three years already he developed a respiratory insufficiency during the night and a pulmonary high pressure. A treatment with sildenafil, furosemid and spironolacton and ventilation with BIPAP became necessary. The BMI went up to 52 kg/m² and the inflation pressure got worse because of a none compliance with the parents in the dietary plan as well as not providing the necessary ventilation. Special oxygen masks had to be prepared. The development of the motorical, lingual and social skills was stopped according to his age. The last option for the recovery of the boy was a special home for children which made sure that the therapy was followed through. In about twelve months the boy lost weight (BMI 42 kg/m²) and had a normal pulmonary pressure both was achieved by arranging ventilation during the night and keeping the right diet. The boy
managed to catch up in his motorical, lingual und social skills. 

**Conclusion.** The occurrence of cultural peculiarities and complex chronic illness represents a challenge for the child and the doctor in the pediatric sleeping laboratory.

### 099 SLEEP ALTERATIONS DUE TO RADIO-FREQUENCY ELECTROMAGNETIC RADIATION EXPOSURE DURING DEVELOPMENT

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**Objectives.** Disturbances of sleep by radiofrequency electromagnetic radiation (RF-EMR) emitted by mobile phone base stations type GMS are not well-established. This may be explained by the fact that this environmental stress is not strong enough to disturb homeostasis control. Additional stress (for example thermal stress) could increase adverse effects of RF-EMR exposure. However, in the literature, studies are carried out in adults exposed to thermoneutral environment even though not strictly controlled and there is a lack of information concerning growing organisms for which sleep is particularly important since it promotes cerebral and body restitutions. In the present study, it is held that RF-EMR exposition could potentiate sleep disturbances induced by thermal stress in juvenile rats.

**Methods.** 13 male Wistar rats (3 weeks-old) were exposed to RF-EMR during 5 weeks (exposed group) and compared to a control group composed of non exposed 11 animals. One week after surgery, sleep recordings were made on different days between 00 pm and 06 pm at thermoneutrality (environmental temperature of 24°C ± 1°C) and in a warm environment (31°C ± 1°C), combined or not with RF-EMR exposure. The polysomnographic data were visually scored in 30 second-periods to determine Wakefulness (W), Slow Wave Sleep (SWS) and Paradoxical Sleep (PS). The total durations of W, SWS and PS, the mean durations of each episode and their frequencies were analyzed with ANOVA.

**Results.** RF-EMR exposure did not modify the total duration of sleep stages and of wakefulness. When compared to the controls, a significant effect of RF-EMR exposure on the sleep structure was found at 31°C but not at 24°C: the mean duration of W episodes was increased (7.0 vs 5.0 min; p=0.001) while their frequency decreased (0.9 vs 1.8 episodes.h⁻¹; p<0.001). Similar results were found for SWS: the mean duration was increased (3.2 vs 2.8 min; p=0.01) while the frequency was decreased (12.1 vs 14.2 episodes.h⁻¹; p=0.006). The duration of PS episodes decreased from 1.7 vs 2.1min (p=0.03). Independently of the thermal load, PS frequency was increased by RF-EMR exposure (5.2 vs 3.8 episodes.h⁻¹; p<0.0001).

**Conclusion.** The influence of RF-EMR on sleep appears when exposure to these radiations was associated to a heat stress. This observation strongly suggests that RF-EMR modify the sleep structure by disturbing thermoregulatory processes.

### 100 FAMILIAL JOUBERT SYNDROME - RESPIRATORY MANIFESTATIONS

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Joubert syndrome (JS) is a rare autosomal recessive disorder characterized by the “tooth molar sign” on MRI (cerebellar vermis hypoplasia and brainstem anomalies), hypotonia, developmental delay/mental retardation, and, in variable degree, abnormal eye movements and irregular breathing pattern. Respiratory abnormalities described are usually seen in neonatal period and improve with age. The authors report two JS siblings with different respiratory abnormalities and an unusual evolution.

**Case 1** – Seven year old boy with mental retardation, JS diagnosed at 4 months due to irregular breathing pattern (tachypnea and apnea) during sleep and awakening, abnormal eye movements and feeding problems. Polysomnogram (PSG) showed episodic tachypnea and central apneas. A mild laryngomalacia was found on flexible bronchoscopy. Non-invasive ventilation, started at 5 months, is still maintained due to persistence of breathing abnormalities, confirmed by PSG.

**Case 2** – Nine year old girl with mild mental retardation, squint and cerebral vermis hypoplasia on MRI. JS was diagnosed at 3 years age, after her brother’s diagnosis. Although there were no clinical respiratory symptoms, namely snoring, a screening PSG was performed. It showed an irregular respiratory pattern and obstructive sleep apnea syndrome (RDI 8). On physical examination she has a normal growth, ovagal palate and small tonsils.

**Comments.** The difference in clinical severity of these two siblings confirms JS phenotypic heterogeneity. The improvement of respiratory abnormalities with age referred in literature has not been the evolution of case 1. Sleep respiratory investigation should probably be performed in all JS, even in those children without typical manifestations (neonatal tachypnea / apnea) or without symptoms reported by their parents. Respiratory abnormalities treatment might have a positive impact in the children development.

### 101 DELTA INDEX AS A PREDICTOR OF OSAHS IN PAEDIATRIC SICKLE CELL ANAEMIA

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**Introduction.** Sleep Disordered Breathing (SDB) is 4-6 times more common in black than white children. Morbidity may also be increased in those with sickle cell anaemia (SCA) but polysomnography (PSG) recorded in a hospital or dedicated sleep laboratory is expensive compared with oximetry conducted at home. In studies using oximetry in adults in the general population, delta12s values of >0.4 predicted an apnoea/hypopnea index (AHI) of >15 with 88% specificity and 70%. There are few data in children.

**Methods.** Children with SCA were recruited from Sickle Cell clinics in London to undergo overnight PSG in a hospital/lab setting. PSGs were analysed using standardised paediatric protocol (The AASM Manual for Scoring of Sleep and Associated Events) and delta12s was calculated blindly using DownLoad 2001 software (Stowood). Delta12s and % desaturation index were used in a regression model to predict AHI.

**Results.** 46 children with SCA (24 boys; median age 10, range 4-18 years) were recruited. The median (range) for Delta12s, 3% Desaturation Index and AHI were 0.96 (0-12.5), 0.24 (0.02-0.8) and 0.40 (0-18.2) respectively. 3%...
Desaturation Index was a stronger predictor of AHI than Delta12s (Table). Using the same cutoffs for Delta12s and AHI as the adult study, specificity and sensitivity were 100% and 89% respectively.

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<td>3% OAH I</td>
<td>3% Desaturation index</td>
<td>0.638</td>
<td>&lt;0.001</td>
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<tr>
<td>3% OAH I</td>
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Discussion. The combination of Delta12s and 3% Desaturation Index produced a similar R² to that previously reported in adults (R²=.7), suggesting Delta12s may be a useful diagnostic tool for SDB in pediatric SCA. However, a complication of SCA is low oxyhaemoglobin saturations, which could increase variability of SpO2 through mechanisms unrelated to OSA and the relationship between these variables should be explored further.

102 SLEEP ORGANIZATION IS STILL ALTERED IN HEALTHY 10-YEAR-OLD CHILDREN WITH IRON-DEFICIENCY ANEMIA (IDA) IN INFANCY

Introduction. IDA in infancy is associated with altered sleep organization in preschoolers, despite the correction of hematological variables after iron treatment. Since the effects of IDA later on have not been reported yet, we assessed sleep organization in otherwise healthy former IDA (FIDA) and control children 10-yr-old.

Methods. We studied 99 children (64 male, 35 female): 47 FIDA and 53 controls. All were participants in an ongoing cohort follow-up since infancy. Nighttime polysomnographic recording were performed in the laboratory following their usual sleep routine. Sleep-waking stages (non-REM sleep stages I, II and SWS, REM sleep, and waking) were visually scored according to international criteria. For this study the variables of interest were (a) sleep efficiency (SE: the percentage ratio between SWS+REM sleep total amounts and total sleep time), (b) total amount of sleep stages, and (c) number and duration of sleep stage episodes. Sex was used as covariate in all analyses.

Results. Mean age was 10.3±0.2 yr. As compared to controls, FIDA children showed lower SE (39.8±5.1 vs. 37.2±6.2%, p<0.05), percentage and episodes number of SWS (p<0.003), and higher percentage of non-REM sleep stages I and II (p<0.05). Finally, the first REM episode was longer in FIDA than in control children (10.8±8.2 vs. 7.5±5.0 min., p<0.02).

Conclusion. These results show differences in sleep organization between FIDA and control children at 10 years, emphasizing that IDA in infancy is associated with persistent alterations in sleep organization throughout child development. [Support: NIH HD 33487 and Fondecyt 1070668 grants].

103 SLEEP PROBLEMS IN CHILDREN WITH ACUTE LYMPHOBLASTIC LEUKEMIA

Difficulties with sleep are common in healthy children. One would expect that these problems would be exacerbated in children with cancer because of the effects of stress on the child and family, multiple medical appointments, painful medical procedures, and direct effects of often traumatic and toxic cancer treatments. Though sleep problems have been described in children with cancer referred for sleep evaluations, the prevalence of sleep problems has not been documented in an unselected population of children with cancer. Forty one children, ages 2-16 year (median 5 years) with acute lymphoblastic leukemia (ALL), on maintenance chemotherapy were screened for sleep problems using the children’s sleep habits questionnaire (CHSQ), pediatric daytime sleepiness scale (PDSS), parent and child fatigue scales (PFS, CFS), and actigraphy. Thirty nine percent of children were identified as problem sleepers on the CHSQ; 85.2% of children were sleepy based on PDSS; 56.3% were considered fatigued based on the CFS and PFS. The sleep problems moderately or severely impacted the parent’s sleep in 48% and the childrens sleep in 45% of the cases by the parents report. However, only 2 children were identified by their oncologists as having a sleep problem and were referred for a sleep evaluation.

Conclusion: Sleep problems are common in children with ALL but the problems often go unrecognized by their oncologists and the children are rarely referred for a sleep evaluation.
VI. Narcolepsy and excessive daytime sleepiness

104 SLEEP DEPRIVATION AS THE MAJOR CONTRIBUTION FOR DAYTIME SLEEPINESS AMONG SCHOOL-AGED CHILDREN EVALUATED FOR OBSTRUCTIVE SLEEP APNOEA

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Introduction. Excessive daytime sleepiness (EDS) is a common complaint among school-aged children, but the underlying etiology is diverse. Studies have shown that this can have a negative effect on school performance and cognitive function. The aim of this study was to investigate the relationship between daytime sleepiness, sleep hygiene, and polysomnographic characteristics.

Methods. 127 school-aged children had overnight polysomnogram (PSG) performed in our hospital due to clinical suspicion of obstructive sleep apnoea during 2007-2009.

Self-reported questionnaires were filled in prior to PSG on their sleep habit and whether they had experienced EDS. The demographic and polysomnographic characteristics were compared between the groups with and without EDS using independent t-test for continuous variables and chi-squared test for proportion. Statistical significance was defined as p<0.05.

Results. 67 out of 127 of the subjects reported EDS. This group of patients had a shorter sleep duration at home (8.7±1.1 hrs vs. 9.08±0.87 hrs, p=0.044). However, when they were given the opportunity to sleep in a controlled setting during PSG study, they could sleep longer (425±41.7mins vs. 398±69.3mins, p=0.016) and had a higher sleep efficiency (84.2±6.27% vs. 78.7±13.6%, p=0.0037). Regarding their sleep architecture, their non-rapid eye movement (NREM) sleep stage components were similar. The group with EDS spent a greater proportion on rapid eye movement (REM) sleep (16.3±8.05% vs. 13.2±7.9%, p=0.0316) though the time to REM onset was just comparable. These findings might reflect their pre-existing sleep-debt state.

There was no significant difference among the 2 groups with regard to their apnoea-hypopnoea index (5.98±10.66 vs. 5.82±9.11, p=0.93), respiratory-disturbance index (15.6±21.1 vs. 16.2±24.2, p=0.89) and arousal index (7.14±3.72 vs. 9.8±4.21, p=0.26).

Conclusion. Sleep apnoea and sleep disruption are not the primary determinants of EDS. EDS is more related to sleep duration at night, hence promotion of sleep hygiene is important in school-aged children.

105 FIRST PERSON ACCOUNTS OF CHILDHOOD NARCOLEPSY

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Introduction. Narcolepsy is a disorder of rapid eye movement (REM) sleep characterized by excessive daytime sleepiness (EDS), cataplexy, sleep paralysis, hypnagogic hallucinations and disrupted nocturnal sleep. Although the disorder is most often diagnosed between the ages of 15 and 30 years, a metaanalysis of 235 subjects found that 34% of all subjects had onset of symptoms prior to the age of 15 years, 16% prior to age 10 years, and 4.5% prior to age 5 years. The average time elapsed between onset of symptoms and diagnosis is 10 to 15 years, leading to misinterpretations and misdiagnosis. The aim of our study was to improve the knowledge and understanding of narcolepsy in children, by means an educational program for pediatricians and patients, based in “The First Person Accounts”.

Methods. Our seven narcoleptic children and parents were asked to explain their experiences, in their own words, from the beginning of the symptoms until the diagnosis of the narcolepsy and the way how to deal with it. We present these “The First Person Accounts” of our narcoleptic children.

Conclusion. With these “First Person Accounts” we hope that pediatricians will take the opportunity to learn about the issues and difficulties with diagnosis of narcolepsy by children. In addition, we hope that these accounts will give patients and families a better sense of not being alone in confronting the problems and also that can be anticipated by persons with serious difficulties in understanding the disorder.

106 SECONDARY NARCOLEPSY

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Introduction. Narcolepsy with cataplexy is a chronic disease that affects 1/2000 individuals, with prevalence close to 0.04 %. In addition to the idiopathic form of the disease, any insult of the central nervous system which affects the hypothalamic area or its surroundings may develop a “secondary narcolepsy”. The most frequent causes are: inherited disorders, tumours and head trauma.

Methods. We describe a 6 year old girl, healthful until December 2009, time in which she developed endocranial hypertension due to a hemorrhagic cerebrovascular accident in the left thalamus and internal capsule, with mass effect. The angio-IRM was normal. The suprasellar mass was then evacuated and later, she developed a secondary hydrocerephalus that was resolved with a ventriculo-peritoneal shunt. When she was derived to our Institution, she had a spastic quadripareisis, III bilateral oculopuparesis and moderate conscious impairment. She developed periods of “paroxistic disconnections” during the day and one probable diagnosis was “absence attacks”. We made a polysomnographyc study which showed no EEG or cardio respiratory abnormalities. During the diurnal recording she had 6 REM spontaneous sleep periods. A HLA DQB1 0602 typing was negative.

We started treatment with modafinil 100 mg/d and the improvement in daytime hypersonomolence was dramatic. A new polisomnographyc study a month later, showed also an improvement in the sleep variables also.

Conclusion. Secondary narcolepsy is a challenging diagnosis in a seriously neurological affected patient. Sleep attacks shouldn’t be confused with epileptic ones. The localization of the lesion must be taken into account, specially the supratentorial one. The central stimulants are efficient in these conditions so it is important to make an adequate diagnosis. The CSF hypocretin control would be useful in all cases in which narcolepsy is suspected.
107 COMPARISON OF SLEEP PATTERNS AND DAYTIME SLEEPINESS BETWEEN YOUNGER AND OLDER SIBLINGS
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Introduction. Sleep patterns in children and adolescents are influenced by significant number of biological, psychological, cultural and social factors. Little is known about the influence of familiar interaction on siblings regarding to sleep patterns and sleep habits. The aim of this observational study was to compare sleep patterns and daytime sleepiness in a sample of school-aged children and adolescents, and their older siblings.

Methods. The Children’s Sleep habits questionnaire (CSHQ) was used to assess children sleep patterns and sleep habits as reported by parents of 10 pairs of school-aged and adolescent siblings who were evaluated in order to initiate orthodontic treatment. A modified CSHQ was used to assess older than 12 years old brothers. Excessive daytime sleepiness score was assessed by the CSHQ 8-item Daytime Sleepiness subscale.

Results. The groups differed significantly (p<.05) regarding with age (9 ± 3.5 vs 14 ± 3.7) and BMI (17.8 ± 1.5 vs 19.4 ± 3.9) with a mean age difference of 4.2 ± 2.3 years old between siblings. Sleep patterns and sleepiness were similar in both groups of younger and older siblings (p>.05). Usual amount of sleep was negatively correlated with age (r=-.53; p=.02) and with bedtime (r=-.63; p=.003) but positively correlated with wake time (r=.61; p=.004). Usual bedtime was also positively correlated with age (r=.47; p=.03) and with daytime sleepiness score (r=.46; p=.04).

Conclusion. In this preliminary study we couldn’t find any differences between siblings regarding to sleep patterns or excessive daytime sleepiness even thought that sleep needs are theoretically different between them. These results suggest that negative social and cultural familiar influence may affect children sleep quality and daytime function compromising their individual sleep needs.

108 WHERE SLEEPINESS EVERY THIRD DAY IS NOT TRULY SLEEPINESS
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Sleep medicine practitioners evaluate many patients who are excessively sleepy. It behooves the practitioner to be aware of other conditions that may masquerade as sleepiness. This is the case report of a child with apparently strictly periodic sleeplessness that was finally diagnosed to be a manifestation of epilepsy. Emmalee presented at age seven with sleepiness since age two. This appeared to be periodic in that she was sleepy every third day. Emmalee would wake up as usual on those days, but would soon be noted to be very sleepy until mid afternoon. There were no additional features of narcolepsy. Sleep hygiene was excellent. Tonsillectomy had been performed for snoring. Wrist actigraphy was performed off medications (melatonin for sleep initiation and fluoxetine for mood). Average nocturnal sleep was ten hours. In addition, she slept for two to three hours in the morning twice a week. Polysomnography revealed decreased sleep efficiency with increased arousals. There were no periodic limb movements in sleep or sleep related breathing disorder. Multiple Sleep Latency Test revealed a mean latency of 8.6 minutes with no sleep onset REM periods. Brain Magnetic Resonance Imaging and Cerebrospinal Fluid hypocretin levels were normal. Complete evaluation at another reputed pediatric sleep clinic was noncontributory. Methylphenidate, amphetamines and dextro-amphetamines in various doses and short and long acting forms were futile. Modafinil only led to behavioral dyscontrol.

Observation of Emmalee in hospital during one of these typical sleepy days revealed a dazed and confused child. An electroencephalogram performed at this time was grossly abnormal with prolonged and frequent bursts of generalized spike and wave discharges, in marked contrast to a non-sleepy day where there were no interictal discharges. Emmalee has had complete resolution of her sleepy days on Divalproex Sodium!

109 NARCOLEPSY YOUTH AND PARENT SUPPORT GROUP: ENHANCING COPING AND TREATMENT COMPLIANCE
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Introduction. Narcolepsy is not only an uncommon diagnosis in children, but acceptance and treatment compliance can often be difficult to achieve with this population. It can be isolating for children when the treatment regimen has to be done during prime social times (for eg. naps at noon and after school). Given the powerful positive impact of group support, especially with rare medical conditions, we created the first Narcolepsy Youth and Parent Support Group in North America for our pediatric patients and their families. We will provide an overview of our process of implementing this innovative treatment and demonstrate how it has made a significant difference in the lives of these families.

Methods. Utilizing multidisciplinary staff (psychologist, social worker, and child life specialist), we planned and facilitated two branches of the group – youth and parents. The children were 8 – 17 years old, with time since diagnosis ranging from three weeks to several years ago.

Results. Encouraging key feedback from the youth group included the reassuring knowledge that they were not alone in coping with their narcolepsy and that they could still be “normal”. The older children provided helpful role modelling to the younger ones. There were reports of improved coping and compliance with treatment following the group meeting. For the parents, key aspects included finding it beneficial to share their stories with one another, and discuss their coping strategies. It was helpful that the experienced parents offered their expertise to those with newly diagnosed children. Follow-up indicated increased acceptance and enhanced coping of the parents.

Discussion. Being diagnosed with narcolepsy as a child can be extremely challenging and isolating for the child and the family. Bringing together narcoleptic children and their parents through a supportive group framework has been a powerful clinical tool to enhance coping and treatment compliance for both children and parents.
UNUSUAL CAUSES OF EXCESSIVE DAYTIME SLEEPINESS
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Introduction. Excessive daytime sleepiness (EDS) can cause significant disruption to the daily routines of children and their families. It is most frequently associated with obstructive sleep apnoea syndrome however it is a common symptom and other aetiologies should also be considered. We report three unusual causes of EDS.

