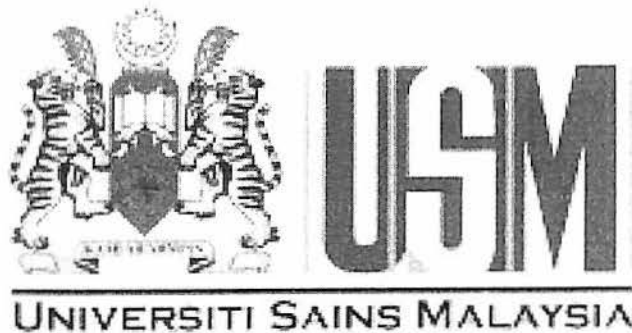


**SLEEP DISORDERS AMONG CHILDREN
ATTENDING THE PAEDIATRIC CLINIC
IN UNIVERSITI SAINS MALAYSIA (USM)
HOSPITAL**

by

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ABSTRAK

MASALAH GANGGUAN TIDUR DI KALANGAN KANAK-KANAK YANG MENERIMA RAWATAN SUSULAN DI KLINIK PEDIATRIK, HOSPITAL USM.

OBJEKTIF : Untuk menilai kekerapan masalah gangguan tidur di kalangan kanak-kanak yang sedang menerima rawatan susulan di klinik pediatric, Hospital USM.

PESAKIT DAN CARA : Kertas penilaian “Sleep Disturbance Scale for Children” mempunyai 26 soalan yang mana apabila digabungkan akan menghasilkan enam kategori masalah gangguan tidur iaitu “Disorder of Initiating and Maintaining Sleep”(DIMS), “Sleep Breathing Disorder”(SBD), “Sleep Wake Transition Disorder”(SWTD), “Sleep Hyperhydrosis”(SHY), “Disorder of Arousal”(DA), “Disorder of Excessive Somnolence”(DOES). Bagi tujuan kajian ini, kertas penilaian ‘SDSC’ ini telah diterjemahkan kepada Bahasa Malaysia. Iubapa yang datang menemani anak-anak mereka ke klinik Pediatrik bagi tujuan rawatan susulan pada tarikh antara Februari, 2006 hingga Februari, 2008 telah diberikan kertas penilaian ini ketika sedang menunggu giliran untuk berjumpa doctor. Kanak-kanak tersebut mestilah berumur antara 4 hingga 16 tahun dan tidak mengalami sebarang kecacatan mental dan fizikal.

KEPUTUSAN : Daripada 680 kanak-kanak yang dipilih dari 8 klinik pediatrik ini, 52.8% (361) adalah kanak-kanak lelaki. Bilangan kanak-kanak bagi setiap kumpulan umur adalah seperti berikut : 6-12 tahun (462, 67.5%), 4-5 tahun (86, 12.6%) dan 12 tahun ke atas (136, 19.9%). Enam puluh tiga (9.2%; 95% CI 7.3% - 11.6%) kanak-kanak didapati mempunyai masalah gangguan tidur secara keseluruhan. Peratusan kanak-kanak yang mempunyai masalah gangguan tidur mengikut kategori adalah seperti berikut: 64 (9.4%) DIMS, 55 (8.0%) SBD, 31 (4.5%) SWTD, 27 (3.9%) SHY, 31 (4.5%) DA dan 57 (8.3%) DOES. Analisa regresi menunjukkan kekerapan SBD ($p=0.01$) dan SWTD ($p=0.03$) mempunyai perbezaan yang ketara di antara klinik-klinik pediatrik tersebut. Analisa ini juga menunjukkan kanak-kanak yang berumur melebihi 12 tahun mempunyai kekerapan yang ketara ($p=0.03$) bagi kategori DOES. Tidak ada perbezaan yang ketara yang dapat dilihat pada komponen jantina dan kaum.

PERBINCANGAN DAN KESIMPULAN : Masalah gangguan tidur di kalangan kanak-kanak di klinik pediatrik, Hospital USM adalah tinggi secara relatifnya. Disebabkan impak yang besar kepada kanak-kanak dan keluarga mereka, adalah perlu agar kesedaran mengenai masalah gangguan tidur ini dapat ditingkatkan di kalangan kakitangan perubatan di klinik dan juga di kalangan komuniti.