Methods. Retrospective case note review.

Results. Case 1. Nine month old term infant with significant sleep disturbance and history of cow’s milk intolerance. Cardiorespiratory polysomnography confirmed restlessness with frequent awakenings each preceded by stretching and a loud cry. No respiratory events and normal simultaneous pH monitoring. He had positive endomysial antibodies. Commenced on a wheat free diet resulting in dramatic symptom resolution.

Case 2. Six year old with persistent lethargy. History of fragmented sleep, complaining of pains in his limbs exacerbated by increased daytime activities. Clinical features of hypermobility. Full polysomnography showed normal sleep architecture with disturbance associated with distress most likely secondary to leg pains. Normal periodic leg movement index with no significant respiratory events. MSLT excluded narcolepsy. Rheumatology assessment confirmed hypermobility with Ehlers Danlos Syndrome. Sleep symptoms improved with specialist input. Case 3. Sixteen year old with autistic spectrum disorder, epilepsy and asthma. Recent onset EDS with sleeping up to 22 hours/day. Full polysomnography revealed poor sleep efficiency (55%). No respiratory events. Spike and wave activity seen throughout non REM sleep. Not present on wake or REM EEG. Neurologists confirmed Electrical Status Epilepticus during Slow Wave Sleep (ESESS). Treatment with prednisolone resulted in significant sleep improvement.

Conclusions. Excessive daytime sleepiness may not always be due to a primary sleep disorder. Other possible aetiologies of sleep disturbance must be considered and treatment directed at the underlying cause.
restless sleep and some have a lot of simple leg movements. Sometimes sleep in lab doesn’t reflect the severity of the SDB and repeating sleep studies (PSG) in children may be a problem. The aim of this study was to correlate the amount of leg movements (LM) during sleep and the severity of the obstructive sleep breathing disorder.

**Methods.** The PSG of the children referred to the Sleep and Ventilation Lab for SDB from July 2008 to June 2010 were analyzed. Children with neuromuscular and chronic lung disorders were excluded. The PSG of 144 children with suspected obstructive SBD were examined. Significant LM and respiratory events were scored after AASM 2007. Obstructive sleep breathing disorder was classified into: upper airway resistance syndrome (UARS), mild, moderate and severe obstructive sleep apnea syndrome (OSAS).

**Results.** Sixty-three percent of the 144 children were male and the median age was 4 years (9 months to 18 years). The median time of total sleep was 424.5 min (179-547 min). The apnea-hypopnea index (AHI) varied from 0 to 75.7 (median 2.9) and respiratory disturbance index (RDI) from 0 to 75.9 (mean 2.9). Movement index (MI) varied from 0.4 to 129.1 (median 11.4) and arousal index (AI) from 0 to 71 (median 8.3). The SDB was classified as: UARS 43.8%; mild 17.4%, moderate 13.2% and severe OSAS 14.6%. MI had a positive correlation (p<0.01) with AHI, RDI and AI.

**Conclusion.** The amount of sleep leg movements may be a helpful additional value to decide about the severity of the SDB and therapeutic strategy.

### 112
**DO LEG MOVEMENTS PREDICT SEVERITY OF SLEEP BREATHING DISORDERS?**

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**Introduction.** Restless legs syndrome (RLS) in children is commonly reported, yet frequently undiagnosed. RLS can cause significant sleep disturbance and its associated deficits may have cardiovascular and neurocognitive consequences. Growing pains (GP) is often confused or synonymous with RLS, yet has been better researched and can be identified by parental questionnaire. RLS has not been able to be so distinguished, which renders an outstanding need. Therefore this study aimed to develop and validate a questionnaire to identify RLS in children.

**Methods.** A process of triangulation was undertaken to develop the RLS questionnaire. The literature, parent interviews and a children's focus group were the sources of initial data. Themes were extracted by independent review of the transcripts and the questionnaire was subsequently constructed and validated. The reliability of the questionnaire was examined using a same subject, repeated measures study.

**Results.** The interviews covered the parent’s accounts of RLS in six children (two girls, four boys) all aged between eight and 10 years. The focus group obtained the experience of children suffering RLS. A questionnaire of 11 questions was developed and validated from a small
convenience sample ($n=11$). Internal consistency yielded 65% and repeat measures reliability $\rho = 0.58$.

**Conclusion.** The questionnaire developed enables RLS to be identified in children specifically and for the first time. Such instrumentation may be used to establish prevalence, discriminate RLS from GP, to evaluate management programs and to assist treating clinicians.

### 114 LEG MOVEMENT ACTIVITY DURING SLEEP IN CHILDREN WITH ADHD IS NOT (YET?) PERIODIC

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Several studies suggested a relationship between Attention Deficit Hyperactivity Disorder (ADHD) and sleep related movement disorder, but this relation is not yet clear. Pennestri et al., (2206) showed that periodicity of limb movements (LMs) develops with age and cannot be found in children. Ferri et al. (2005) recommended a new approach for the detection and analysis of quantity, duration, amplitude and periodicity of LMs (Ferri et al., 2006). Following this approach, we evaluated the leg motor pattern during sleep in children with ADHD to describe LMs periodicity and distribution.

**Method.** As part of a multisite study thirteen children with ADHD (mean age 9.3 years) and 8 normal controls (mean age 9.4 years) underwent standard PSG. LMs were detected according WASM-IRLSSG (Zucconi et al., 2006) and AASM (Iber, Ancoli-Israel, Chesson, & Quan, 2007) criteria.

**Results.** ADHD children showed an increase in total LMs and periodic LMs (PLMS) index mainly during NREM sleep. Also the number of PLMS sequences was higher in ADHD, while the average duration of all types of LMs was not statistically different between the two groups, as well as the periodicity index (PI) which showed relatively low values during both NREM and REM sleep. Further ADHD children showed increased values for the majority of intervals $\leq 50$ s and on the highest PLMS nigh the difference is predominant for intervals $\leq 5$ s.

**Conclusion.** The low level of periodicity as measured by the PI and the absence of the typical “periodic peak” in the distribution of their inter-LM intervals might have implication for treatment of “PLMS” in ADHD children: we might hypothesize that dopaminergic agents will have little effect on these movements and the efficacy of the dopamine-agonists in ADHD might act through a different mechanism (Ferri et al., 2009).

### 115 EVALUATION OF ORAL IRON TREATMENT IN TWENTY-FOUR JAPANESE PEDIATRIC CASES WITH RESTLESS LEGS SYNDROME (RLS)

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**Introduction.** Restless legs syndrome (RLS) has been gradually recognized as a cause for insomnia in adults, but there have been few detailed reports about children with RLS. We describe seventeen pediatric RLS patients with emphasis on the diagnostic and treatment process.

**Cases and Methods.** All of them came to Osaka University Hospital from 2005 to 2009 with similar manifestation in that the patients complained about their bedtime problems. They consisted of nine males and eight females, aged from 2 to 14 (mean 6.8). All night polysomnography was performed in 13 out of 24 and the index for periodic limb movement during sleep (PLMSI) was counted. The diagnosis was done after the present criteria for the childhood RLS.

**Results.** The onset of RLS symptoms ranged from infancy to the age 14 (mean: 4.3). Positive family history was recognized in 17 out of 24 (70.8%). There were only 3 children with PSG-defined PLMSI more than 5 /hr among thirteen children to whom PSG was performed. Serum ferritin levels ranged from 9 to 62 (ng/ml; mean 26.3). Oral iron supplement was performed in all cases and was highly effective in 7, effective in 12, ineffective in 3 and indeterminable in 2. The ineffective two were the severest cases with infantile onset, and was treated with additional pramipexole, which was partially effective in both.

**Conclusion.** We describe seventeen pediatric RLS patients presented with bedtime problems which distressed their parents. All patients showed low concentration of ferritin, and iron supplementation was highly effective in pediatric RLS.

### 116 PERIODIC LIMB MOVEMENTS IN SLEEP (PLMS) IN A TWO-YEAR-OLD BOY WITH FAMILIAL HISTORY OF RESTLESS LEGS SYNDROME (RLS). CLINICAL, ANALYTICAL AND PSG FINDINGS

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**Introduction.** Recent literature has documented prevalence of restless legs syndrome (RLS) in both children and adolescents, about 1.9% for ages 8–11 years and 2.0% for ages 12–17 years. Parental history indicative of RLS is around 71% of children 8–11 years of age and 80% of adolescents 12–17 years of age. The early onset form is inherited in an autosomal dominant fashion, shows genetic anticipation and is more prevalent in females (2:1). The exact mode of inheritance remains controversial.

**Methods.** Case report.Two-year-old boy referred by ENT specialist due to snoring, disturbed sleep and daytime fatigue, with no history of witnessed apneas or abnormal breathing. Nocturnal video-polysomnography (PSG) was performed.

**Results.** PSG showed neither sleep disordered breathing nor parasomnias, but a severe index of PLMs (52.7/hour), presented during both NREM and REM sleep. The affection was mainly in the lower limbs, but it was also observed in the arms. The mother told about low ferritin levels, without clinical anemia. Familial history of Restless Legs Syndrome (RLS) was positive in maternal grandmother and the mother during pregnancy.
Iron supplementation was started and further clinical, analytical and PSG evaluation is scheduled.

**Conclusion.** This patient had a strong familial history of RLS. There’s an iron deficiency, with serum concentrations of ferritin lower than 50 mg/dL. Together with the PLMS, the diagnosis between RLS + PLMS VS PLMD arises. Pediatric cases of PLMD evolving into RLS have been described, as children grow up and meet the different criteria for RLS and PLMD, some of them not easy applicable earlier. This case also underlines the importance of video-PSG for the diagnosis of sleep disorders.

**117 ASSOCIATION BETWEEN FERRITIN LEVELS AND MARKERS OF RESTLESS LEG SYNDROME AND PERIODIC LIMB MOVEMENTS OF SLEEP**

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**Introduction.** Decreased serum ferritin (SF) levels have been associated with increased Periodic Limb Movements of Sleep (PLMS) and symptoms of Restless Legs Syndrome (RLS) in some pediatric studies; however, these associations have not been consistently observed.

**Methods.** In a retrospective chart review of 1-17 year olds referred for sleep problems, associations between SF levels obtained at initial evaluation and RLS symptoms endorsed on the Pediatric Sleep Questionnaire (PSQ). PLMS Index (PLMSI), and Apnea/Hypopnea Index (AHI) on overnight polysomnogram (PSG) were analyzed.

**Results.** Of 370 children with SF and PSQ available, mean age: 8.6±4.4 years, 59% male, 77% Caucasian, mean SF 33.5±22.7 ng/ml. 69% endorsed the PSQ RLS/PLMS subscale. Of 297 with SF and a PSG available, mean PLMSI: 4.5±8.3, PLMSI ≥5/hour: 28.6%. SF was not significantly correlated with RLS/PLMS subscale on PSQ, but was with the PLMSI on PSG (r= -0.14, p=0.015). Those with SF <50 ng/ml had a higher percentage with a PLMSI ≥5 (32% vs. 15% X²=6.83, p=0.009). However, those with an AHI ≥1 also had higher PLMSI (5.2 vs. 1.7 F=8.85, p=0.003) and had a higher percentage with a PLMSI ≥5 (32% vs. 15% X²=4.72 p=0.03). In the subset of children with an AHI ≥1 (n=73), SF was not significantly associated with either measure of RLS or PLMS.

**Conclusion.** Lower SF levels were not associated with RLS symptoms or higher PLMSI when elevated AHI was taken into account. This data suggests caution in using the 50ng/ml cutoff for SF levels in the absence of an elevated AHI.

**118 PERIODIC LIMB MOVEMENTS OF SLEEP IN CHILDREN TREATED WITH SELECTIVE SEROTONIN REUPTAKE INHIBITORS**

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**Introduction.** The pediatric literature is very limited regarding the prevalence and etiology of periodic limb movements of sleep (PLMS) in children. Previous studies have shown that some antidepressants may increase PLMS in the adult population. The purpose of this study is to assess the prevalence of PLMS with use of selective serotonin reuptake inhibitors (SSRIs) in the pediatric population.

**Methods.** Forty-one consecutive patients on SSRIs undergoing a overnight diagnostic polysomnography in one year at a single center were identified. Median age was 15.4±4.0 of which 10 were boys. Antidepressants included citalopram/escitalopram (n=15), fluoxetine (n=14) and sertraline (n=12). PLMS were scored according to American Sleep Disorders Association criteria and the PLM index (PLMI) was calculated.

**Results.** Thirteen out of 41 (31.7%) children on SSRI had PLMS, while only 77 (7.8%) out of 982 children undergoing an overnight diagnostic polysomnography in one year and not on SSRI had PLMS. Specifically, children on SSRI had a 5.4-fold higher risk of having PLMS than the children not on SSRI; OR: 5.45 (CI 2.71-10.96). The median PLMI in patients on SSRI was significantly higher than the median PLMI of patients not on SSRI (11.2 IQR 12.6, and 6.5 IQR 5 respectively; p=0.04). The children on different SSRI had different median PLMI: citalopram/escitalopram 8.0 IQR 5; fluoxetine 5.1 IQR 5 and sertraline 14.1 IQR 5; p= 0.2.

**Conclusion.** The risk of developing PLMS in children on SSRI is significantly higher and the PLMI in children who had PLMS on SSRI is higher than in children with PLMS without SSRI. It is thus important to rule out PLMS in a patient taking SSRI and complaining of leg pains at night, disturbed sleep and excessive daytime sleepiness. Prospective studies need to be developed to assess the prevalence of PLMS, Restless Leg Syndrome and REM Sleep Behavior Disorder in children with SSRI use including which SSRIs have a higher prevalence than others. This may have therapeutic implication in choosing the appropriate antidepressant so as not to induce a sleep disorder.
VIII. Sleep breathing disorders

119 PREGNANCY OUTCOMES OF MATERNAL OBSTRUCTIVE SLEEP APNEA
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Sleep disturbances occur commonly during pregnancy. Many pregnant women report an increased desire to
sleep, and complaints of snoring, restlessness, fatigue, and sleep disruption are often noted. Recent studies
suggest that snoring and sleepiness during pregnancy can result in the development of serious adverse conditions,
such as pre-eclampsia and intrauterine growth retardation (IUGR) in the fetus. The objective of our study was to
determine if snoring and/or excessive sleepiness during pregnancy were associated with unfavorable pregnancy
outcomes. The study group consisted of post-partum mothers within 24 hours of delivery of a healthy infant at
The Valley Hospital in Ridgewood, NJ. Mothers were randomly chosen and they were asked to complete 2
standardized questionnaires, the Epworth Sleepiness Scale (ESS) and the Snoring Symptoms Inventory (SSI).
These questionnaires are used to identify symptoms of obstructive sleep apnea (OSA), specifically, snoring and
excessive daytime sleepiness. In addition, medical chart reviews were conducted, looking at pregnancy, labor, and
delivery information and infant growth and well-being data. We enrolled 107 mothers in our study. The mean
maternal age was 34 years (SD 5). The most common method of delivery was a scheduled Caesarian section
(p=0.009). In our population, pregnant women who had mild obstructive sleep apnea, 18% had moderate and
elevated scores on the ESS and SSI were associated with adverse maternal outcomes. We conclude that OSA
syndrome was associated with obstructive sleep apnea. 11(4.6%) children had Trisomy 21 and they were
significantly at risk of obstructive sleep apnea (p=0.038).

Conclusions. Though there were more males undergoing overnight polysomnography, sex was not a risk factor for
obstructive sleep apnea. Obesity was the main risk factor associated with obstructive sleep apnea. Children with
Trisomy 21 are at risk of obstructive sleep apnea. Adenotonsillectomy significantly improved the
obstructive sleep apnea.

121 SNORING AND SLEEP-RELATED SYMPTOMS IN FINNISH SCHOOLCHILDREN
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Introduction. Sleep disordered breathing varies between light snoring and severe obstructive apneas causing
various types of clinical symptoms. The prevalence of snoring among children is reported approximately 10%
in Western countries. The most common cause of SDB is enlarged tonsils. The aim of our study was to study
sleeping habits, snoring and possible related factors in ordinary Finnish school children age 7 to 10 in the city of
Tampere.

Methods. We used a parental questionnaire (a Finnish version of the sleep disturbance scale for children) for
collecting information. The scale consists of six subscales: disorders maintaining and initiating sleep, sleep-disordered breathing, disorders of arousal or nightmares, sleep-wake transition disorders, disorders of excessive somnolence or daytime attention and sleep hyperhydrosis. The following issues were also assessed:
age, weight and height, previous adenotonsillar surgery, upper respiratory infection, history of allergic rhinitis and
asthma of the children, and parental smoking and snoring of the parents or siblings. SPSS 13.0 was used for
statistical analysis (cross tabulations, Fisher exact test, the Chi-square, logistic regression).

Results. There were 33/289 (11.3%) often or always
snoring children. There were no statistical age, gender, parental smoking and paternal snoring differences
between snorers or non-snorers. Snorers were more often worried at bedtime, had more muscle twitching when
falling asleep, and night awakenings than non-snorers. They had more apneas, night sweating and difficulties
with getting up in the morning, and their mothers and siblings snored more often. Snorers had more tiredness
and inappropriate falling asleep during the day, more absent mindedness, hyperactivity and distractibility by
outside factors. In the logistic regression analysis the factors most connected with snoring were sleep-related
apneas, tiredness in the morning and sensitivity to outside distraction.
Conclusions. In conclusion, the prevalence of snoring in Finnish schoolchildren is similar to the figures in other countries. Disturbed sleep and daytime problems are more common among snorers than non-snorers.

122 SLEEP CHARACTERISTICS OF TODDLERS SUFFERING FROM MODERATE TO SEVERE OSAS BEFORE AND AFTER ADENOIDECTOMY AND / OR AMYDALECTOMY (ENT SURGERY) Scaillet S,1 Deyroede B,1 Mansbach AL,1,2 Dramaix M,2 Groswasser J,2
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Introduction. The aim of this study was to compare a group of young children to themselves, before and after ENT surgery.

Method. 24 children with an average age of 1.8 years (median 1.8, min 0.6; max 3) suffering from OSAS underwent an overnight sleep polysomnography 41 days prior to ENT surgery (median 37, min 7; max 99). These same children benefited from a second sleep study 48 days after surgery (median 45, min 18; max 96).

Result. The children’s obstructive sleep apnea index (OSAI) dropped from 21.9 (median: 18.5, min 7; max 79) to 0.4 (median 0.3, min 0; max 1.9). The mean time interval between the first and the second PSG was 90 days.

The mean saturations and the mean heart rate during REM and NREM sleep, the minimum saturation value within total sleep time and the number of desaturation clusters changed significantly after ENT surgery. A Wilcoxon Signed-rank test was applied to the results. As age may influence the HR during sleep, a linear regression analysis was applied to the HR values before and after ENT surgery. This analysis showed that while age influences the HR after ENT surgery (Rsquared=0.318, in REM sleep and 0.404 in NREM sleep), it had little influence on the HR prior to surgery (Rsquared=0.027 in REM sleep and 0.045 in NREM sleep).

Conclusion. OSAS in three year olds perturbs the autonomic regulation of HR. Further heart rate variability studies are necessary to determine how the presence of OSA influences the ANS. This effect is reversible.

123 SNOARING IN INFANTS IS ASSOCIATED WITH LESS MATERNAL SLEEP DURATION, MORE MATERNAL CONCERN AND HIGHER MATERNAL POSTNATAL DEPRESSION SCORES Piteo A1,4 Lushington K1,4 Roberts R1,4 van den Heuvel CJ1,5 Nettelbeck T1,5 Kohler M1,5 Martin J4,5 Kennedy D4,5
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Introduction. It is well established that maternal sleep in the postpartum period is often disrupted and restricted due to frequent night waking by infants. In turn this is associated with poor parental sleep quality and depressed mood. Furthermore, it is known that parental concern about child breathing during sleep in infants with Sleep Disordered Breathing (SDB) is common. Consequently, parents report that they often stay awake at night to watch their child sleep and it is probable that their sleep duration and quality would be adversely affected, in turn, affecting maternal daytime functioning and contributing to depressive symptoms. The aim of this study was to examine whether mothers of habitual snorers had more maternal concern, less sleep duration, poorer sleep quality and higher post natal depression (PND) scores compared with mothers of controls.

Methods. A total of 19 habitual snorers (snoring ≥ 3 nights a week) and 83 control infants (never snoring in the absence of a cold) were assessed at 6 months old. Parents completed infant and parent sleep surveys and the Edinburgh Postnatal Depression (PND) scale at each assessment.

Results. Compared to mothers of control infants, mothers of habitual snorers had higher PND scores. A significantly larger proportion of mothers of habitual snorers had less sleep duration and more concern about their child’s breathing during sleep. There were no significant differences between mothers of habitual snorers and controls for sleep quality.

Conclusions. Snoring in infancy has an impact on a mother’s functioning. Considering the consequences of prolonged sleep restriction/disruption on daytime functioning in adults, it is necessary to consider interventions that will help mothers improve sleep and mental health scores in the first year of life.

124 NEUROCOGNITIVE-DEVELOPMENTAL ASSESSMENT AND POLYSOMNOGRAPHY IN CHILDREN WITH SNOARING Aslan AT1, Soysal S1, Geyik E1,2 Kokturk O2
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Objective. Many mental and behavioural disorders during childhood and adolescence are associated with sleep difficulties. Our objective is to outline Attention Deficit/Hyperactivity Disorder (ADHD) in snoring patients ve to determine whether the rate of ADHD and learning disability (LD) differs between patients who were diagnosed as OSAS with those who don’t have OSAS by polysomnography.

Methods. Twenty two children (14 male, 8 female; mean age: 9 year) who have snoring and observed sleep apnea were evaluated in terms of obstructive sleep apnea syndrome, ADHD and LD. Neurocognitive assessment was done by Stroop, Wisconsin Cart Sorting Test and Developmental assessment was done by Denver Developmental Screen. Nocturnal video-polysomnography were also administered.

Results. OSAS was observed in 17 patients and polysomnography was normal in 5 patients. While ADHD was detected in 5 patients (29 %) out of 17 in OSAS observed group. There were one (20%) patient with ADHD in the group without OSAS. LD was observed in 2 patients in both groups.

Conclusion. This study underlines the rate of ADHD is increased in OSAS detected patients who are snoring and have sleep apnea. It is particularly important to investigate ADHD patients in terms of snoring and sleep apnea and to perform polysomnography for OSAS. The sample size was small, therefore, more research is needed to determine the effects of OSAS on ADHD and LD.
125 INFLUENCE OF AGE AND BMI ON NEUROPSYCHOLOGICAL AND BEHAVIORAL IMPROVEMENT AFTER ADENOTONSILLECTOMY IN CHILDREN
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Introduction. Cognitive and behavioral symptoms are common in children with sleep-disordered breathing (SDB) but their resolution after treatment by adenotonsillectomy (AT) is variable. Children's age and body mass index (BMI) could influence outcomes, but have not yet been examined in this context.

Methods. Children (n=100, age 3-8 years) referred for AT based on pediatric or otolaryngology office-visits were evaluated before and 6-months after surgery. Evaluations included: height, weight, nocturnal polysomnography, neuropsychological tests, and parent rating scales of children's behavior. SDB was determined using respiratory disturbance index (RDI)>1, (95% of sample at baseline). Repeated Measures ANOVAs were computed examining effects of Age (3-5, 5.1-8 years), BMI (90th percentile=heavier; <90th percentile=lighter) and Session (pre- and post-AT) on respiratory disturbance index (RDI), cognition, and behavior. Analyses included age-adjusted scores from the Stanford-Binet: 5th-Edition Abbreviated IQ and NEPSY Memory and Attention/Executive domains.

Results. A higher proportion of lighter children, in comparison to heavier peers, demonstrated a reduction in RDI between baseline and follow-up (p=.03; Lighter %RDI=1 Baseline=93%, Follow-up=57%; Heavier %RDI=1 Baseline=96%, Follow-up=85%). For executive functioning, younger children demonstrated more significant age-adjusted gains than older children, regardless of BMI (p=.003). For IQ, there were no significant main effects or interactions. For memory, a significant BMI by Session interaction was observed. Although both BMI groups improved, heavier children demonstrated the largest improvement (p=.002; lighter change=0.5 Standard Deviation, heavier change=1.0 SD). Regarding behavioral measures, regardless of age or BMI, significant improvements were evident in all groups over time for oppositional (p=.002) and hyperactive (p=.01) ratings.

Conclusions. Age and BMI may have significant impact on prognosis for neurobehavioral improvement following AT. In this study, although lighter children demonstrated greater reduction in RDI, heavier children improved most in memory scores. SDB parameters may be more reversible at younger ages, but memory may be particularly sensitive to obesity-related factors in children with SDB.

126 DIFFERENCES BETWEEN PARENT AND TEACHER REPORTS OF BEHAVIOR IN SNORING CHILDREN
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Introduction. Despite problematic behavior being widely reported in children with Sleep Disordered Breathing (SDB), there is little consensus as to which behavior domains are most affected by SDB. In addition, previous studies have been limited by the need for objective sleep measures and a reliance on parent report only. This study assesses sleep in children with SDB and controls using polysomnography (PSG), while assessing child behavior from the perspectives of parents together with teachers.

Methods. Data was available for 19 snoring children aged 3-12 years awaiting adenotonsillectomy (SDB group) and 27 age and gender matched non-snoring controls from the community. Children were screened for prior diagnoses of other medical and/or behavior and learning disorders. All children underwent PSG and both parent and teacher ratings of daytime behavior.

Results. Snoring children displayed significantly greater severity of SDB on PSG compared to controls. Despite increased problematic behavior in SDB children on both parent and teacher reports, the agreement between parents and teachers was poor. Parental report indicated that SDB children had greater somatic complaints, emotional/affective problems, anxiety and withdrawn behavior, while teacher reports indicated higher emotional/affective problems, oppositional and aggressive behavior, and inattention.

Conclusion. Frequently snoring children display increased problematic behavior compared to non-snoring controls, however there is poor agreement between reports by parents and teacher with the exception of emotional/affective problems. This study indicates that the behavior problems reported in children with SDB may be context dependant and underpinned by affective problems.

127 DIAGNOSTIC CHALLENGES OF SLEEP APNEA IN CHILDREN AND INFANTS
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Introduction. Sleep apnea is relatively highly prevalent condition in children and adults. Modern diagnostic methods include clinical presentation, comprehensive physical, x-ray, overnight polysomnography, magnet resonance (MR) imaging, computer tomographic (CT) scans, cephalometry, laboratory examinations, contactless monitoring of the motion of the infant’s abdomen, etc. We aimed at identifying the set of most suitable procedures for early detection of sleep apnea in childhood.
Methods. During the period from January 2007 till June 2010, 12 patients with various sleep breathing disorders were diagnosed in St. Petka Eye and Ear Clinic of Varna, Bulgaria. They were 7 boys and 5 girls aged between 4 and 15 years at a mean age of 9.5±5.5 years. Along with detailed physical examination, the following diagnostic methods for the specification of sleep apnea were used: rhinomanometry (in 10 patients), rigid fiberoptic endoscopy for palatal tonsillar hypertrophy (in 8 patients), somnography in a standard laboratory setting (in 6 patients), CT scans (in 4 patients), MR imaging (in 3 patients), cephalometry (in 2 patients), and skull radiography (in one patient).

Results. The somnographic results showed alterations of sleep efficiency in 4 patients (in 33.3% of the cases) and of sleep latency in 6 patients (in 50% of the cases). There were elevated apnea-hypopnea index (in 5 or 41.7% of the patients) and arousal index (in 2 or 16.7% of the patients). An absolute pulse rate increase was found in 3 or 25% of the patients and oxygen saturation - in 2 or 16.7%. The rest diagnostic methods contributed to the differentiation of sleep apnea from the other common sleep breathing disorders, too.

Conclusion. Timely diagnosis of sleep apnea in children and infants by overnight somnography often necessitates the additional application of the other appropriate diagnostic methods such as skull radiography, MR imaging and cephalometry.

128 INSTITUTIONALIZATION OF RESEARCH IN THE FIELD OF SLEEP APNEA IN INFANCY AND CHILDHOOD

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Introduction. Institutionalization, interdisciplinarity and internationalization are essential intrinsic features of modern science (D. Tomov, 2001). Recent advances in the topic of sleep apnea in adults and children necessitate comprehensive analyses of the international scientific communications which could contribute to further improvement of research quality in smaller countries.

Methods. A problem-oriented retrospective search on sleep apnea in children and infants revealed a continuous publication output growth as reflected in Web of Science (WoS), MEDLINE (through EBSCO), Scopus and EMBASE in 1985-2009.

Results. There were 2931, 3374, 4547 and 5073 abstracted publications. Original articles prevailed (1979 in WoS, 3076 in EMBASE and 3183 in MEDLINE) followed by review articles (275, 1132 and 612), conference papers and abstracts (518, 413 and 5), etc. Most papers were authored by the USA scientists as in any other fields. In WoS, next came Australia, Canada, UK, France (with 189, 183, 180 and 144 abstracted papers) and 58 other countries. The authors worked in more than 1780 scientific institutions, e.g. University of Louisville, Stanford University, University of Pennsylvania, University of Sydney, etc. English language dominated in all data-bases. In WoS, 571 journals dominated by “Sleep” (241 papers), “International Journal of Pediatric Otorhinolaryngology” (134), “Pediatrics” (117) and “Pediatric Pulmology” (115) contained these primary publications. In EMBASE, the corresponding figures were 222, 146, 115 and 83. The publications were assigned to 83 single subject areas dominated by pediatrics (with 975 papers or 33.25%), clinical neurology (543 or 18.52%), respiratory system (449 or 15.31%) and otorhinolaryngology (429 or 14.63%). D. Gozal, C. L. Marcus, C. Guilleminault, L. Khrairandish-Gozal and A. Kahn were the most productive investigators (with 139, 78, 61, 48 and 45 papers).

Conclusion. The rich collection of publications on sleep apnea and author’s affiliations worldwide could help creating successful international interdisciplinary collaboration teams and thus promote research effectiveness.

129 COMPARISON OF OBSTRUCTIVE SLEEP APNEA BEFORE AND AFTER ADENOTONSILLECTOMY AMONG IRANIAN CHILDREN

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Introduction. The obstructive sleep apnea among children is mainly due to hypertrophy of tonsils with hypertrophy of adenoid and the adenotonsillectomy surgery improves the symptoms. So the aim of this study was to compare the sleep disorder symptoms of adenotonsillectomy candidate children before and after adenotonsillectomy surgery.

Methods. Thirty children (15 girs and 15 boys, aged 3-12 y) having sleep disorder who were candidate for adenotonsillectomy surgery recruited and standard DSHQ and BEARS questionnaire completed by interviewing their parents conducted before and 6 months after adenotonsillectomy surgery. The sleep disorder symptoms compared using t-test.

Results. Six months after adenotonsillectomy surgery the snoring, difficulty of breathing during sleep, observed sleep apnea, night sweating, nightmare, awakening during night significantly reduced from 86.7, 63.3, 86.7, 39.1, 19.2, and 22.2 percent to 13.3, 13.3, 10, 0, 0, and 0 percent respectively (P < 0.001). Also observed daytime symptoms including difficulty of awakening in the morning, daytime sleepiness, and poor appetite among these children significantly reduced from 53.3, 39.3, and 75 percent to 6.7, 14, and 10 percent respectively. Moreover psychologic disorders such as hyperactivity, anxiety and irritability, and poor learning which were 22.7, 14.7, and 13.6 percent among these children did not observed after adenotonsillectomy surgery. Further, the physical growth, nasal obstruction, chronic coughing, difficulty in swelling, getting flue, and hearing problem significantly improved after adenotonsillectomy surgery. Conclusion. Although adenotonsillectomy surgery significantly improves the related symptoms of sleep apnea, but some children may suffer from related symptoms after adenotonsillectomy surgery. These children may need follow up by polysomnography and using CPAP as second choice of medication.

130 HOMOZYGOTIC TWINS AND OBSTRUCTIVE SLEEP APNEA

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Introduction. Obstructive sleep apnea (OSA) has been shown to be a familial disorder. And search for genetic association has been performed.

Method. We identified 10 pairs of homozygotic twins with symptoms of OSA. We performed a systematic study of each pair. Homozygocity was first demonstrated by DNA analysis. Each child had clinical pediatric evaluation, sleep/wake study including attended polysomnography with nasal cannula pressure transducer, oto-laryngological and cranial-facial anatomy evaluation by specialists including performance of frontal and lateral cephalometric evaluation. Tests for sleep/wake and cephalometric evaluation were first scored blind by specialists kept unaware of relationship.

Results. The mean age at time of study was 7.5 ± 3.6 y/o, mean BMI 20.9 ± 4.2 kg/m². All children had overall normal pediatric development for age, height and weight. None of them was overweight. All pairs of twins (6 girls) were discordant for OSA. Each pair was discordant for clinical symptoms, and polysomnographic results with discordant apnea-hypopnea-index (AHI). In 4 pairs out of 10, one twin scored with normal AHI while the other was abnormal and in 6 pairs there were major difference in AHI score. When all twins were tabulated together the twins with no SDB symptoms had significant AHI difference. Cephalometric evaluation showed that the SDB affected twin presented with difference at evaluation compared to the normal twin. The anatomical changes were not the same for all children but affected the primarily the mandible in about 80% of the cases. A pair by pair analysis was performed that showed variability in types of anatomical risk factor finding. A retrospective analysis showed that the affected twin was always the twin with smaller birth weight.

Conclusion. Pediatric homozygote twins are discordant for OSA symptoms, PSG, and anatomical risk factors. Environmental factors either in utero or early in life may have a strong influence on OSA occurrence in childhood.

131 CARDIAC, LUNG AND BRAIN THROMBOSIS IN A CHILD WITH OBSTRUCTIVE SLEEP APNEA

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A 3 year old boy with failure to thrive and severe adenotonsillar hypertrophy with a clinical presentation of prolonged obstructive sleep apnea (OSA), was referred to the emergency room due to severe respiratory distress and anasarca. Echocardiography revealed right heart failure, a cystic lesion in the right ventricle and severe pulmonary hypertension. D-dimer was elevated but spiral computerized tomography (CT) and lung scan did not show any perfusion defects. Excision of the cardiac lesion during open heart surgery, lung biopsy and adenotonsillectomy were performed. Pathological examination showed an intracardiac organized thrombus and eccentric intimal fibrosis of the pulmonary arteries – which is pathognomonic for pulmonary arterial microemboli. Brain CT revealed vein thrombosis of the left sigmoid sinus. Blood tests for inherited thrombophilia were normal. Today, 5 years after adenotonsillectomy, the child is normally developed, completely asymptomatic, free of any medications for more than 3 years, and has a normal echocardiography. The procoagulant state associated with obstructive sleep apnea may explain the multifocal thrombosis (heart, lung and brain) that were found in our patient. This child had no other risk factors for his procoagulant state such as: no family history for cardiovascular or thrombotic events, hypertension, and obesity, and had negative blood test for inherited thrombophilia. The rapid and full recovery from all symptoms, including the respiratory symptoms, developmental delay, and behavior problems after adenotonsillectomy support the diagnosis. This case report may indicate that prolonged OSA can be a procoagulant state which can cause severe cardiovascular morbidity in children.

132 ACCIDENTAL DEATHS DURING SLEEP IN CHILDREN WITH HISTORY OF OSA AND VERY AGITATED SLEEP

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2Stanford University Sleep Medicine Program, Stanford, CA, USA

The clinical symptoms associated with OSA are well-documented and multi-faceted, including agitation and disrupted sleep, parasomnias (sleepwalking, sleep terrors, enuresis etc.), and noisy breathing at night. Pediatric sleep-disordered-breathing (SDB) is most commonly related to a small upper airway. The nasomaxillary complex and the mandible are the bone structures supporting the soft tissues lining the upper airway. We present a retrospective series of 3 young children who have died between 2006 and 2008 at time of sleep. All children had post mortem evaluation in a forensic unit specializing in the investigation of abrupt deaths in infants and young children in the 92th department of France depending of the city of Versailles Court and investigating judges. The unit utilizes a detailed protocol for investigation of abrupt death in young children, including thorough death scene investigation, investigation of the child’s health around the time of death (via pediatric records), review of the sleep history from family and medical reports and a thorough autopsy performed by a single forensic pathologist. Deaths occurred in the context of abnormal sleep which had been present for months to years with excessive movements associated with sweating during sleep, finding the child rotated in bed with “feet on the pillow” and including seating-up with sleep mumbled, talking and crying. Snoring and heavy noisy breathing was present in two cases. The “agitation” during sleep was significant enough to have been noted by each child’s parent and mentioned to pediatrician and in one case documented by photo with child sleeping with head in hyperextension since 3 months of age. There was presence of acute upper airway infection at time of death in case 1 and 3. Deaths were related to accidental strangulation due to bedding and abnormal movements during sleep. Autopsy demonstrated important narrowing of upper airway due to treatable anatomical risk-factors for OSA.

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133 UNPREDICTED DEATHS IN INFANTS AT TIME OF SLEEP AND ABNORMAL NASAL PASSAGES (PART B)

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Infants at birth are considered obligatory nasal breathers, and nasal breathing is the normal way to exchange air during sleep. However, in the setting of abnormal nasal resistance, a transition to mouth-breathing occurs at a variable age after birth; this is associated with an increase in respiratory effort during sleep.

We present a retrospective series of 4 infants who have died between 2006 and 2008 at time of sleep, and for whom death was determined to be “abrupt”. All of these children had post-mortem evaluation in a forensic unit specializing in the investigation of abrupt deaths in infants and young children in the 92th department of France (western suburbs of Paris) depending of the city of Versailles Court and investigating judges. The unit utilizes a detailed protocol for investigation of abrupt death in young children, including thorough death scene investigation, investigation of the child’s health around the time of death (via pediatric records), review of the sleep history from family and medical reports and a thorough autopsy performed by a single forensic pathologist. The deaths were considered to be abrupt and without clear explanation at the death scene.

All infants at autopsy presented evidence of mild rhinitis or rhino-pharyngitis. Examination showed presence of anatomically small upper airway with presence of narrow nasal valves, a finding known to be associated with increase nasal resistance. Infants #1, 2, 3 normally slept prone infant #4 slept supine.

<table>
<thead>
<tr>
<th>Case #1</th>
<th>Case #2</th>
<th>Case #3</th>
<th>Case #4</th>
</tr>
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<tbody>
<tr>
<td>Age</td>
<td>40 days</td>
<td>50 days</td>
<td>60 days</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
</tr>
<tr>
<td>Behavioral state</td>
<td>Before autopsy</td>
<td>After autopsy</td>
<td>Post-mortem</td>
</tr>
<tr>
<td>Information</td>
<td>Abrupt death</td>
<td>Abrupt death</td>
<td>Abrupt death</td>
</tr>
<tr>
<td>Information before autopsy</td>
<td>Unexplained</td>
<td>Unexplained</td>
<td>Unexplained</td>
</tr>
<tr>
<td>Autopsy findings</td>
<td>Hypoxia during sleep</td>
<td>Hypoxia during sleep</td>
<td>Hypoxia during sleep</td>
</tr>
<tr>
<td>GA at birth</td>
<td>36 weeks</td>
<td>40 weeks</td>
<td>37 weeks</td>
</tr>
</tbody>
</table>

Case Information:
- **Age at death**: 40 days, 50 days, 60 days, 52 days
- **Gender**: Male, Male, Male, Male
- **Behavioral state**: Before autopsy, After autopsy, Post-mortem, Autopsy
- **Information**: Abrupt death, Abrupt death, Abrupt death, Abrupt death
- **Information before autopsy**: Unexplained, Unexplained, Unexplained, Unexplained
- **Autopsy findings**: Hypoxia during sleep, Hypoxia during sleep, Hypoxia during sleep, Hypoxia during sleep
- **GA at birth**: 36 weeks, 40 weeks, 37 weeks, 38 weeks

**Conclusion.** Autopsy of these infants clearly shows anatomical risk factors, including very narrow nose, for increased nasal resistance.

134 ON RESPIRATORY CYCLE RELATED EEG CHANGES (RCREC)

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**Introduction.** Respiratory cycle related EEG changes (RCREC) is a promising method for investigating cortical activity within respiratory cycles [1] and can predict daytime sleepiness [2]. A crucial step in estimating RCREC is segmentation of the airflow signal, a process commonly complicated by artefacts and signal distortion. We have investigated how alternative segmentation and filtering techniques influence RCREC and airflow signal morphology.