ABSTRACT

Sleep disorders among children attending the paediatric clinic in USM Hospital.

OBJECTIVE: To evaluate the frequency of sleep disorders among children attending the pediatric clinic in USM Hospital.

METHODOLOGY: The Sleep Disturbance Scale for Children (SDSC) consisting of 26 items which concentrates on six sleep disorders, Disorder of Initiating and Maintaining Sleep (DIMS), Sleep Breathing Disorder (SBD), Sleep Wake Transition Disorder (SWTD), Sleep Hyperhydrosis (SHY), Disorder of Arousal (DA), Disorder of Excessive Somnolence (DOES), was translated to Bahasa Malaysia. Parents of children aged 4-16 years attending the paediatric clinic, USM Hospital from December 2005 to February 2008 were requested to complete the SDSC while awaiting consultation.

RESULTS: Among 684 children from 8 sub-specialty clinics who completed the SDSC, there were 361 (52.8%) boys. The number (%) of children in each age group was as follows: 6-12 years old (462, 67.5%), 4-5 years old (86, 12.6%), more than 12 years old (136, 19.9%). Sixty-three (9.2%; 95% CI 7.3% to 11.6%) children had a significant total sleep problem score. The proportion of children with specific sleep disorders were as follows: 64 (9.4%) DIMS, 55 (8.0%) SBD, 31 (4.5%) SWTD, 27 (3.9%) SHY, 31 (4.5%) DA, and 57 (8.3%) DOES. Regression analysis revealed that the frequency of SBD ($p=0.01$) and

SWTD ($p=0.03$) was significantly different among subspecialty clinics, and children aged more than 12 years had a significantly higher prevalence of DOES ($p=0.03$) than other age groups. No significant gender differences were observed.

CONCLUSION: Sleep disorders were relatively high among children attending the paediatric clinic in USM Hospital. Given the impact of sleep disorders on children and families, there is a need for increased awareness of children's sleep problems in the clinics and community.

1.0 INTRODUCTION

1.1 Prevalence of sleep disorder in children

Sleep disorders has long been recognized and described in the literature. A growing amount of literature suggest sleep disturbances are common among children (Bruni et al., 1996). It affects up to 30% of children (Blunden et al., 2004). Kahn et al (1989) and subsequently Lozoff et al (1985) , concluded that between 20 and 30% of children and 15% of adolescents experience some form of sleep disturbance. In Beijing, China, the overall prevalence of sleep disorder in children aged 2 to 12 years old were 21.2% (Liu et al., 2005)

Among the types of sleep disorders, sleep breathing disorder (SDB) has been most widely studied in terms of prevalence as well as its association with psychosocial/neurocognitive dysfunction. This is because the diagnosis of sleep breathing disorder can be made objectively via polysomnography and sleep study. Other types of sleep disorder are mainly diagnosed subjectively based on the history and behavior study. Ali et al (1993) and Anuntaseree et al (2005) reported prevalence of 0.7% (7/996) and 1.3% (10/755) of children with obstructive sleep apnoea syndrome (OSAS) respectively. In addition, Anuntaseree et al (2005) also demonstrated children who had severe OSAS showed evidence of severe and frequent apnoea episodes during sleep characterized by apnoea-hypopnoea index (AHI) of 1.5 – 9.2 per hour of sleep.

A study conducted by Archbold et al (2002), using validated Paediatric Sleep Questionnaire distributed to parents of 1083 children, aged between 2.0 – 13.9 years old at 2 general paediatric clinics. He demonstrated significant number of children with sleep disturbances. Of which, disorder of initiating and maintaining sleep (DIMS) contributed to 41% (430), sleep terrors/sleep walking/nocturnal bruxism 38% (390), habitual snoring 17% (176), increased

daytime somnolence 14% (148) and sleep disordered breathing 11% (115). There were 2 or more symptoms present in 18% (191) children.

1.2 Development of Sleep Medicine

By 20th century, increasing number of sleep disorders have been documented and characterized. To date, there are approximately 84 recognized sleep disorders. Among the first influential books on the development of sleep medicine was Pieron's *Le Probleme Physiologique Du Sommeil* in 1913; *Sleep and Wakefulness* by Kleitman in 1939 and *Diagnostic Classification of Sleep and Arousal Disorders* by the Association of Sleep Disorder Centers headed by Howard Roffwaeg in 1979 became decisive volumes for the classification sleep.