**Method.** Ten paediatric polysomnograms using a standard sleep montage with EEG (C3/A2, C4/A1, O2/A1, O1/A2), bipolar EOG and submental EMG, RIP bands and naso-oral thermistors were analysed. RCRECs were quantified in all frequency bands for the first three hours of sleep. Respiratory cycle segmentation was performed first with a standard low pass filter to smooth the airflow signal and repeated with a Savitzky-Golay filter (a local polynomial fitting filter designed to preserve peak and trough morphology). Each respiratory cycle was then divided into four segments based on the peaks and troughs in the airflow signal and their mid points. To further characterize the EEG signal within these segments we computed three parameters in addition to power: skew, kurtosis and irregularity index. Irregularity index, calculated by Sample Entropy method, is a nonlinear measure of complexity of a signal; we speculated that numerous microarousals reflected by RCREC (hypothetically), may also manifest themselves as complexity changes. One way ANOVA was used to test the significance of the differences between the segments.

**Results.** Use of the Savitzky-Golay filter accentuated differences between EEG characteristics for inspiratory versus expiratory segments (most prominent for kurtosis) compared to the low pass filtering approach. Interestingly, for most subjects, differences among irregularity indices did not reach significance in any of the frequency bands between respiratory phases irrespective of filtering technique.

**Conclusion.** RCREC is sensitive to prior segmentation of the airflow signal and Savitzky-Golay filtering accentuates differences between respiratory segments.

135 CENTRAL APNEA SYNDROME IN CHILDREN CLINICAL ASPECTS AND THERAPY

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**Objectives.** Since the introduction of the new AASM rules (2007), delineation of central apneas during sleep (CSA) in children, can be done in a more systematic way. We aim at describing origin, clinical and polysomnographic (PSG) aspects, therapy and outcome of a series of young patients with CSA.

**Methods.** The SEIN sleep laboratory is referral center for children with sleep disorders in a large area. Each year about 75 children, 2-10 years of age, are seen and have a PSG. Most of these children suffer from encephalopathies of various origin and severity. Using the AASM rules PSGs and aspects of respiration were recorded and assessed. According to our own normal data an apnea syndrome in children 2-10 years of age is diagnosed at an AHI of 3 or higher. Therapy is based on a stepwise approach: a) optimization of the upper airway and pulmonary function (ENT, pulmonologist) b) positioning during the night on one side c) acetazolamide 125-250 mg/day d) CPAP or BiPAP @ oxygen therapy, 0.5-1 liter minute f) nocturnal ventilation at home.
(University Groningen). All patients had one or more PSG’s during the therapeutic work-up.

**Results and Conclusions.** Eight children (4 boys, age median 5 years, range 2-8) with relevant CSAS were seen in a period of three years. Three had Prader Willi syndrome, one suffered from Rett syndrome with moderate to severe PMR and the others had a non-classified encephalopathy. Referral was due to disturbed sleep and tiredness or excessive sleep during the day. Two patients were thought to have nocturnal epilepsy. Based on PSG and additional long term videoEEG events during the night in these children proved to be CSA’s. There was no other co-morbidity. The sleep of all children was characterized by moderately abnormal deep sleep and REM percentages and many awakenings during the night. The AHI ranged from 8-60/hr. Taken all respiratory events together, 60-100% was of the central type. As yet, the follow-up period is limited to one year or less, but after optimizing the upper airway (with success or spontaneous resolution in two patients), one patient did well on oxygen therapy, four patients were satisfactory treated with acetozolamide and only one patient had to be ventilated during the night.

**136 IDIOPATHIC CENTRAL SLEEP APNEA IN PRE-SCHOOL CHILDREN**

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**Introduction.** Central apnoeic events are physiological in early infancy and diminish in frequency and extent over the first year. They are significantly more common in those born prematurely. The persistence of frequent apnoeas with desaturation beyond infancy is uncommon. There is literature evidence that frequent episodic oxygen desaturation is potentially harmful to the developing brain. We present four children with persistent idiopathic central sleep apnoea well beyond infancy, who responded to oxygen therapy.

**Methods.** All four of the children presented clinically with concerns about breathing during sleep, two of them are siblings. Each had polysomnography at diagnosis and during subsequent follow-up. Scoring was done using the AASM criteria.

**Results.** Each of the children had repeated bouts of regular breathing patterns of several normal breaths followed by a central apnoea with desaturation. At presentation each child had >100 central apnoeas per hour. None of the children has significant neurological findings but two have speech delay. Each was treated with night-time oxygen therapy titrated to abolish periodic breathing. This resulted in dramatic reduction in the frequency of central apnoea and improvement in the overnight oxygen saturation profile. Regular sleep studies were performed to assess oxygen needs and to chart any improvement in breathing during sleep. Only one of the children has successfully weaned from oxygen therapy, the others remain in oxygen at 2, 3 and 5 years of age.

**Conclusion.** This rarely reported clinical scenario may go unrecognised with potential to do harm due to repeated exposure to hypoxia of the developing brain. Treatment with oxygen is relatively simple but long term follow-up is essential as the natural history of this condition is not well described.

**137 CENTRAL SLEEP APNOEA- A MANIFESTATION OF EPILEPSY, AN IDIOPATHIC FORM OR A COMPLEX SLEEP APNOEA**

Ferraz C,1 Estevão MH,2 Winck JC,1 Vaz LG1,3

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**Case report.** The authors present a 2 years old boy, with a complex cardiopathy (transposition of great vessels), with a complex surgery in neonatal period; no other relevant past history. Since one year ago, the parents referred observable apnoeas and cyanosis during sleep. These events occur only during sleep and there isn’t a typical pattern or exacerbation factors identified so far. The polysomnography (PSG) study showed two events with central apnoeas, in one of them an epileptic activity was simultaneous and the other preceding the apnoea. There was a significant desaturation during these events. The PaCO2 was stable during all recorded. There was no periodic breathing in this PSG. The complementary study (Video-EEG, brain magnetic resonance imaging, Holter 24H, ECG and echocardiogram) was normal. Antiepileptic drugs were tried and there was a significant increase of apnoeas with a high level of desaturation during sleep. Central sleep apnoea describes a group of conditions in which cessations in air flow occur without respiratory effort. In this particular case we don’t know yet the etiology of central apnoeas and so the optimal treatment. As the central apnoeas occur with a significant desaturation with a high risk of sudden death we want to discuss the diagnosis and the possible best treatment.

**138 RETRUDED MANDIBLE CAN PREDICT SLEEP DISORDERED BREATHING EVENTS IN CHILDREN**

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**Introduction.** More than thirty percent of children have sleep disorders breathing and a modified craniofacial morphology can be a predisponent factor for these disorders. Lateral radiography is a common approach to recognize this feature. Our hypothesis is that cephalometric measures mainly mandible angular measure might be predictive of polysomnographic changes in children. The aim of this study is to investigate possible associations among polysomnographic data and mandible cephalometric measure in children.

**Method.** Twenty-seven children aged 7 to 14 years were subjected to polysomnographic and lateral radiography. The polysomnographic variables were: sleep efficiency, sleep latency, AHI (apnea-hypopnea index), SaO2, arousal index and snoring. The evaluated cephalometric measures were: SNA, SNB, ANB, NS.PIO, NS.GoGn, 1.NA, 1.NB, SPAS, PAS, MPH and C.H. Statistical analysis was based on Fisher’s test.

**Results.** A higher proportion of children with retruded mandible snored (p=0.0007). Children with retruded mandible showed a trend to have smaller SPAS when compared to normal growing mandible (p=0.09). Snoring
children had smaller SPAS \( (p=0.05) \) when compared to non-snorers \( (p=0.05) \).

**Conclusions.** Our study showed association among polysomnographic data and mandible cephalometric measure in children. Snoring was the most important variable associated with retruded mandible. Cephalometric measurements are important to be evaluated in order to predict the presence of sleep-disordered breathing in children, and it is important to correct facial growth, mainly mandible growth while children are still growing age.

**139**  
**CRANIOCERVICAL POSTURE AND UPPER AIRWAY DIMENSIONS IN A GROUP OF CHILDREN WITH SLEEP-RELATED BREATHING DISORDERS**  
*Hurtado M,1 Lineros K,1 Peirano P,2 Cortés J*  
1Department of Oral Surgery and Maxillofacial Traumatology, Faculty of Dentistry and 2Sleep Laboratory, INTA, Universidad de Chile, Chile

**Introduction.** The most frequent cause of obstructive disorders of the upper airway in children is adenoid/tonsil hypertrophy. This hypertrophy leads to an extension of the head with relation to the cervical spine, which allows better respiratory function. The aim of this study is to compare the craniocervical architecture and the dimension of the upper airway in a group of children with sleep-related breathing disorders to a group of healthy children without such disorders.

**Methods.** 63 patients were selected as study group. Their ages were between 5 and 12 years old. The patients were diagnosed with a sleep-related breathing disorder based on an ENT review and the Pediatric Sleep Questionnaire survey. The control group included 33 healthy children of the same age range who were selected based on both their history and the same survey. Each child underwent a craniocervical architectural analysis and an airway dimension analysis drawn over a cephalometric radiograph.

**Results.** When comparing both groups, there was a greater extension of the head in children with sleep-related breathing disorders. The study group had a smaller nasopharynx sagittal diameter and a larger oropharynx sagittal diameter compared with the control group.

**Conclusions.** Sleep-related breathing disorders in children involve a decrease of the pharyngeal sagittal diameter combined with changes in craniocervical posture while awake.

**140**  
**FACIAL PATTERNS AND PRIMARY NOCTURNAL ENURESIS IN CHILDREN**  
*Esposito M, Precenzano F, Carotenuto M*  
Sleep Clinic for Developmental Age, Clinic of Child and Adolescent Neuropsychiatry, Second University of Naples, Italy

**Introduction.** Primary Nocturnal enuresis is a multifactorial disease also related to OSAS in both adults and children. Anatomical recognized predisposing factors for SRBD include craniofacial abnormalities. Aims of our study was evaluating the prevalence of dolicofacial pattern, of abnormal head posture in bedwetters, and their correlation with SRBD.

**Methods.** The sample was composed by 270 enuretic children (mean age 9.62 ± 2.31) compared with 274 healthy children matched for age and sex distribution. All subjects’ mothers filled out the SDSC scale to screen the children sleep habits. Among these scales, only SBD scale was taken into account. Cephalic index was calculated for each patient in order to identify the peculiar facial patterns. An overnight PSG was performed in 28, randomly chosen, enuretic children and in 38 healthy volunteer controls matched for age \( (8.73±0.79 \text{ vs. } 9.12±1.23; p=0.147) \) and sex distribution \( (\text{chi-square}=0.062; p=0.803) \).

**Results.** The distribution of facial patterns was significantly different in enuretics than in control children: the dolichofacial pattern was predominant \( (p=0.001) \), followed by the mesiofacial \( (p=0.001) \), and by the brachyfacial pattern \( (p=0.774) \). The OR was for the specific facial pattern was: dolicocephalic \( \text{OR}=2.01; CI \ 95\%\ 1.40–2.88 \) , mesiocephalic \( \text{OR}=0.55; CI \ 95\%\ 0.388–0.779 \) , brachiocephalic \( \text{OR}=0.92; CI \ 95\%\ 0.63–1.35 \) . Abnormal head posture was more frequent in enuretics than control children \( (p=0.003) \) with an OR of 2.55 \( (CI \ 95\%\ 1.41–4.64) \). The OR of facial patterns associated with pathological SBD scale results was: dolico \( \text{OR}=41.88; CI \ 95\%\ 16.21–108.15 \) , meso \( \text{OR}=19.60; CI \ 95\%\ 9.59–40.07 \) , brachio \( \text{OR}=11.26; CI \ 95\%\ 4.92–25.77 \) . The craniofacial characteristics of the PSG subgroup and their AHI and ODI data are shown in Table 1

**Table 1.** Differences in prevalence between group of enuretic and control children among abnormal head posture, facial patterns according to cephalic index (brachycephalic, CI≤ 80; mesocephalic, CI between 75 and 80; dolicocephalic, CI ≥75), AHI (Apnea/Hypopnea Index; normal value ≤1/h), and ODI (Oxygen Desaturation Index; normal value ≤1/h).

<table>
<thead>
<tr>
<th></th>
<th>Enuretic (N=28)</th>
<th>Controls (N=38)</th>
<th>P OR CI/95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal head</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CI≤75</td>
<td>57.15%</td>
<td>18.42%</td>
<td>&lt;0.001</td>
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<tr>
<td>75 &lt; CI &lt; 80</td>
<td>25%</td>
<td>57.89%</td>
<td>NS</td>
</tr>
<tr>
<td>CI ≥80</td>
<td>17.85%</td>
<td>23.69%</td>
<td>NS</td>
</tr>
<tr>
<td>AHI</td>
<td>6.37 ± 2.69</td>
<td>0.76±0.89</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>ODI</td>
<td>4.08 ± 2.71</td>
<td>0.29±0.27</td>
<td>&lt;0.001</td>
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</table>

**Conclusion.** Bedwetters showed a higher prevalence of dolicocephalic pattern, and abnormal head posture than controls.

**141**  
**EFFECTS ON PULMONARY FUNCTION PERFORMANCES OF INTRANASAL CORTICOSTEROID THERAPY IN CHILDREN WITH OBSTRUCTIVE SLEEP APNEA SYNDROME**  
*Tranchino V, Rizzi D, Tedeschi G, Amato O, Goffredo A, Brunetti L*  
Centro di riferimento Interregionale per le apnee infantili, Department of Pediatrics, University of Bari, Bari, Italy

**Introduction.** There is preliminary evidence of an improvement in the severity of obstructive sleep apnea syndrome (OSAS) in children treated with intranasal corticosteroids. Understanding the relationship between upper and lower airways has greatly increased through epidemiological and pharmacological studies.
Inflammation represents the most important link between the upper and lower respiratory tracts. The severity of symptoms in children OSAS is increased during episodes of upper airway inflammation. The aim of the study was to investigate the effect of intranasal corticosteroid therapy on lung function parameters, such as forced expiratory volume in 1 second (FEV1), in children with OSAS.

Methods. We enrolled 16 consecutive children (10 males), aged 4 to 10 years, with signs and symptoms suggestive for OSAS and adenoidal or tonsillar hypertrophy assessed on radiography and clinical evaluation respectively. At entry, each child underwent nocturnal polysomnographic monitoring (NPM) and lung function tests. Patients who were diagnosed as having OSAS (Apnea/Hypopnea Index >3) received intranasal corticosteroids (15 consecutive days each month, for 3 months). Then, they performed again lung function tests.

Results. Of 16 children, 10 (62%) were diagnosed as having OSAS by NPM. After intranasal corticosteroids treatment, all children had a clinical improvement of symptoms, particularly nasal obstruction and nocturnal snoring, assessed by parental questionnaire. Compared to baseline, the median FEV1 value after therapy was significantly increased [119.9 (117.6-122.2) vs 104.1 (89.4-116.9), p<0.05].

Conclusions. Our study confirm that topical corticosteroids may be helpful in ameliorating pediatric OSAS. Moreover, our findings suggest that intranasal corticosteroids may affect child pulmonary function test performances; this may have therapeutic implications in patients affected by OSAS associated with lower airway inflammatory disorders, such as asthma.

143 EFFECTS ON PULMONARY FUNCTION PERFORMANCES OF INTRANASAL CORTICOSTEROID THERAPY IN CHILDREN WITH OBSTRUCTIVE SLEEP APNEA SYNDROME.
Tranchino V, Rizzi D, Tedeschi G, Amato O, Goffredo A, Brunetti L.
Centro di riferimento Interregionale per le apnee infantili, Department of Pediatrics, University of Bari, Bari, Italy

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PAEDIATRIC HOME NON-INVASIVE VENTILATORY SUPPORT: EXPERIENCE IN A TERTIARY CENTRE IN HONG KONG
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Introduction. With advances in technology, the application of home non-invasive ventilation (NIV) in children has been increasing worldwide, allowing children with different respiratory problems to be cared for at home.

Methods. All patients followed up at the paediatric respiratory clinic, Queen Mary Hospital, Hong Kong, with NIV initiated between Jan 1995 to Dec 2009 were included. Patients with neuromuscular disorders were excluded because there were managed by another rehabilitation unit. Medical records were reviewed

Results. 21 patients were included. 12 were male. Mean age of commencement of home NIV was 7.3 years with median age of 6.6 years. Use of home NIV has been increasing: 1 patient was initiated on home NIV during the period 1995-1997, followed by 2 in 1998-2000, 2 in 2001-2003, 6 in 2004-2006, and 10 in 2007-2009. 7 (33%) has upper airway anomalies, 4 (19%) has obstructive sleep apnoea syndrome (OSAS), 4 (19%) has craniofacial anomalies (1 Pierre Robin, 1 Apert, 2 achondroplasia), 3 (14%) has central hypventilation or mixed apnoea, and 3 (14%) has underlying lung diseases (1 scoliosis with restrictive lung disease, 1 Down syndrome with chronic lung disease, 1 cystic fibrosis with respiratory failure). The age of commencement was lowest for patients with upper airway anomalies (median age = 0.8 year). Median age of commencement was 10.1 and 11.6 years for patients with craniofacial anomalies and OSAS respectively. NIV can be weaned off in most (71%) with upper airway anomalies. 50% with craniofacial anomalies and OSAS were still on NIV in Dec 2009. All with underlying lung diseases passed away.

Conclusion. Use of home NIV in children has been increasing in Hong Kong, with indication varying according to referral pattern and practice of individual institution. Patients with upper airway anomalies tend to require NIV at a younger age and wean off more successfully.

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ASSISTED BREATHING AMBASSADORS FOR YOUTH WITH DISABILITIES
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Introduction. The problem of positive pressure compliance is compounded if the patient is a youth, cognitively disabled or has chronic disease(s). This report describes the influence a patient with a tracheostomy experienced in using positive pressure ventilation (PPV) called the “assisted breathing ambassador” had on another contemplating the same technologies. This case caused the authors to reevaluate the method a medical provider employs to educate patients of the value and consequences of PPV.

Case report. Larry is a 22 year old young man with Duchenne muscular dystrophy whose respiratory insufficiency had led the team to contemplate a tracheostomy with PPV. He began using the PPV mask continually but remained in chronic respiratory failure. His caregivers were concerned that without some significant changes he might suffer a pneumonia or acute respiratory demise. His inpatient hospital team began to try to convince him of the need for PPV delivered through a tracheostomy. Improvement in quality of life and longevity were emphasized. He remained wary and undecided. An experienced physician asked a patient-friend with Duchenne muscular dystrophy who already had a tracheostomy and used PPV to speak to Larry. After a long and ultimately fruitful discussion Larry agreed to a tracheostomy. Afterwards he had a sleep study to titrate the effective positive pressure. He was discharged very pleased with the courageous choice the ‘assisted breathing ambassador’ and the inpatient team helped him to make. This case report broadens the emphasis from exclusive technical management to address the fears of the chronically disabled youth by someone who has faced the same sober realities. The inclusion of the “assisted breathing ambassador” evolves the communication from empathy to sympathy. The hospital has gone on to use “assisted breathing ambassadors” for children with Down Syndrome and Cerebral Palsy.

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ROLE OF COBLATION IN THE MANAGEMENT SCHEDULE OF OBSTRUCTIVE SLEEP APNEA SYNDROME IN CHILDREN
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Introduction. Obstructive sleep apnea syndrome (OSAS) often causes metabolic, cardiovascular and neurocognitive morbidity in children presenting with increased upper airway resistance, impaired responses to hypercapnia, subatmospheric pressure and inspiratory resistive loading during sleep. In later life, oxidative stress, inflammation, autonomic activation, and disruption of sleep homeostasis may occur. The methods of treatment are recently dominated by different types of coblation alone such as intracapsular microdebridement, intracapsular coblation, traditional extracapsular electrocautery dissection, and endoscopic-assisted coblation lingual tonsillectomy, or in combination with other procedures.

Methods. During the period from January 1, 2008 till June 30, 2010, eight children with OSAS were diagnosed and surgically treated in St. Petka Eye and Ear Clinic of Varna, Bulgaria. They were 3 boys and 5 girls aged between 4 and 10 years at a mean age of 7±3 years. Seven of them presented with overweight. Both intracapsular and extracapsular coblation techniques were applied following either tonsillectomy, or adenoidectomy in 2 patients each (in 25% of the cases each).

Results. The surgical treatment resulted in a considerable subjective improvement of the children with OSAS. However, they demonstrated a better postoperative recovery after the coblation-assisted intracapsular tonsillectomy than after the traditional subcapsular electrocautery tonsillectomy. Mean preoperative apnea-hypopnea index was 18 and mean postoperative one was 4. Somnogram normalization was achieved in only 42.8% of overweight children. There were no postoperative complications at all.
Conclusion. The best early and late postoperative results were obtained by using coblation-assisted intracapsular tonsillectomy. Our experience gained with this small children’s contingent could allow us to recommend this effective and safe surgical procedure for broader usage in the clinical practice.

147 SLEEP AND BEHAVIORAL COMPLAINTS WITH A FOCUS ON TOOTH GRINDING/CLENCHING IN A PEDIATRIC ORTHODONTIC POPULATION

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Introduction. Many sleep complaints are clinically reported (e.g., poor sleep quality, sleepiness, headache and tooth grinding) in the orthodontic population. This study aimed to assess the prevalence and risk factors of such complaints.

Methods. Consecutive subjects (n=608; 7-17 y.o.) seeking orthodontic treatments were involved in the study. All patients completed questionnaires on dental and medical history including tooth grinding/clenching, sleep quality and daytime behavior. They received a clinical examination by an orthodontist in a university clinic. Fisher’s Exact Test and Logistic Regression were performed.

Results. Three sub-groups were identified: 1) sleep bruxers (SB;n=58) who clench and/or grind at night; 2) daytime tooth clencher (n=42); 3) control subjects (n=220) without day/nighttime parafunctions. SB group was composed mainly of children ≤12 y.o. (67.3%), the clenching group was composed mainly of adolescents ≥13 y.o. (78.6%; p<0.0001). Control subjects were equally distributed between children and adolescents. Both groups reported more symptoms related to sleep (unrefresh sleep, difficult to awake, daytime sleepiness, long delay to fall asleep) and behavioral complaints (easily distracted or interrupted by others) in comparison to controls. The majority of SB children were retrognathic (60.3% vs. clencher 39% and controls 36%); Odds Ratio (OR) was >5 for daytime headache and sleepiness. Clenchers were more prone to report frequent sleep awakenings, dry mouth on awakening and pain (p<0.03); OR were >5 for unrefresh sleep, difficulty awakening, and daytime sleepiness.

Conclusion. The three groups were different on dental, sleep and behavioral related complaints. SB and tooth clenching increase risk for sleep and behavioral problems and should be investigated in further depth in children and adolescents. (Supported by CIHR).

148 THE EFFECT OF FUNCTIONAL ORTHOPAEDIC TREATMENT ON OROPHARYNGEAL AIRWAY DIMENSIONS AND SLEEP DISTURBANCE: A CASE REPORT

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Aim. The sagittal skeletal pattern affects the dimensions of nasopharynx. Especially a significant relationship was observed between changes in nasopharyngeal airway size and mandibular retrognathia. The aim of this report is to demonstrate the changes on airway dimensions and HSS results after orthopaedic treatment.

Subject and method. A 9 year-old girl applied for orthodontic treatment. Initial examination revealed a skeletal and dental Class II malocclusion with a retrognathic mandible. The patient had a history of snoring and difficulty in breathing. In the light of cephalometric analysis, the primary treatment objectives were to reduce the overjet, to achieve a Class I posterior occlusal relationship. Treatment protocol was the orthopedic stimulation of mandibular growth.

Results1 After 9 months of treatment period, SNA (mandibular position) changed from 81° to 79.5°, SNB (mandibular position) changed from 69° to 72°. ANB (relation between maxilla and mandible) changed from 12° to 7.5°. Apnea-hipopnea index (AHI) has changed from 8 to 3.

Conclusion. Post-treatment cephalometric analysis and superimposition of pre- and post treatment cephalometric tracings showed skeletal changes in both jaws, as expected in a growing patient, with favorable downward and forward mandibular growth. And snoring was reduced with the functional appliance.

149 SLEEP, RESPIRATION, AND NOCTURNAL MOTOR SEIZURES IN JOUBERT SYNDROME: A CASE REPORT

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Introduction. Joubert syndrome is a rare, autosomal recessive disorder, characterized by a complex midbrain-hindbrain malformation visible on brain imaging and a broad spectrum of other phenotypic findings caused by defects in the structure and/or function of the primary cilium.

We report the clinical and polysomnographic features of an adolescent diagnosed with Joubert syndrome who presented paroxysms of hypopnea followed by periodic respiration and related partial motor seizures. Case report. The patient was a 15-year-old boy with mild mental retardation, hypotonia, mild ataxia, and abnormal eye movements (oculomotor apraxia). He had no kidney or liver abnormalities. MRI showed the typical “molar tooth sign”. He was referred to the Sleep Unit, because his parents noticed that he experienced spells of apnea while sleeping. He did not complain of excessive daytime somnolence. His anthropometric measurements were as follows: weight, 63.4 kg; height, 172 cm; BMI, 21.5 kg/m².

Results. The Paediatric Daytime Sleepiness Scale score was 12 and waking EEG was normal. Video-PSG revealed the following: disturbed macro and microstructure of nocturnal sleep, long sleep latency, increased WASO, high sleep fragmentation index, decreased efficiency index, and an extremely low percentage of REM sleep (2.5% of total sleep time). Respiration was normal with periods of hypopnea accompanied by body movements and followed by central periodic breathing lasting for several minutes with no significant oxygen desaturation. The arousals provoked by central apnea triggered partial motor seizures with dystonic movements in the right foot and the Babinski reflex (isolated or repeated), which lasted 1
to 5 seconds. These episodes appeared in clusters during NREM sleep throughout the night.

**Conclusion.** Joubert syndrome is a clinically heterogeneous disease. Video-PSG is mandatory for the identification of breathing abnormalities and related motor seizures during sleep.

**150 COMPLEX SLEEP APNEA IN JOUBERT SYNDROME: CHALLENGES IN MANAGEMENT**

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**Introduction.** Joubert syndrome is a rare autosomal recessive disorder characterized by hypotonia, mental retardation, neuro-ophthalmologic abnormalities and respiratory dysregulation. This case highlights challenges in the management of complex sleep apnea in a child with Joubert syndrome.

**Case.** A 3-year-old male with Joubert syndrome was referred to the sleep clinic for suspected sleep apnea. A previous echocardiogram showed moderate pulmonary hypertension and concerns were raised that sleep apnea with oxygen desaturations might contribute to the pulmonary hypertension. His body mass index was at the 91st percentile, he had a crowded upper airway, macroglossia and enlarged tonsils. Polysomnogram showed an apnea-hypopnea index (AHI) of 24.5 events per hour (obstructive 0.1/hour, hypopneas 19.9/hour, mixed 0.6/hour, central 3.9/hour) with intermittent mild periodic breathing. Oxygen saturation nadir was 77%. A treatment study with continuous positive airway pressure (CPAP) was unsuccessful due to emerging complexity of his sleep apnea during the titration. A subsequent bilevel positive airway pressure (BiPAP) titration in S/T mode decreased the severity of the apneas and oxygen desaturations. He did not tolerate BiPAP and underwent adenotonsillectomy given his crowded oropharynx and enlarged tonsils. A repeat polysomnogram after surgery is pending.

**Discussion.** This case highlights challenges in the respiratory management of children with Joubert syndrome. The initial sleep study showed mostly hypopneas and only during the CPAP titration study did the patient exhibit a more pronounced classic pattern of hyperpnea and central apnea. Intolerance of non-invasive ventilation is a challenge in young children with developmental disability. Our patient required a multidisciplinary approach with positive airway pressure therapy and surgery because of complex sleep apnea with periodic breathing in the setting of anatomic and neuromuscular abnormalities.

**151 OSA IN INFANTS WITH DOWN’S SYNDROME: TREATMENT WITH PALATAL PLATE AND OROFACIAL STIMULATION**

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**Introduction.** In Down’s syndrome (DS), orofacial hypotonia and micrognathia may lead to obstructive sleep apnea (OSA). No study, however, has yet focused on OSA treatment in DS starting in early infancy. We performed a prospective observational study to determine if the combination of palatal plate and orofacial regulation therapy (Castillo Morales) improves or prevents OSA in infants with DS.

**Methods.** Forty-one consecutive infants referred to our sleep lab with DS (21 boys; age at admission 2.5 months (mean; min-max 0.1-11.2)) underwent palatal plate and Castillo Morales therapy. Outcome was determined as the rate of mixed/obstructive apneas/hour (MOAI) in polysomnography (PSG).

**Results.** Twenty-two infants (54%) had OSA (i.e., MOAI>=1) upon admission. Of 19 infants (46%) without OSA (MOAI<1), 11 parents agreed to a follow-up PSG after 3 months. Two infants from this group had developed OSA on repeat PSG despite prophylactic treatment. Of 22 infants with OSA, 17 parents agreed to a follow-up PSG. MOAI improved from a mean of 2.8 (1.3-13) to 1.2 (0.5-15.4) after 3 months of treatment. Four infants in this group continued to have a MOAI>5 despite the above treatment; in these, the addition of a velar extension to their plate was considered necessary (Buchenau, J Pediatr 2007;151:145-9) and resulted in a decrease in MOAI from 10.4 (8.8-15.4) to 0.6 (0-2.9). No infant required continuous positive airway pressure (CPAP).

**Conclusion.** OSA in DS may already develop in infancy. Early treatment with a palatal plate and Castillo Morales therapy appeared feasible and effective for cases of mild OSA. For more severe cases, other orthodontic treatment methods may be considered as an alternative to CPAP or invasive treatment procedures such as tracheostomy.
IX. Epidemiology

152 PROCESS OF ENTRAINMENT IN THE EARLY STAGE OF LIFE HAS BEEN ALTERED IN THE MODERN SOCIETY

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In 1953, Kleitman and Engelmann [1] reported a longitudinal sleep log record of a baby from the second week of the birth to the 26th week. According to this record, free-running rhythm was observed during 7th to 16th week after the birth. In 1987, Segawa [2] reported a longitudinal record of sleep log of a Japanese baby from birth to the 6th month of age. According to this record, free-running rhythm was observed during the 1 to 2.5 months of age (from 4th to 10th week after the birth). These chronological changes have been interpreted as the process of entrainment of biological clock to a 24 h cycle of the earth. According to these figures, the age of the entrainment was occurred at 16th week and 10th week after showing free-running rhythm, respectively.

In 1999, Shimada et al [3] reported that the entrained sleep-wake rhythm emerged after transient manifestation of either ultradian or irregular sleep-wake patterns for 3-4 weeks in 75% of the infants. They also reported that only 7% of the infants showed a free-running sleep-wake rhythm before the entrainment. In addition, according to Shimada et al, the mean age of the entrainment was 44.8± postconceptional weeks.

If the Shimada’s observation was also true for 1953 and 1987, we are supposed to have a very rare (7% x 7% = 0.049%) experience. I would like to hypothesize that age of entrainment of babies has become earlier with few free-running period in the modern society.

153 POORER HEALTH-RELATED QUALITY OF LIFE IN CHILDREN PRESENTING TO A PEDIATRIC SLEEP CLINIC

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Introduction. Sleep problems have considerable negative effects on children and their families. These include health, academic, behavioral and social impairment.

Methods. A prospective cohort study design was used. Parents completed the PedsQL 4.0 for children 2 years or older, and children ages 5 to 17 completed the self-report version. The perceived quality of life of children referred to a pediatric sleep clinic was compared to data from healthy and chronically ill counterparts from previously published research.

Results. Seventy-one children (8 months - 17 years of age) with various sleep problems were studied. These children presented with variety of complex sleep issues, including sleep-disordered breathing, parasomnias, childhood behavioral insomnia, and restless legs syndrome. When compared to healthy children in the original PedsQL 4.0 sample (Varni et al, 2001), parents and children in the disordered-sleep sample reported poorer quality of life across all areas assessed (all ps < .01). The pediatric sleep clinic sample also had lower ratings for most of the PedsQL scales when compared to a sample of chronically ill children. Of note, the physical QOL ratings were similar across these samples (ps > .05).

Conclusion. Children and adolescents who present to pediatric sleep clinics have complex sleep issues that impact many aspects of their well-being. These children and their parents report a poorer quality of life than healthy counterparts and their ratings are poorer than those with chronic health conditions for most areas of functioning.

154 CHILDREN’S SLEEP IN WARDS

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Introduction. The impact of sleep disturbance on the pathophysiology of illness is recognized but not completely understood. There are many studies in literature evaluating sleep in Intensive Care Units, but we didn’t find any study concerning sleep conditions in paediatric wards.

Objective. To characterize sleep habits and environment in paediatric wards of a Portuguese tertiary hospital.

Methods. A questionnaire was created. Questions focused on the organization of the ward, time to sleep, nightly routines, time to wake up and naps. Descriptive statistics. Nonparametric tests (α=5%).

Results. The questionnaire was applied to 84 healthcare professionals: 31% (n=26) doctors, 69% (n=58) nurses, in 5 paediatric wards. In all wards one caregiver stays at night and all rooms have televisions. Children was said allowed to play until 20h in 44,7% (n=76) answers. Regarding the bedtime, 57,1% (n=77) professionals consider that it occurs between 20-22h; 23,1% (n=26) doctors didn’t responded as well as 1,7% (n=58) nurses. Concerning the time that electronic devices are turned off, 70,0% (n=20) doctors and 19,3% (n=57) nurses said that there is no set time. During the night, noise and light was said to be reduced by most professionals (71,8%, n=85; 91,8%, n=85, respectively). Of those healthcare professionals who work at night, 76,8% (n=56) turn on the ceiling bedroom light; 83,3% (n=12) doctors and 52,3% (n=44) nurses turn on the bedside light. Most doctors (68,0%, n=25) and nurses (87,7%, n=57) report that nap is common. Sleep habits knowledge is significantly different between doctors and nurses concerning playtime (p=0,02), time that electronic devices are turned off (p=0,00), time to wake up (p=0,005) and nap time (p=0,02).

Conclusions. Sleep in hospital is frequently disturbed. There aren’t well known sleep and nightly routines. This needs to be changed in order to achieve good sleep hygiene in paediatric wards.

155 SLEEP PATTERNS IN HOSPITALIZED CHILDREN

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**Introduction.** Each year thousands of children are hospitalized for a variety of reasons. Hospitalization changes daily routines and sleep patterns are among the factors that can be altered by hospital and disease itself. We studied children’s sleep during a hospital stay of at least five nights in general wards, in relation to age, gender, and previous experience with hospitalization.

**Method.** We investigated 139 hospitalized children admitted due to respiratory diseases, aged 4-14 years old, without neurological problems. Sleep logs were used to measure sleep patterns: total sleep time during hospitalization (TST), sleep time at night, time spent in bed at night, sleep latency, sleep efficiency, number of awakenings during the night, time spent awakened during the night, number of naps during the day, and time spent napping during the day.

**Results.** Boys with 4-7yo had TST of 797.4±1011.0 min; those 7.1-11yo had 604.0±51.02 minutes, and in 11.1-14yo had 563.2±109.2 minutes. Girls with 4-7yo had TST of 617.8±73.38 minutes, 7.1-11yo had 592.8±101.4, and 11.1-14yo had 567.7±54.05 minutes (p among groups=0.008). TST decreased with age as well as sleep at night. Sleep latency was different for girls regarding age: older girls presented longer latencies (51.7%). Sleep parameters regarding previous experience with hospitalization showed no differences. The children in the study slept more (10.51h compared to 9.2h referred in the literature) and had better sleep efficiency, probably due to disease and had better sleep efficiency, probably due to disease and 11.1-14yo had 567.7±54.05 minutes (P<0.011). 41.4% of children had difficulty falling asleep in 20 minutes. Co-sleeping with parents was revealed in 42.9%. It was correlated with significant resistance going to bed (P<0.000) and taking long time in falling asleep (P<0.028).

**Conclusion.** Sleep problems are surprisingly common among Iranian children. These results reveal why pediatricians should have special attention to sleep and sleep habits. These include the possibility of identifying treatable problems such as snoring and apnea. Proper family education about good sleep hygiene and sleep habits should be promoted with the hope of reduced sleep problems among Iranian children.

**156 SLEEP PROBLEMS AND SLEEP HABITS IN 3 TO 6 YEARS OLD IRANIAN CHILDREN**
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**Introduction.** Sleep is controlled by homeostatic and chronobiological mechanisms those are affected by developmental changes through life; but sociocultural, familial and other factors influence the sleep. The purpose of this study was to survey the prevalence of sleep problems and sleep habits in preschool aged children.

**Methods.** This cross sectional study was conducted on 224 (3 to 6 years old children from guardians in 2009. Subjects were included randomly if their parents agreed to cooperate in filling BEARS questionnaire and Iranian version of children sleep habits questionnaire (CSHQ).Children with active medical illnesses and who taking any medication for sleep problems were excluded.

**Results.** The most common sleep problems were sleep talking (18.2%), teeth grinding(17%), restless sleep(14.8%), difficulties waking up in the morning(14.7%), being tired during the day (14.3%), anxiety during night (13.8%) and resistance going to bed (12.9%) respectively.11.6% of children were reported to snore more than 3 night per week. Napping is a common sleep habit in 81.2% of subjects. Mean sleep duration was significantly lower than normal sleep time in children (9.54 vs. 12 hours, P<0.000). Total sleep time in girls was more than boys (9.73 vs. 9.32, P<0.011). 41.4% of children had difficulty falling asleep in 20 minutes. Co-sleeping with parents was revealed in 42.9%. It was correlated with significant resistance going to bed (P<0.000) and taking long time in falling asleep (P<0.028).

**Conclusion.** Sleep problems are surprisingly common among Iranian children. These results reveal why pediatricians should have special attention to sleep and sleep habits. These include the possibility of identifying treatable problems such as snoring and apnea. Proper family education about good sleep hygiene and sleep habits should be promoted with the hope of reduced sleep problems among Iranian children.

**157 TIME FROM BEING PUT TO BED TO FALLING ASLEEP IS ASSOCIATED WITH BODY MASS INDEX IN 2-5 YEAR OLD CHILDREN AT HIGH RISK OF DEVELOPING OVERWEIGHT**
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**Introduction.** It has been suggested that children with a high birth weight or a pre-pregnant obese mother are at a particularly high risk of developing overweight. Research suggests that too much food and too little exercise are insufficient explanations for the increased prevalence of obesity seen in most countries, and more recent studies have suggested that lack of sleep may be another important determinant.

**Methods.** A total of 129 children aged 2-5 years with either high birth weight (> 4000 g.) or a mother with a pre-pregnancy Body Mass Index (BMI) >28 kg/m2 participated. Information on time from being put to bed falling asleep was obtained from a questionnaire filled out by the parents. Height and weight was measured, and BMI was calculated. Linear regression analyses were performed.

**Results.** Children spend on average 19 minutes from being put to bed to falling asleep, BMI increased with 0.01 kg/m2 per minute spend from the child was put to bed to it fell asleep (p = 0.03). Analyses were adjusted for age, gender and socioeconomic status.

**Conclusion.** The time spend to fall asleep is directly associated with BMI among 2-5 year old children, who are at high-risk of developing overweight.

**158 SLEEP HABITS AND SLEEP PROBLEMS IN CHILDHOOD OBESITY**
**Introduction.** One sleep deprivation consequence is the increased risk of weight gain, in children there might be a negative correlation between sleep hours and Body Mass Index (BMI). However, the relationship between child obesity and sleep problems is yet to be well understood.

**Methods.** The purpose was to determine the association between sleep duration and sleep problems with BMI. The sample consisted of 273 schoolchildren with 10 (± 1.52) years old average, which whom 45% were girls. It was used the “Escala de Trastornos del Dormir para Escolares (ETDE)” which included a questionnaire about the sleep time (n=82) (Moo-Estrella, et al., 2009), the Child Day Sleepiness Scale (α=.81) (Drake, 2003) and the Pediatric Sleep Questionnaire (α=.8098 in section A and .6257 for section B) (Tomás Vila, Torres Miralles and Beseler Soto, 2007).