Within the past 40 years, sleep research has become viewed as valuable and pertinent. In 1961, organized sleep medicine in the United States began with the founding of the Association for the Psychophysiological Study of Sleep (APSS), composed of a group of clinical sleep research. The Association of Sleep Disorder centers (ASDC), founded in 1976, established a nationally recognized accreditation process for sleep disorder centers.

The association later changed its name to American Sleep Disorder Association and again in 1999 to American Academy of Sleep Medicine (AASM) following recognition by The American Medical Association. Beginning from 1970, apart from America, more and more number of associations and societies concerning sleep disorders were developed including Europe, Canada, United Kingdom and Japan. Up to date, there are more than 1,000 sleep centers and labs worldwide, mostly accredited by ASSM.

1.3 Prevalence of sleep disorders in local population

In Malaysia, studies concerning sleep disorders are still very scarce. Therefore, sleep medicine, one of the subspecialties which has been long recognized and credited worldwide is still alien to the Malaysian medicine. The only sleep disorder that is slowly emerging to be explored particularly by the otorhinologists and respiratory physicians is obstructive sleep apnoea (OSA).

One of the few studies concerning the OSA was the prevalence study of snoring among Malaysian children, conducted at hospital based clinics in Kuala Terengganu Hospital (Saeed et al., 2007). The study revealed 14.5% of Malaysian children snored during their sleep. It was also revealed that these children had craniofacial abnormalities that could be the cause of the symptom. The study made use of the Berlin's questionnaire, known as Sleep Behavior Questionnaire.

1.4 Under-report of sleep disorders in children

Nevertheless, sleep disorders remains under recognized and sometimes misinterpreted. A contributing factor may be the lack of community awareness of the negative effects of sleep problems on daytime functioning in children and hence the under-reporting by parents at medical consultation (Blunden et al., 2004). A study conducted by Chervin et al in 2001, at two community based general paediatric clinic, it revealed that children with Pediatric Sleep Questionnaire (PSQ) – identified sleep problems, seldom had these problems addressed, diagnosed or treated despite discussions about some aspects of their sleep in the large majority of cases .

A study conducted by Blunden et al in 2004 on 361 children aged 4.5-16.5 years attending their GPs clinic showed that chronic sleep problems were seldom raised during medical consultation. Despite a relatively high percentage of reported sleep disturbances on questionnaire – 24.6% (89/361), only 13.9% (11/79) raised the problem at consultation. Similar findings have been reported by Stein et al (2001) , who found that although 10.8% of 4-12 year olds (n=472) reported persistent sleep problems within the previous 6 months, less than 50% of parents discussed sleep at consultation.

There is also evidence that medical practitioners may under-report sleep problems in children. It was reported in one of the studies that only 15% of symptomatic children had documentation of sleep problems in the case notes, with diagnosis recorded in 2% (2/86) and treatment not recorded at all (Chervin et al., 2001). Owens (2001) reported that only 34% of paediatricians (n=626) were confident in evaluating sleep problems in children and adolescents, with only 25% confident to treat them. Blunden et al (2004) also reported that general practitioners raised sleep problems in only 10.1% (8/79) of symptomatic children.

Misdiagnosis and inadequate diagnosis are common. Various forms of sleeplessness may well not be distinguished from each other and often treated ineffectively with medication rather than a usually more appropriate behavioral approach. Excessive sleepiness has been frequently diagnosed as laziness, lack of interest and poor motivation. The parasomnias are particular cause of confusion. Sleep disorders should be part of training for paediatricians, child psychiatrists and those involved in the care of children. As has been suggested by Mindell et al (1999), there is a need for increased instruction in sleep medicine despite the already overloaded medical curriculae.

1.5 Potential sequelae of sleep disorders

Untreated sleep-related disorders may lead to potential sequelae such as reduced academic performance, neurocognitive function and increased problematic daytime behavior (Stores, 1999). Severe sequelae, such as cor pulmonale, developmental delay, failure to thrive and death, are rare with recognition of the disorder. Psychometric studies have shown that sleep disturbance can produce a range of cognitive impairments, depending on its duration, the nature of the task and individual susceptibility which is influenced by motivation, personality and the individual's usual sleep requirements. Memory, attention and visuospatial abilities can be affected but sustained attention (vigilance) and possibly divergent intelligence (creativity) are particularly vulnerable.