**Results.** It was found that there isn’t a relation between BMI, sleep hours, sleep problems, and somnolence reported by the children (p > .01), however it was found a relation between somnolence (in the questionnaire answered by parents) and BMI (r=.256, p=.01).

**Conclusions.** In contrast with the literature reviewed, the main correlations found in the mothers’ reports by the fathers report that their children have relevant DIMS. Insomnia of the father and infant DIMS are not associated. Also in the fathers’ report DIMS and EBP are correlated (r =.27; p <.01) and both correlate with high VE (r=.18; p<.05; r=.19; p=.05) but only EBP correlate with a poor parental self concept. In hierarchical regressions fathers’ VE is predicted by a low emotional self efficacy (β= -.32; p <.001) and by insomnia (β=.25; p<.01), a further contribution to prediction is given by the infants’ perceived vivacity (β=.19; p=.05) and not by PEB. Also among fathers the parental self-concept is predicted by their VE (β=.3; p<.01) as well as by a low emotional self efficacy (β=.18; p<.05) and -among the characteristics attributed to the infant- by internalizing problems (anxiety β=.27; p<.01) and bad mood (β=.19; p<.05).

**Conclusions.** The main correlations found in the mothers’ reports are confirmed. Compared to the mothers fathers seem less sensitive to their infants’ DIMS, and more sensitive to vivacity than to irritability and to the infants’ internalizing problems.

**Method.** We have analyzed the same scales completed by 125 fathers of the same children aged 3 - 39 month (Mean=20.2; SD=10.2) considered in the study based on mothers’ reports (Violani et al. 2010).

**Results.** 32.8% of the fathers report that their children have relevant DIMS. Insomnia of the father and infant DIMS are not associated. Also in the fathers’ report DIMS and EBP are correlated (r =.27; p <.01) and both correlate with high VE (r=.18; p<.05; r=.19; p=.05) but only EBP correlate with a poor parental self concept. In hierarchical regressions fathers’ VE is predicted by a low emotional self efficacy (β= -.32; p <.001) and by insomnia (β=.25; p<.01), a further contribution to prediction is given by the infants’ perceived vivacity (β=.19; p=.05) and not by PEB. Also among fathers the parental self-concept is predicted by their VE (β=.3; p<.01) as well as by a low emotional self efficacy (β=.18; p<.05) and -among the characteristics attributed to the infant- by internalizing problems (anxiety β=.27; p<.01) and bad mood (β=.19; p<.05).

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**Results.** 32.8% of the fathers report that their children have relevant DIMS. Insomnia of the father and infant DIMS are not associated. Also in the fathers’ report DIMS and EBP are correlated (r =.27; p <.01) and both correlate with high VE (r=.18; p<.05; r=.19; p=.05) but only EBP correlate with a poor parental self concept. In hierarchical regressions fathers’ VE is predicted by a low emotional self efficacy (β= -.32; p <.001) and by insomnia (β=.25; p<.01), a further contribution to prediction is given by the infants’ perceived vivacity (β=.19; p=.05) and not by PEB. Also among fathers the parental self-concept is predicted by their VE (β=.3; p<.01) as well as by a low emotional self efficacy (β=.18; p<.05) and -among the characteristics attributed to the infant- by internalizing problems (anxiety β=.27; p<.01) and bad mood (β=.19; p<.05).

**Conclusions.** The main correlations found in the mothers’ reports are confirmed. Compared to the mothers fathers seem less sensitive to their infants’ DIMS, and more sensitive to vivacity than to irritability and to the infants’ internalizing problems.
the parental and student version of the questionnaire properly (response rate: 83.7%) were included in the analysis. Sleep habits (bedtime and wake time) and total sleep problem score and subscale scores (bedtime, nighttime, daytime) of CASC were compared between parental and self reports for each school age group.  

Results. Comparison of reported bedtime and wake time between parental and self report showed no significant different among elementary school children, but showed significant difference among senior high-school students. Total and all subscale scores of CASC were shown to be significantly lower in parental report for all age groups except for bedtime subscale scores for senior high-school students.  

Conclusion. Parental reports tend to underestimate sleep problems compared with that of self report. This difference could be largely influenced by cultural background.  

162 DAYTIME NAPS AND ACCIDENTAL FALL RISK IN YOUNG CHILDREN

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Introduction. In developed countries, unintentional injuries are the main cause of death in children over one year. Like in adults, studies in children have found an association between sleep deprivation and injury, which is not fully understood. The aim of this study was to evaluate the role of daytime naps as potential key point for preventive interventions.  

Methods. A transversal comparative study with the purpose of finding an association between sleep deprivation and accidental fall risk was conducted over 12 months. A questionnaire was applied to 2 groups of children aged 1 to 14 years: children observed in an emergency room for AF (G1); children attending health care visits (HV) (G2). Collected data included demographic characteristics, medical history, previous week’s sleep pattern (PWSP), sleep duration and sleep pattern in the preceding 24 hours, mechanism of fall and injury severity. Children with acute or chronic disease or exposure to drugs interfering with sleep were excluded. The existence and duration of a daytime nap was analyzed in detail for this study.  

Exploratory analysis. Age stratification. Non parametric tests. Multivariate logistic regression. Significance level 5%.  

Results. We obtained 1756 questionnaires in G1 and 277 in G2. Of those, 874 in G1 and 267 in G2 were analyzed. Daytime naps were found to be a rare event in children over 6 years. In both the 1-2y and 3-5y age groups there was a higher percentage of naps in G2 (72.3% vs 90.1%, p = 0.001; 40.2% vs 52.5%, p= 0.047, respectively), with no difference in nap duration. In these age groups, naps might also be associated with lower injury severity, as fractures were more frequent in children who did not have a nap (1-2y: 11% vs 3%, p = 0.046; 3-5y: 16.2% vs. 6.8%, p = 0.09). After controlling for age, gender, parental education and profession, lack of naps was associated with increased fall risk (OR 2.1; 95%CI 1.3-3.2).  

Conclusions. Our study provides evidence of a protective effect of naps in young children, establishing their role as target for preemptive measures that must be included in anticipatory guidance.
X. Sleep in psychiatric disorders

163 EARLY SLEEP PATTERNS IN CHILDREN WITH AUTISTIC SPECTRUM DISORDERS: A LONGITUDINAL ENGLISH COHORT STUDY
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Introduction. Children with autistic spectrum disorders (ASD) are known to have different sleep habits compared to typically developing children, but there are few longitudinal studies with prospective data.

Methods. The ALSPAC (Avon Longitudinal Study of Parents and Children) is an ongoing prospective investigation of over 14,000 children born in 1991-2 in SW England. Parental reports of sleep duration were collected by questionnaire at 8 time points from 6 months to 140 months. Children with an ASD diagnosis at age 11 years (n=76) were identified from health and education records. A series of linear regression models were constructed to measure multivariable associations.

Results. Total sleep duration for children with ASD fell within the normal limits of the ALSPAC cohort. A reduction in total sleep duration of 14 minutes was first noted in the ASD group at 30 months of age, increasing to a mean (95% CI) reduction of 26 minutes (12 to 40 minutes) at 42 months of age (p=<0.0001), and peaking at 81 months of age with a reduction of 43 minutes (32 to 54 minutes, p=<0.001). After 81 months of age the difference between ASD and the rest of the cohort decreased, to 22 minutes (9 to 35 minutes) at 140 months (p=0.001).

The difference in sleep duration was mostly a reflection of changes in night-time rather than daytime sleep duration. Night-time sleep duration was shortened by 70 minutes at 140 months of age (p=0.001), and was 30 minutes shorter at 30 months of age (p=0.05). There were no other significant differences in sleep duration between ASD and TD children.

Discussion. Sleep duration in children with ASD is reduced from 42 months of age and persists until adolescence. The clinical implications of early reduction in sleep duration in this population will require further investigation.

164 A CONTROLLED STUDY OF SLEEP QUALITY IN SCHOOL-AGED CHILDREN WITH AUTISM AND THEIR SIBLINGS AND ASSOCIATIONS WITH MATERNAL DEPRESSION
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Introduction. Children with Autism Spectrum Disorder (ASD) experience sleep problems which add a significant burden of care to the primary caregiver (typically the mother). We studied familial dimensions of sleep problems in ASD children, specifically how their sleep differs from typically developing (TD) siblings and from TD controls and how this may adversely influence maternal mood.

Method. Thirty eight children with ASD and 19 TD siblings aged 4 to 13 years were studied using parent completed Child Sleep Habits Questionnaire (CSHQ) and Social Communication Questionnaire (SCQ). CSHQ data was available from 90 controls who were TD school children (Hampshire, UK). Mothers of ASD children completed the Epworth Sleepiness Scale, Pittsburgh Sleep Quality Index and Major Depression Inventory.

Results. After controlling for age and gender, TD children had significantly lower total CSHQ scores than children with ASD and TD siblings. There were no significant differences in CSHQ scores of ASD children and their siblings. CSHQ total scores were positively correlated with ASD communication skills and social functioning difficulties (total SCQ scores). 49% of mothers reported poor sleep quality and 25% reported day-time sleepiness that impaired day-time function. Based on DSM IV criteria 36% of mothers reported depressed mood, for 25% this was severe. Maternal sleep quality accounted for 38% of the variance in maternal depression.

Conclusions. This study confirms a high prevalence of sleep problems in children with ASD. Sleep problems were more severe in children with greater communication skills and social functioning difficulties. We also report novel findings of increased sleep problems in non-autistic siblings. There is a high prevalence of depression in mothers of ASD children. Maternal sleep quality accounts for 38% of the variance in depressed mood. Sleep problems in children with ASD and their siblings are amenable to treatment and should be routinely addressed in clinical management.

165 TECHNICAL CONSIDERATIONS FOR THE EVALUATION OF CHILDREN WITH AUTISM SPECTRUM DISORDERS IN THE PEDIATRIC SLEEP LABORATORY
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Introduction. Autism spectrum disorders (ASD) are global developmental disorders. A high prevalence of sleep anomalies has been described in these patients (40-83%). The social and behavioural perturbations of these children make unusual and complex activities as polysomnography (PSG) very difficult to be done.

Objective. To describe strategies used with children with ASD to cooperate in PSG and report polysomnographic abnormal events.

Methodology. Retrospective descriptive study. Records of children with ASD referred to the Paediatric Sleep Laboratory (PSL) between June of 2009 and October of 2010 who did PSG were reviewed as well as collaboration techniques to increase children collaboration. To the questionnaire used in PSL. and data Simple exploratory analysis was done.

Results. Four children were studied, 3 (75%) male, median age 4.5 years (max: 8; min: 3). All were referred for respiratory sleep disturbance. Four children reported daytime mouth breathing and 3 had sleep breathing
difficulty, snoring and breathing pauses. The answers concerning sleep architecture, respiratory events and desaturation and leg movements were analysed. Parasomnias were present in all children. Difficulties in initiating and maintaining sleep were reported in 2 children. Daytime irritability and inattention were present in 3 patients and 1 had excessive daytime sleepiness. All children had decreased sleep efficiency (average: 81.7%), 2 had increased sleep latency (average: 41.5 min) and 3 presented decreased REM sleep (average: 33 min). One child had significant respiratory and saturation disturbance (apnoea/hypopnoea index: 3.2/h; desaturation index: 5.3/h). Strategies to increase collaboration included previous information and involvement of the parents, child's participation in and use of books and electro assembly music as entertainment factors. PSL is a practicable and reliable test in children with ASD. The success of this 

Conclusion, technique depends on experienced technicians using adapted communication strategies. Sleep disturbances are frequent in children with ASD justifying more extensive studies.

166 ASSESSMENT OF THE INTAKE OF TRYPTOPHAN-ENRICHED CEREALS AND ITS INFLUENCE ON THE SLEEP OF AUTISTIC CHILDREN

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Alterations in the secretion of the neurotransmitter serotonin and the indole melatonin have been shown to play a role in the sleep problems and circadian rhythm variations observed in autism spectrum disorders. For this reason, we administered cereals enriched with the essential amino acid tryptophan (200 mg/100 g cereals; Ordesa, S.L.), the precursor of both the neurotransmitter serotonin and the indole melatonin. The aim of this study was to evaluate the effects on their sleep. Data were collected for 5 weeks according to the following breakfast/dinner schedule: The first week the children consumed tryptophan-enriched cereals at breakfast and control cereals (75 mg/100 g cereals) at dinner; the third week control cereals were eaten at breakfast and tryptophan-enriched cereals at dinner; the fifth week tryptophan-enriched cereals were taken at both breakfast and dinner; the second and fourth weeks control cereals were consumed at both breakfast and dinner. Variables were measured by wrist actimeters and analyzed by Sleep Analysis 5C® (Cambridge Neurotechnology Ltd, UK). The consumption of tryptophan-enriched cereals resulted in an increase of the activity-inactivity circadian rhythm consistency (p<0.05) when the cereals were ingested at dinner time. These cereals may be used as a dietary tool for improving sleep-wake rhythm in children with autistic disorders.

167 SLEEP BEHAVIORS IN CHILDREN WITH AUTISM SPECTRUM DISORDER AND SEVERITY OF DEPRESSIVE MOOD OF THEIR PARENTS IN SOUTH KOREA

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Purpose. Many patients with autism spectrum disorder have been reported to have sleep problems. The aim of this study was to analyze sleep behaviors of children with autism spectrum disorders using the Children’s Sleep Questionnaire and to estimate the degree of depressive mood of their parents or caregivers using Beck depression inventory.

Methods. Sleep questionnaire (SQ) included questions about sleep-wake patterns, presence of co-sleeper, primary sleep disorder such as sleep-disordered breathing, parasomnias. Conner scale(CS) were assessed from the patients with autistic spectrum disorders who had participated in the summer camp of August 2010 in South Korea. Beck depression inventory(BDI) was also collected to evaluate mood of parents or caregivers.

Results. A total of 48 patients aging from 7 to 29 years and 42 parents were recruited and completed the survey. 10 patients with epilepsy were included. Mean night sleep time in weekdays was 7.8±1.37 hours and there wasn’t any significant correlation between age and sleep duration. Mean sleep latency was increased to 47±26.4 minutes. 17 patients answered pediatric daytime sleepiness scale and the mean score was 13±6.76. Mean BDI of parents was 16.73±10.70. 58.1% of patients slept with one or both of their parents. 42(87.5%) patients answered they had sleep problems with falling asleep(54.2%), daytime sleepiness(27.1%), behavior problems during daytime(45.8%), insufficient sleep duration(58.3%) and sleep disorder(33.3%). The rate of daytime sleepiness and sleep disorder increased in patients with epilepsy upto 40% each. The most common complaint was that patients couldn’t sleep well and awake frequently during night.

Conclusions. This study demonstrated the pattern of sleep problems of patients with autism spectrum disorder and we can conclude that most patients with autism spectrum disorder suffer from sleep problems and their parents have depressive mood in moderate to severe degree. Furthermore study on the effect of improvement of sleep quality on autism spectrum disorder will be needed.

168 CHANGES IN SLEEP-WAKE PATTERNS AFTER THE EARTHQUAKE IN A GROUP OF CHILEAN ADOLESCENTS

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Introduction. One of the strongest earthquakes ever recorded struck Chile on February 27th at 03:34 am, with a magnitude of 8.8 Mw and lasting up to 90 seconds. Studies show that natural disasters can lead to health problems, including sleep disturbances. The aim of this study was to assess whether sleep-wake patterns changed after the earthquake in a sample of Chilean adolescents.

Methods. We studied 44 17-year olds (24 females, 20 males) before the earthquake (October-December 2009) and repeated the assessment after the earthquake (April-June 2010). Using activiwatches (Activiwatch-16/64)
169 SLEEP AND DAYTIME SLEEPINESS IN CHILDREN WITH DEPRESSION

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Introduction. Changes in objective sleep in adults with major depression (DM) include: sleep continuity disturbances, short latency to rapid eye movement (REM) sleep, increase phasic REM sleep, and diminish slow-wave sleep. In contrast, the changes observed in children with depression are less consistent (Ivanenko and Johnson, 2008, Kaufman et al, 2001), even when they report more subjective sleep complaints compared to controls (Bertocci, Dahl, Williamsom, 2005).

Methods. There were included 18 children between 8 and 13 years old with an average of 10.3 ± 1.4 (SD) years, eight met criteria for MD using K-SADS-PL-MX Interview (Kaufman et al, 1997, Ulloa, et al, 2006). Ten age-matched subjects were medically healthy and served as controls. Children with MD were free of medications at the time of the study. Children were subjected to two consecutive nights of polysomnographic recording with standard techniques. Daytime sleepiness was measured using the Pediatric Daytime Sleepiness Scale (Drake, 2003).

Results. There were not statistically significant differences in the macrostructure of sleep and daytime sleepiness between the groups (p> .01). However, in the group with depression, daytime sleepiness was associated with decreased slow wave sleep (r = -.69) and more sleep stage transitions (r = .67), whereas in the group without depression was associated with decreased REM sleep phase (r = -.83) and increased latency to REM sleep onset (r = .70).

Conclusion. Our results suggest that the macrostructure of sleep in children with depression differs from reports in adults with MD. However, indicate that daytime sleepiness is associated with a different architecture of sleep between groups with and without depression.

170 SLEEP DISTURBANCES IN CHILDHOOD – MENTAL ILLNESS IN ADULTHOOD?

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Introduction. Various studies have demonstrated that sleep disturbances in childhood and adolescence can lead to chronic conditions. Aside from the risk of chronicity, we have to also consider the question of whether sleep disturbances actually lead to mental disturbances.

Methods. The sleep related survey comprised of 73 items, meant to assess sleep behaviour in childhood and adolescence, and current sleep behaviour of adulthood. Two groups were asked: the healthy control group consisted of N = 152 adults (56 men, 96 women) with a mean age of M = 32.73 ± 10.18 years and 151 patients (69 men, 82 women) with a mean age of M = 33.46 ± 11.08 years. Patients were, at the time of the survey, outpatients of psychological therapy.

Results. The results of the study show that, as indicated by self report, in the patient group sleep problems were present to a substantial extent from an early age. Symptoms of insomnia, consequences of insomnia as daytime sleepiness as well as sleep related anxieties and parasomnias were reported significantly more than in the healthy control group through every age (childhood, adolescence and adulthood).

Conclusion. Insufficient or non-restorative sleep is associated with a reduced ability to control, suppress or change emotional reactions to pursue long term goals, social norms, or other goals. Sleep disturbances can lead to emotional instability as well as being a risk factor for mental illness.

171 INSUFFICIENT SLEEP OF CHILDREN WITH PSYCHOPATHOLOGICAL PROBLEMS DURING SUMMER CAMP

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Introduction. Studies in ADHD children have consistently shown increased frequency of sleep complaints such as delayed sleep onset, numerous nocturnal awakenings and sleepiness on awakening. Our aim was to describe sleep and its variability in children with ADHD and co-morbid psychopathological disorders during Summer Camp, a summer program where parents and children spend the week days at camp where they are trained in behavior modification techniques to improve behavioral regulation, but they sleep at home.

Methods. Sleep was continuously monitored by actigraphy for 7 days in 18 children (15 boys, aged 9.4yrs ± 1.7yrs, 88.9% Caucasian, 11.1% Other ethnicity). All children were taking one or multiple medications. Based on parentally reported diagnosis, the group comprised 7 ADHD, 8 ADHD with comorbidity, and 3 children with other psychopathology. In addition to standard sleep
measures, the variability of sleep patterns was also calculated for each sleep measure. 

**Results.** During the study, children slept 6hr58min (graph) with a variability of 1hr3min relative to the mean.

On average their sleep showed 33% restlessness (i.e., the sum of the % Mobile and the % Immobile Bouts <1-min. duration to the number of Immobility Bouts for the given interval), with no differences between weekdays and weekend. This was a “typical” night as reported by 66.7% of the parents. With an endorsement rate of >30% these children were frequently to almost always easy to awaken in the morning, willing to go to bed, restless sleeper, complaining about difficulty going to sleep, falling asleep easily. When children with ADHD were compared to those with additional comorbidities, the latter didn’t wake up as often during the night. 

**Conclusion.** Regardless of diagnosis, children with psychopathological problems clearly have insufficient and variable sleep despite the increased drive to sleep as expressed by subjective reports of daytime sleepiness.

172 DEPRESSIVE/ANXIOUS AND SLEEP DURATION TRAJECTORIES: A LONGITUDINAL STUDY DURING CHILDHOOD
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**Introduction.** Little is known about the association between internalizing symptoms and sleep problems during childhood (Gregory et al., 2006, 2008). Gregory and her collaborators (2008) found that sleep problems during infancy were associated with an increased risk of presenting depressive and anxious problems later in life. To our knowledge, no study has evaluated this association longitudinally for both problems during childhood.

**Objectives:** Our aim was to evaluate the association between depressive/anxious symptoms (DAS) and sleep duration trajectories during childhood after adjusting for sociodemographic factors.

**Methods.** A total of 2223 children aged 5 months-old were included in the longitudinal sample. Children were seen yearly thereafter until the age of 10 years. Mothers were asked to rate their child on a frequency scale indicating whether they never (0), sometimes (1), or often (2) exhibited the following DAS in the previous 12 months: “is nervous high strung or tense”; “appears fearful or anxious”; “appears worried”; “not happy as other children” and “has difficulty having fun” when the children were between 1.5 and 5 years. Nocturnal sleep duration was reported by mothers from 2.5 years to 10 years of age by through the following open-ended question “Indicate how long in total your child sleeps during the night (on average) and do not count the hours that your child is awake.” The sociodemographic factors used for adjustment were as follows: sex of the child, prematurity of the child, familial insufficient income, maternal Caucasian status and maternal education. A semiparametric modeling strategy was used to calculate the DAS trajectories (N=1759) and sleep duration trajectories (N=1877 children). A multinomial regression was used to calculate the association between DAS and sleep duration trajectories after controlling for the above sociodemographic factors (P<.05).

**Results.** Three DAS trajectories were obtained from the ages of 1.5 to 5 years: “high-rising” (14.7%), “moderate-rising” (55.4%), and “low” (29.9%) (Côté et al., 2009). Four sleep duration trajectories described the nocturnal sleep duration course from the ages of 2.5 to 10 years of age: “short-persistent” (7.5%), “short-increasing” (3.6%), “10-hour persistent” (52.0%), and “11-hour persistent” (36.9%). A significant model was found after adjusting for sociodemographic variables (P=.03). The short-persistent sleepers were 2.02 times more at-risk of following the high-rising DAS trajectory (95% CI=1.09–3.73, P=.03) compared to the children following the 10/11-hour sleep duration trajectory. Finally, the short-persistent sleepers were 1.67 times more at-risk of following the moderate-rising DAS trajectory (95% CI=1.03–2.72, P=.04) compared to the children following the 10/11-hour sleep trajectory.

**Conclusion.** Internalizing symptoms and short sleep duration are associated during childhood. Future studies should examine the etiological mechanisms common or specific to these problems.

173 SLEEP SYMPTOMS REPORTED IN CHILDREN DIAGNOSED ADD/ADHD IN A CLINICAL SETTING FROM THE YEARS 1992 TO 2009
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**Introduction.** To investigate reported co-morbid sleep, mood and health symptoms in a diagnosed ADD/ADHD population seen at a private outpatient clinic.

**Method.** The total sample of children and adults is over 3,000. This study is an initial analysis of 483 children, ages 5 to 13 years, 153 females, 332 males, 259 participants diagnosed with ADD and 218 diagnosed with ADD plus additional disorder (sleep and/or impact to brain function). The primary referral question was ADD/ADHD (referrals for brain insult/injury were excluded). Referrals were from teachers, parents, physicians, suburbs, metropolitan area, middle, working class. Children were evaluated with a specific neuropsychological test battery to measure attention variables and self-report measures were completed by parents and teachers. Self-report measures consisted of the following:

Teacher Measures: Child Attention Profile, ACTERS, ADDES, Academic Performance Scale School Situations

Results. Initial analysis reveals a significant number of children who were not pure ADD, who had numerous sleep symptoms as well as emotional and health related variables reported by parents on self report measures consistent with prior research.

Conclusions. Findings will address symptom trends seen on self-report measures and the relationship to neuropsychological testing in a diagnosed ADD/ADHD clinical sample of children ages 5 to 13 years.

174 THE JOINT EFFECTS OF SLEEP AND ADHD SYMPTOMS ON ACADEMIC PERFORMANCE
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Introduction. Sleep quality and quantity have been shown to be correlated with variation in academic performance. Children with ADHD are also known to perform less well at school than other children and they are also more prone to disorders of sleep. It is unknown whether sleep disturbances and ADHD have independent or inter-related effects on school performance. The present study was designed to identify the extent to which effects of sleep on school performance were shared with those of ADHD symptoms and were mediated via disorders of attention.

Methods. Thirty-seven children (21 male) aged 7-9 years were recruited through schools. Sleep was measured for one week using actigraphy. ADHD symptomatology was assessed using the Connor’s Teacher Rating Scale. Attention was measured using the Continuous Performance Test (CPT) and academic performance was measured using an aggregate score of school Standard Assessment Tests.

Results. ADHD symptomatology (r = -.44, p<.01) and sleep duration (r = .46, p<.01), but not sleep efficiency (r = .095, ns), were related to academic performance. Path analysis was used to determine the strength of the relationships between ADHD symptoms, attention and sleep duration. The effects of sleep duration on academic performance were direct and in addition were mediated via ADHD symptoms and attention. Sleep duration did not have a direct effect on attention. The model provided a good fit the data (χ² = 5.13, d.f. = 5, ns; CFI = 0.99; RMSEA = 0.03, CI 90% 0.00 to 0.23)

Conclusion. Duration is the component of sleep most closely related to academic performance. In part this relationship is explained by an increased level of ADHD symptoms and poor attention abilities in children with short sleep duration. However the major part of the effects of sleep duration on academic performance is via other mechanisms not tested in this study.
Objective. To evaluate sleep macrostructure, sleep disorders incidence and daytime sleepiness in attention-deficit/hyperactivity disorder (ADHD) affected children compared with controls.

Methods. 31 patients (26 boys, age range 6-12 years, mean age 9.3±1.7) with ADHD diagnosed according to DSM-IV criteria, without comorbid psychiatric or other disorders, as yet never before pharmaco logically treated for ADHD. The controls - 26 age-and sex-matched children (22 boys, age range 6-12 years, mean age 9.2±1.5). Nocturnal polysomnography (PSG) was performed for two nights followed by the multiple sleep latency test (MSLT).

Results. No differences between the two groups comparing both nights were found in the basic sleep macrostructure parameters or in the time (duration) of sleep onset. Occurrence of sleep disorders (sleep-disordered breathing; SDB, periodic limb movements in sleep-PLMS, parasomnias) did not show any significant differences between the investigated groups. A statistically significant difference (p<0.015) was found in the trend of the periodic limb movement index (PLMI) between two nights (a decrease of PLMI in the ADHD group and an increase of PLMI in the control group during the second night). While the mean sleep latency in the MSLT was comparable in both groups, children with ADHD showed significant (sleep latency) inter-test differences (between test 1 and 2, 1 and 4, 1 and 5, p<0.01).

Conclusion. After the inclusion of adaptation night and exclusion of psychiatric comorbidities, PSG showed no changes in basic sleep parameters or sleep timing, or in the frequency of sleep disorders (SDB, PLMS) in children with ADHD compared with controls. Though we found no proof of increased daytime sleepiness in children with ADHD against the controls, we did find significant vigilance variability during MSLT in the ADHD group, possibly a sign of dysregulated arousal.

177 PREDICTING ADHD FROM SLEEP PATTERNS AND BEHAVIOURS IN INFANCY AND EARLY CHILDHOOD
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Introduction. Associations between sleep disturbance in infancy and early childhood, and the diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) were investigated using data from the Avon Longitudinal Study of Parents and Children (ALSPAC) in South West England.

Methods. Parental questionnaires at 8 time points, from 6 to 140 months, asked detailed questions about sleep patterns and behaviours. ADHD diagnoses were made using a standardised psychiatric assessment, the Development and Well Being Assessment (DAWBA), completed by parents when their children were aged seven. Linear and logistic regression analyses explored associations between sleep and ADHD.

Results. Of 14,000 children in the original ALSPAC cohort, 8195 were assessed using the DAWBA and 173 cases (2.1%) met DSM-IV criteria for ADHD. Predictors of ADHD included male gender, young maternal age, pre-term or low birthweight. Children with ADHD slept significantly less at night in early childhood (13 minutes) and primary school (14-18 minutes). Differences decreased towards commencement of secondary school (age 11). Children with ADHD went to bed later at most ages but never by more than 10 minutes, and got up earlier, by only a few minutes. They slept less during daytime in early childhood and slightly more in later childhood, although differences were only a few minutes. By 18 months slightly more of the ADHD group had dropped their daytime sleep than the rest of the cohort. The ADHD group reported more disturbed night-time sleep at all time points but only significantly so from around 69 months. Some associations were found for individual ADHD subtypes.

Conclusions. Sleep disturbances are evident from early infancy/childhood in children with ADHD and predate official diagnosis and treatment of ADHD. Early sleep patterns may be both a useful risk factor and a marker that helps define a group potentially amenable to early intervention.
LONG-TERM EFFECTS OF METHYLPHENIDATE ON THE SLEEP PROBLEMS OF TAIWANESE CHILDREN WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER: EVALUATIONS BY BOTH SUBJECTIVE AND OBJECTIVE MEASUREMENTS
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Introduction. ADHD is the most common behavior and developmental disorder in childhood. More and more studies have focused on its' impact on sleep structure and its' comorbidity with sleep problems. The aim is to investigate the sleep problems in children with ADHD and different ADHD subtypes and long-term effects of methylphenidate (MPH) on sleep of ADHD children by both subjective and objective measurements.

Methods. 71 ADHD children (54M, mean age = 8.8 ± 1.9 y) were included: 35 had ADHD Inattentive (ADHD-I) and 36 Combined (ADHD-C) subtype. 30 age-matched children without ADHD were controls. Sleep problems were assessed by the pediatric sleep questionnaire (PSQ) and a nocturnal polysomnography (PSG) both pre- and 6 months post treatment with MPH (0.3-0.7mg/kg/dose; once or twice daily) for ADHD.

Results. ADHD children had significantly higher rate of delay sleep onset (P=0.013), daytime sleepiness (P=0.038), enuresis (P=0.047), bruxism (P=0.001), nightmare (P=0.003), periodic leg movement disorder (PLMD) (P=0.029), and snoring (P=0.004) than normal controls by PSQ parental reports, but PSG showed only differences in apnea hypopnea index (AHI), arousal index, and slow wave sleep percentage. There were no significant differences between ADHD-I and ADHD-C types by either PSG or PSQ measurements. Children treated with MPH had a significant decrease in ADHD rating scale (P < 0.001). In addition there were significant decreases in bruxism rate (48.6% vs. 28.6%, P=0.022) and snoring rate (34.3% vs. 25.7%, P=0.046) in ADHD-I; in nightmare frequency (27.8% vs. 13.59%, P=0.021) in ADHD-C type as showed by 6 months post treatment PSQ and rate of PLMD in the total ADHD children.

Conclusions. Daily treatment of children with ADHD with MPH improved not only subjective complaints but also objective sleep disturbances that demonstrated by PSG. As expected AHI and AI were however unchanged in the total ADHD children.

THE EFFECTS OF SUGAR ON ATTENTION OVER TIME: A PILOT STUDY
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Introduction. Poor sleep has been related to poor attentional capacity. Diet has also been reported to affect attention. However, there is paucity of research assessing the interrelationship between these three factors: diet, sleep and attention. Given previous reports that increased sugar decreases sleep quality (1), we hypothesized that increased sugar would decrease attention both immediately after consumption and the next morning, as a result of a poorer quality sleep.

Methods. In a randomized cross over, repeated (baseline-manipulation) design, nine healthy, pre-pubescent females (mean ±SD, 11.1 ± 0.57 years) participated in 2 overnight laboratory stays where sugar intake was significantly increased on one of the nights (increased by 100g). Sleep was measured with a reduced paediatric polysomnographic montage. Attention (reaction time, errors and concentration lapses) was measured by psychomotor vigilance task (PVT) at three time points (6:30pm, 8:30pm & 7:30am the following morning).

Results. Dietary sugar intake prompted a non significant increase in reaction time, concentration lapses and errors immediately after dietary ingestion of sugar at 6.30 PM and 8.30 PM. However these increases disappeared after sleep and showed a non significant trend towards an increased attentional capacity in the sugar condition compared to the non sugar condition.

Conclusion. Attentional capacity appeared to be decreased by sugar intake, but contrary to expectations, sleep improved this decrease. Therefore sleep appeared to positively impact attentional capacity the next morning after increased sugar load but this finding needs to be replicated in a larger sample size.
XI. Sleep and neurodevelopmental diseases

181 RESPIRATORY FUNCTION IN CHILDREN WITH SEVERE MOTOR DISORDERS USING NIGHT-TIME POSTURAL EQUIPMENT
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Introduction. Night-time postural equipment (NTPE) prevents hip subluxation in children with severe motor disorders (SMD) by stabilising body position in sleep. A polysomnographic study studied one night in NTPE and one night sleeping unsupported and reported lower oxyhaemoglobin saturation (SpO2) in children using NTPE. It was unclear if findings represented usual night to night variation in SpO2 or related to NTPE use. This study extended these findings by assessing NTPE users over multiple nights and comparing their night-to-night SpO2 variability to typically developing controls (TDC).

Method. NTPE users aged one to 19 years had domiciliary pulse oximetry (Masimo Radical) for 14 nights alternating between NTPE and sleeping unsupported. Transcutaneous CO2 (TOSCA500) measures for one night in each condition studied hypoxventilation. Similarly aged TDC had pulse oximetry for seven nights.

Results. Seventeen NTPE users and 20 TDC were recruited. Analysis is based upon 165 nights of SpO2 monitoring for 13 NTPE users, mean age 8.6 (SD 4.2) and 53 nights for 10 controls, mean age 8.5 (SD 2.9). There were no significant differences in oximetry measures or hypoxventilation between sleeping conditions in NTPE users. No NTPE users had all SpO2 parameters within normal limits across all monitored nights. There were significant differences in delta 12s, minimum SpO2, 3% desaturations/hour, %time>95% and the coefficient of variation for mean SpO2 between TDC and NTPE users, indicating greater variability and reduced nocturnal respiratory function in NTPE users.

Conclusions. Children with SMD are vulnerable to nocturnal hypoxia. In this study the extent of deviation of SpO2 variables from normal values was not influenced by NTPE use. Children with SMD also exhibit greater night-to-night variability in oximetry parameters compared to TDC suggesting that their clinical assessment should include multiple nights.

182 SLEEP DISORDERED BREATHING IN CHILDREN WITH EPILEPSY AND CEREBRAL PALSY
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Introduction. Sleep disordered breathing (SDB) is more common in children with either epilepsy or cerebral palsy (CP). This study evaluates the risk for SDB in children who share these disorders (CP/E) as co-morbid conditions.

Methods. Parents of children aged 2 -17 were asked to fill out the validated Pediatric Sleep Questionnaire: Sleep Disordered Breathing Subscale. Information about motor abilities was obtained via the Gross Motor Scale of Function Family Report Questionnaire (GMFCS). Surveys were scored; > 0.33 is considered positive and suggestive of risk for a sleep-related breathing disorder.

Results. Surveys were completed for 161 children; 82 (50.9%) were males, 79 (49.1%) females. Mean age was 10 years with a range of 2 -17 years. Epilepsy was present in 71/161 (44.1%). Of these children, 41/71 (57.7%) also had CP. GMFCS scores of 3-5 were found in 23.3% of patients with epilepsy only and in 85.4% of CP/E. The majority of patients with CP had spastic quadripareisis: 35/41 (85.4%). A comparison group (CG) of 67/161 (41.6%) children with neither epilepsy nor CP and GMFCS scores of 0-2 were identified. The CG did have other medical and neurologic diagnoses. In the epilepsy only group, 17/30 (56.6%) had positive surveys. In the CP/E group, 30/41 (73.1%) had positive surveys. The CG had positive surveys in 18/67 (26.9%). Significantly different rates of SDB are found between both the epilepsy only and CP/E groups and the CG; p values are 0.005 and >0.001 respectively.

Conclusions. Children with epilepsy are at substantial risk for SDB. If motor impairment to the level of GMFCS 3-5 is a co-morbid condition, the risk is very high indeed. Assessment of SDB is an essential part of the evaluation of all such children. Screening for SDB should also be part of the standard assessment for children with epilepsy.

183 EVALUATION OF ACTIGRAPHY AGAINST POLYSOMNOGRAPHY IN CHILDREN WITH CEREBRAL PALSY
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Introduction. Actigraphy is a convenient tool to estimate sleep parameters from movement data. Whilst widely used in pediatrics its validity has been challenged. The accuracy of actigraphy is lowest in children with insomnia and fragmented sleep. In special populations such as children with cerebral palsy and reduced limb movement actigraphy needs careful validation.

Methods. Four children (3 to 8 years) with severe quadriplegic Cerebral Palsy (GMFCS level 4/5) were admitted for overnight polysomnography to investigate reported sleep fragmentation and possible sleep-related breathing disorders. Polysomnography was carried out using a Nihon-Kohden EEG system and manually scored with Polysmith (version 6.0) using AASM guidelines. Actiwatches were type AW4 from CamNtech Ltd set on a 1min epoch and placed distally on the limb the child could move the most. Analysis was performed using Sleep Analysis algorithm (v7.31) set to high sensitivity. ‘Bed-time’ and ‘Getup-time’ were set at the ‘lights out’ and ‘lights on’ time from the polysomnography, then the automatic analysis applied. The sleep efficiency (SE), sleep latency (SL), total sleep time (TST) and wake after sleep onset (WASO) were noted.
Results. Consistently the actigraphy results indicate higher SE (difference 6.32-16.89%, mean difference 11.6%) and TST (difference 69-116 mins, mean difference 91 mins) than NPSG. Lower actigraphy values for SL (difference 0.27-5.0 mins, mean difference 13 mins) and WASO (difference 25.5-109.5 mins, mean difference 75 mins) were reported compared to NPSG.

Conclusions. As we would predict, actigraphy consistently overestimates TST and underestimates SL and WASO, using the above actiwatches and algorithms. The systematic nature of these errors suggests actigraphy might still be useful in measuring change in sleep parameters. We are continuing this work with epoch by epoch comparisons and other watches and algorithms.

184 NIGHT SLEEP AND CIRCADIAN RHYTHM IN PALSY CEREBRAL CHILDREN AFTER TRYPTOPHAN ENRICHED CEREAL ADMINISTRATION

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People with neurological problems usually show alterations in their sleep-wake circadian rhythm that result in nocturnal sleep difficulties. Our study focused on the evaluation of different treatments of cereals enriched in the amino acid tryptophan (200 mg/100 g cereals; Ordesa, S.L.) administered to children with cerebral palsy (n=10). Data were collected for 5 weeks according to the following breakfast/dinner schedule: The first week the children consumed tryptophan-enriched cereals at breakfast and control cereals (75 mg/100 g cereals) at dinner; the third week control cereals were eaten at breakfast and tryptophan-enriched cereals at dinner; the fifth week tryptophan-enriched cereals were eaten at breakfast and dinner. Variables were measured by wrist actimeters and analyzed by Sleep Analysis 5© (Cambridge Neurotechnology Ltd, UK). Tryptophan-enriched cereals consumed at dinner improved the children’s nocturnal sleep (p<0.05) and there was observed a tendency to improve activity-inactivity circadian rhythm consistency when tryptophan-enriched cereal were consumed at breakfast. We propose tryptophan-enriched cereals to improve circadian sleep-wake rhythm.

185 THE PROBLEMS OF SLEEP IN PARENTS OF SEVERELY MENTALLY AND PHYSICALLY DISABLED CHILDREN

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Introduction. Although sleep disturbances in severely mentally and physically disabled children were widely noticed, few attention have been paid for the problems of sleep in their parents. We aimed to know the sleep disturbances of parents who have taken care of severely mentally and physically disabled children.

Methods. We explained the objects of research to the parents of severely disabled children who are followed-up in our outpatient clinic, and asked them to answer questionnaires and sent it back with unsigned.

Results. 24 parents sent back the questionnaires. Nineteen patients (79%) performed some medical care such as suction, tube feedings and so on to their children. Seven patients (29%) were continuously monitored with alarm function. Twenty patients (83%) had sleep disturbances. Nineteen parents (79%) felt some troubles in their own sleep. Eleven (46%) could not sleep soundly, eleven (46%) awoke in midnight, and seven (29%) felt the short sleeping time. Their mean sleep duration was 6.0 hours, while that of their children were 8.75 hours. All of them felt that the disturbances of their sleep were caused by their concerns on their children’s conditions, such as convulsion, breathing problems and so on. Four (21%) of parents with sleep problems had children without sleep disturbance.

Conclusion. Many parents of severely disabled children had problems in sleep. The reasons of their problems were not only causes in sleep disturbance of their children but also their concerns on the conditions of their children. It is necessary for parents of severely disabled children to take good sleep. Supportive systems to relief their continuous anxiety should be established urgently.

186 EVALUATION OF SLEEP ARCHITECTURE IN EPILEPTIC CHILDREN

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Introduction. There is a growing interest in the bidirectional relationship between sleep and epilepsy. Sleep stages and deprivation may influence the expression of epilepsy and, on the other hand, the occurrence of seizures during sleep is influenced by the epileptic syndrome, seizure type and use of antiepileptic drugs.

The objective of this study was to evaluate the relationship between sleep disorders, frequency of seizures and underlying causes to establish a better diagnosis and treatment in children and adolescents.

Methods. We evaluated 32 children and adolescents with intractable epilepsy related or not to a structural lesion (identified by MRI) and compared sleep architecture of patients with epilepsy with that of normal controls. All subjects underwent a whole night polysomnographic recording. The following sleep parameters were considered for the analysis of sleep architecture: time in bed (TIB); sleep period time (SPT); total sleep time (TST); sleep onset latency (SOL); REM-leep latency; number of stage shifts/h; number of awakenings/h; sleep efficiency (SE); the percentage of...
SPT spent in wakefulness after sleep onset (WASO%); the percentage of SPT spent in sleep stages 1 (S1%), 2 (S2%), slow-wave sleep (SWS%), and REM sleep (REM%). Patients with epilepsy were divided into three subgroups based on the presence of lesion (subgroup 1: lesional by cortical malformation, subgroup 2: lesional by other causes and subgroup 3: non lesional).

The comparison between sleep parameters was performed by means of analysis of co-variance (ANCOVA) with age as covariate. This project was approved by the local ethical committee.

Results. TIB, TST, percentage of REM sleep and SE were reduced in patients with epilepsy. On the contrary, WASO% was significantly increased in the same patients, moreover, we observed an increased SOL in subgroup 1 and reduced sleep efficiency in both lesional subgroups.

Conclusion. Refractory epilepsy during childhood influences sleep organization mainly in patients with lesional etiology. The definition of the type of epilepsy is important to anticipate sleep disorders in this population.

187 ANALYSIS OF SLEEP STRUCTURE, BEFORE AND AFTER EPILEPSY SURGERY, IN 3 PATIENTS WITH DRUG RESISTANT FOCAL EPILEPSY, WITH ONSET IN THE FIRST YEAR OF LIFE

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Background. The relationship between epilepsy and sleep is complicated and reciprocal. Sleep has direct effects on interictal epileptiform discharges and on the occurrence of certain seizures (nocturnal frontal lobe epilepsy, CSWS, benign epilepsy with centro-temporal spikes). The aim of the study was to assess sleep structure before and after epilepsy surgery in 3 patients with drug-resistant focal epilepsy, with onset in the first year of life, and to correlate these findings with epilepsy outcome.

Methods. For our study, we selected 3 patients with drug-resistant focal epilepsy, with onset during the first year of life, who underwent epilepsy surgery. We performed a first polysomnographic sleep recording (PSG) before surgery and a second one three months after the operation. Sleep structure analysis was carried out using Ratschaffen and Kales (1968) standard criteria. Results. Six months after surgery, one of the three patients appears to be free of seizures, while the other two had a 30% reduction in the number of seizures. Concerning sleep parameters, all the patients showed an improvement in sleep efficiency, with an increase in total sleep time and a decrease in the wake after sleep onset (WASO) and in the number of movement time/hour (MT/h). The number of awakenings/hour, as well as, the number of stage shifts/hour, decreased in the patient who had no seizures during the after surgical recording, while it increased in the other two.

Conclusions. Several studies report sleep disruption in epilepsy patients, such as a reduction of REM sleep, an increase in WASO, resulting in a reduction in the number of total sleep time and sleep efficiency, an increase in sleep and REM latency. In our research, we found an improvement of these parameters after surgery. This improvement was more evident in the patient who had the best control of seizures, thus confirming that the number of seizures affects sleep.

The reduction in the number of seizures obtained by means of epilepsy surgery, in patients with early epilepsy, with onset during the first year of life, improves sleep quality. A longer follow-up will allow to assess if this improvement has a correlation with neuropsychological performances.

188 ATYPICAL PRESENTATIONS OF BENIGN CHILDHOOD EPILEPSY WITH ELECTRICAL STATUS EPILEPTICUS IN SLOW WAVES SLEEP

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Benign childhood epilepsy with centrotemporal spikes (BECTS) is the most common partial epilepsy syndrome in the pediatric age group, with an onset between age 3 and 13 years. The typical presentation is a partial seizure with parasthesias and tonic or clonic activity of the lower face associated with drooling and dysarthria. Seizures commonly occur at night and may become secondarily generalized.

Atypical evolutions of BECTS are defined by the appearance of severe neuropsychological impairments and continuous spike and waves during slow sleep. The clinical expression of these situations correspond to the syndromes known as atypical benign focal epilepsy of childhood (ABFEC), Landau-Kleffner syndrome (LKS) and continuous spike and waves during slow sleep syndrome (CSWSS), which may be part of a continuum related of benign childhood epilepsy with centrotemporal spikes (Fejerman N 2009).

In atypical benign focal epilepsy of childhood (ABFEC) several types of seizures, especially partial motor fits, atypical absences and myo-atomic seizures occur. The EEG picture is characterized by a striking contrast between waking records, which usually displayed focal paroxysms, and sleep tracings which shows an almost continuous, diffuse, slow spike-wave activity (Aicardi J, Chevrie JJ, 1982).

Neuropsychological and behavioral dysfunctions that can be observed in atypical evolutions of BECTS are considered to be related to intensity and localization of paroxysmal activity during sleep.

Purposes. In our study we enrolled 14 children (9 males, 5 female) without structural brain anomaly with atypical forms of benign childhood epilepsy with centrotemporal spikes and with electrical status epilepticus in slow sleep.

Here we describe the clinical data and evaluate the efficacy of different therapeutic agents.

Methods. Treatment response until disappearance of ESES was documented with overnight EEG recordings. Neuropsychological valuation was available. We defined EEG aspects, clinical features and the possible correlation with neuropsychological deficit.

Results. It is possible to define a subgroup of atypical form of benign childhood epilepsy age-related with particular EEG aspects and clinical features. There was a significant correlation between the duration of ESES and residual intellectual deficit at follow-up. Prognosis depends closely by early recognition and treatment of ESES-related cases.
XII. Treatment of sleep and associated problems in childhood

189 MELATONIN FOR CHRONIC IDIOPATHIC CHILDHOOD SLEEP ONSET INSOMNIA: IN SEARCH OF THE OPTIMAL DOSE

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Background. Several placebo-controlled trials have shown that melatonin, administered before dim light melatonin onset is an effective treatment for idiopathic sleep onset insomnia in children. However the lowest effective dose has not yet been established.

Methods. In this randomized placebo controlled double blind trial 72 children, aged 6-12 yr., with chronic sleep onset insomnia received either melatonin 0.05 mg/kg, 0.1 mg/kg, 0.15 mg/kg or placebo during one week to establish a dose response relationship.

Results. In all three melatonin treatment groups, one week treatment significantly advanced sleep onset (SO) and dim light melatonin onset (DLMO) by approximately one hour and decreased sleep onset latency (SOL) by 35 minutes. Effect differences between the three melatonin doses were not significant. The interval between time of administration (TOA) of melatonin and baseline DLMO correlated significantly with treatment effect on DLMO (r = .33, p < .05) and SO (r =.39, p < .01).

Conclusion. The present study does not demonstrate a dose-response relationship of melatonin with measures of sleep-wake rhythm and endogenous melatonin onset within a dosage range of 0.05-0.15 mg/kg. It does confirm earlier findings that effect size of exogenous melatonin increases with larger intervals between TOA of melatonin and baseline DLMO within the phase advance zone of the melatonin phase-response curve.

190 MELATONIN TREATMENT FOR CIRCADIAN RHYTHM SLEEP DISORDER IN A BLIND CHILD WITH MULTIPLE DISABILITIES – A CASE REPORT

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Introduction. The majority of children with multiple disabilities have long-standing sleep disorders, management of which is often neglected. Visually impaired children are especially liable to suffer from disturbed sleep patterns which may adversely affect their behaviour and development. The objective of our report was to examine circadian rhythm sleep disorders and describe their treatment in a blind child with multiple disabilities.

Methods. An 11-year old blind boy, former premature with cerebral palsy, symptomatic epilepsy and significant neurodevelopmental delay, presented with a severe circadian rhythm sleep disorder. His sleep-wake rhythm was objectively assessed by prolonged actigraphic recording. Raw actigraphic data was analysed and periodogram analysis revealed a peak correlation at 24:11 hours. Immediately after the introduction of treatment with slow-release melatonin a remarkable improvement was observed. Nocturnal sleep prolonged to a 6-9-hour period of undisturbed sleep while during daytime sleep was registered only occasionally. The entrainment of patient’s sleep-wake rhythm was further confirmed by periodogram analysis revealing a clear peak exactly at the 24-h period. Thought-out the monitoring period no adverse side effects of melatonin treatment were observed.

Conclusion. Properly timed application of slow-release melatonin provides safe and effective treatment for circadian rhythm sleep disorders in blind children with multiple disabilities. By improving nocturnal sleep it can improve also child’s daytime behaviour and social interaction enabling better participation in interventional programmes and thus improving the quality of life of the whole family.

191 THE EFFECT OF A HIGH SUGAR DIET ON SLEEP QUALITY IN PREPUBESCENT GIRLS

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Introduction. Sleep quality, important for optimal functioning and development in children is affected by many factors. The effect of dietary intake, particularly the role of sugar, has been little studied in children. Previous reports have suggested that children who consume more sugar are more likely to report decreased sleep quality (1). This study aimed to determine whether a high sugar diet effects objective sleep quality in prepubescent girls.

Method. Nine healthy female participants aged 10-12 years (mean age: 11 years 8.4 months) underwent two nights of polysomnography (PSG) in a randomised cross over design and were given a standard diet (48g of sugar) or a high sugar diet (100g of sugar) in an otherwise identical diet. Pre study sleep and diet were established as within normal ranges. PSG measurements of total sleep time, arousals, sleep onset latency and sleep efficiency were measured.

Results. Results indicated sugar significantly decreased time spent in stage one sleep (p=0.04) and stage two sleep (p =0.05) with a trend towards increased SWS (p=0.07) and stage three sleep (p=0.09). A split night analysis illustrated that sleep architecture was significantly different between each diet.

Conclusions. A high sugar diet has a significant impact on sleep stages in prepubescent girls. This indicates a relationship between sugar and sleep exists and further research is required.

192 INTERVENTIONS TO MODIFY EATING HABITS, PHYSICAL ACTIVITY AND SLEEP IN COMBAT
OF CHILDHOOD OBESITY: SYSTEMATIC REVIEW PRELIMINARY DATA
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Introduction. In Brazil, there is a tendency to increased prevalence in overweight and obesity in children influenced by intake of unsuitable foods, reduction of physical activity, and reduction of sleep time. Sleep is an important modulator of neuroendocrines functions and of glucose metabolism in children. The aim of this study was to make a systematic review of the literature, searching the best available evidence on educational interventions emphasizing physical activity and changes of eating habits and sleep in school children.

Method. Systematic Review in MEDLINE and LILACS data bases, additional reports identified in the reference lists of the articles. There was no language or type of study restrictions. We selected educative interventions for obesity prevention; physical exercises, sleep, and feed habits changing. Data extraction was carried out independently and in duplicate. Validity assessment of the included trials was carried out at the same time as data extraction. Discrepancies were discussed and a third reviewer consulted. The author of the primary study was contacted when necessary.

Results. 396 articles were found (181 excluded – not educative intervention or age inappropriate). 215 articles were included. At the moment, 35 completed articles were evaluated and shown in interventions as: physical activity practice (increasing of physical activity and decreasing of time spend in front of TV or sedentary), habit practice (increasing of physical activity and changes of eating habits). Data bases, additional reports identified in the reference lists of the articles. There was no language or type of study restrictions. We selected educative interventions for obesity prevention; physical exercises, sleep, and feed habits changing. Data extraction was carried out independently and in duplicate. Validity assessment of the included trials was carried out at the same time as data extraction. Discrepancies were discussed and a third reviewer consulted. The author of the primary study was contacted when necessary.

Conclusion. A brief behaviourial intervention that improved parent-report of sleep in infancy did not prevent overweight/obesity at 6 years. Sleep interventions should not be implemented to improve obesity until efficacy is confirmed. More intensive or differently timed interventions could prove effective but would be challenging to implement at the population level.

194 ASSOCIATION OF INFANT AND CONCURRENT SLEEP PROBLEMS WITH CHILD AND PARENT WELLBEING AT SCHOOL-ENTRY: FOLLOW UP OF A RANDOMISED TRIAL
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Introduction. Infant sleep problems predict later sleep problems. Sleep problems at school-entry age are associated with poorer child and parent mental health. No studies have examined whether infant sleep problems predict child and parent mental health at school-entry age, independent of concurrent sleep problems.

Aims. To examine the association of infant and 6 year sleep problems with (i) child mental health, quality of life, stress regulation, and (ii) parent mental health.

Methods. Design: Longitudinal population-based randomised trial of behavioural sleep intervention (ISRCTN487852250). Trial arms pooled for analysis. Participants: Children with parent-reported sleep problems at 7 months. Measures: Parent-reported child sleep problems at ages 10, 12, 24 months (“yes” versus “no”) and 6 years (none/mild versus moderate/severe). Emotional and conduct problems (Strengths and Difficulties Questionnaire), health-related quality of life (HRQoL: Pediatric-QoL Inventory), maternal mental health (Depression Anxiety Stress Scales) and child mother-reported sleep problem at 7 months, recruited from well-child checks in October-November 2003. Intervention: Behavioural sleep strategies delivered over 1-3 individual structured nurse consultations from 8-10 months, versus usual care. Outcomes at age 6 years: (1) BMI z-score; (2) % overweight/obese (IOTF cutpoints); (3) waist circumference (cm); (4) parent-reported child sleep duration, at age 6. Analyses: Intention-to-treat using linear regression for continuous and logistic regression for dichotomous outcomes, adjusted for demographic variables.

Results. At age 12 months (retention 89%), intervention children had fewer parent-reported sleep problems (39% vs 55%; adj OR 0.50; 95% CI 0.31-0.80) and night wakings (1.4 vs 1.7; adj mean difference -0.25; 95% CI 0.57-0.06) than control children. Retention at 6 years (59%) was similar in both groups, as were anthropometric and sleep outcomes (Table).

<table>
<thead>
<tr>
<th>6-year Outcome</th>
<th>Intervention</th>
<th>Control</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI z-score, mean (SD)</td>
<td>0.47 (0.9)</td>
<td>0.37 (0.9)</td>
<td>0.5</td>
</tr>
<tr>
<td>Normal vs. overweight/obese, n (%)</td>
<td>21 (21.0)</td>
<td>16 (17.6)</td>
<td>0.5</td>
</tr>
<tr>
<td>Waist, mean (SD)</td>
<td>54.9 (4.5)</td>
<td>55.2 (5.3)</td>
<td>0.7</td>
</tr>
<tr>
<td>Sleep duration hours, mean (SD)</td>
<td>10.8 (0.6)</td>
<td>10.8 (0.5)</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Conclusions. A brief behaviourial intervention that improved parent-report of sleep in infancy did not prevent overweight/obesity at 6 years. Sleep interventions should not be implemented to improve obesity until efficacy is confirmed. More intensive or differently timed interventions could prove effective but would be challenging to implement at the population level.
stress regulation (salivary cortisol waking-to-lunch change score) at 6 years. Analyses: Linear regression of outcomes on child 6 year sleep status, adjusting for infant sleep problems, gender, trial arm status, maternal education, age, baseline depression score and socioeconomic status.

Results. Responders (n=225, 69%) were more likely to speak English than non-responders (n=101). 6 year sleep problems (8% prevalence) were associated with poorer outcomes across all measures except cortisol. Of the earlier infant sleep problems, only those at 12 months predicted poorer maternal mental health at 6 years.

Conclusion. Infant sleep problems predicted maternal but not child wellbeing at age 6. Managing current sleep problems could potentially improve child HRQoL and child and parent mental health.

195 A SLEEP SERVICE AND PROFESSIONAL TRAINING PROGRAMME TO ADDRESS SLEEP DIFFICULTIES IN CHILDREN WITH DISABILITIES

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Introduction. Children spend half of their lives asleep. Sleep disturbance impairs learning, mood, daytime behaviour and health. Sleep problems are common in children with physical and learning disabilities. UK studies suggest a prevalence of up to 67% in children with significant learning difficulties. Children with physical disabilities, such as cerebral palsy, have confounding problems such as gastro-oesophageal reflux and sleep disordered breathing that may compound their sleep difficulties.

Methods. In 1998 Sleep Scotland developed a service to train sleep multi-professional counsellors in cognitive behavioural intervention for families with children with additional support needs. The Centre for Health and Social Research evaluated the programme alongside continuous evaluation using the General Health Questionnaire 30(GHQ30), sleep index to rate severity of child’s sleep problems and parental and professional feedback forms.

Results. 286 Sleep Counsellors have been trained and have offered this intervention to 1823 families, as well as supporting 4382 parents and 3655 professionals. Sleep Scotland’s full evaluation data will be presented in the poster presentation. Sleep Scotland is the only body carrying out this behavioural cognitive intervention work throughout Scotland.

Conclusion. The Sleep Scotland service, which uses behavioural and cognitive techniques, successfully address sleep issues in children and young people with additional support needs. This in turn leads to an improvement in an individual’s and their family’s quality of life. Professionals with diverse backgrounds can be trained and supported to improve sleep problems in children with disabilities.

196 A DEVELOPMENTAL APPROACH FOR CHILDREN’S SLEEP PROBLEMS: CHANGES IN SLEEP BEHAVIOUR, BEHAVIOUR PROBLEMS AND PARENTAL SLEEP QUALITY

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Objectives. Sleep problems are common during the first years of life (Owens, 2007). Although sleep difficulties in children may be transient and self-limited in nature, they often persist over years or may even gradually get worse over time if left untreated (Meltzer & Mindell, 2006). At our center, we treat children’s sleep problems by a three-step procedure that considers the development of normal sleep physiology and consists of regularizing bedtime, adjustment of bed time to sleep time and graduated extinction of inappropriate parental attention (Largo & Hunziker, 1984). This study aimed to evaluate and demonstrate the efficacy of our interventional procedure, designed to address multiple types of sleep problems (e.g. difficulties falling a sleep, night wakeings).

Methods. A pre- (T0), post- (T1) and 3-months follow-up (T2) study with sleep disordered children. Children’s sleep problems were assessed by the Infant Sleep Questionnaire (Morrell, 1999) and behaviour problems by the Children’s Behaviour Check List (Achenbach, 2000). Parents’ sleep quality was examined by the Pittsburgh Sleep Quality Index (Buysse, 1989) and psychosocial symptoms by the Symptom Check List (Derogatis, 1995). Areas of family functioning were assessed by the Family Relationship Index (Moos & Moos, 1994). Changes in children’s sleep behaviour over the course of the intervention were estimated by sleep diary and actigraphy (Acitwatch Plus AW4; Cambridge Neurotechnology).

Results. 75 children were included in the analysis (mean age=1.4 years, range 5-47 months; 44 boys and 31 girls).

50 children (67%) had severe sleep problems (frequent difficulties in falling asleep, night wakeings, and sleeping alone), whereas 25 children (33%) had a sleep problem in only one type. The frequency of children’s night wakeings as indicated in the diary and estimated by actigraphy significantly decreased and parental satisfaction with children’s sleep behaviour significantly increased from pre to post intervention (estimated on a 10-point scale: T0=3.7, T1=6.6, T2=4.4, p<0.05).

Conclusion. Our intervention leads to a change in the child’s sleep behaviour, behaviour problems and improves parents’ sleep quality and well-being.
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