Sleep disorders affect child's learning, behavior and sometimes physical development. Parenting and family function can also be affected (Stores, 1999). Gottlieb et al (2003) picked up 25% of 3019 of 5 year old children, having sleep disordered breathing (SDB) characterized by frequent/loud snoring, troubled breathing, loud and noisy breathing during sleep or witnessed apnoea. He demonstrated 19% of those children manifested hyperactivity, 18% with inattention, 12% with aggressiveness and 10% with daytime sleepiness.

Blunden et al (2005) assessed those children with history of snoring and behavior sleep problems (BSP) who were identified from SDSC questionnaire. They were assessed in the area of neuropsychological and psychosocial function using Wechsler abbreviated Scale of Intelligence, Children's memory scale, Test of Everyday Attention and Auditory Continuous Performance Test and Child Behavior Checklist. He demonstrated children with snoring and BSP manifested low intelligence/attention score as well as low memory scores/social competency/problematic behavior respectively. Those children with combination of snoring and BSP manifested both groups of neuropsychological and psychosocial dysfunction

(Blunden et al., 2005). Nevertheless, children with SBD ranging from mild type to obstructive sleep apnoea syndrome (OSAS) who were mainly caused by adenotonsillar hypertrophy demonstrated significant improvement not only in their sleep characteristics but also in their neurocognitive function and day time behavior approximately 6-10 months following adenotonsillectomy (Friedman et al., 2003).

1.6 Paediatric Sleep Disorders

1.6.1 Pediatric Sleep Architecture

A brief review of sleep architecture is useful for the ensuing discussion of commonly encountered sleep disturbances in children. Sleep architecture is defined as the organization and relatively reliable cycling of sleep stages within the nighttime sleep period. When the child is awake, it is characterized by the presence of alpha waves (8-13 Hz frequency) over the posterior brain regions on the electroencephalogram (EEG). Stage 1 non-rapid eye movements (NREM) sleep commences when the alpha waves activity starts to disappear and this followed with the emergence of low-voltage mixed-frequency EEG. When K complexes and sleep spindles emerge subsequently, stage 2 sleep is the most abundant sleep stage after 3 months of age. Stages 3 and 4 NREM sleep, or delta sleep are marked by the gradual prominence of delta waves (1-2 Hz). A background composed of 20% to 50% delta waves corresponds to stage 3 and one of 50% or more delta waves corresponds to stage 4 sleep. Stages 1 through 4 comprise what is collectively referred to as stage NREM sleep. After an average duration of 90 to 120 minutes for a complete cycle of NREM sleep, the EEG shifts to a low voltage pattern coupled with loss of muscle tone and the advent of rapid eye movements, corresponding to the stage of rapid eye movement (REM) sleep or so called “dreaming sleep” (Capp et al., 2005).

The time spent in REM sleep and total sleep varies markedly with age. By 12 months of age, REM sleep accounts for 20% to 25% of total sleep time, a proportion that remains through adulthood. The total sleep requirement progressively decelerates throughout infancy and childhood until reaching 9.5 hour requirement during adolescence, 8 hours in adulthood and then lesser amount with aging.

Table 1.0. Average daily sleep requirements from neonates to adolescence

1 week	: 16.5 hours	9 years	: 10 hours
6 months	: 14.5 hours	Adolescent	: 9 hours
12 months	: 13.8 hours	Adult	: 8 hours
2 years	: 13 hours		
3 years	: 12 hours		
5 years	: 11 hours		

By 6 months of age, daytime sleep usually becomes consolidated into a morning and afternoon nap. By 18 to 24 months of age, there is generally one long afternoon nap. By 5 or 6 years of age, many children have given up their afternoon nap (Capp et al., 2005)

1.6.2 Classification of Paediatric Sleep Disorders

Pediatric sleep disorders have been defined and grouped according to the type of disruption of sleep architecture. Based on the International Classification of Sleep Disorders – Revised (Thorpy, 1990), its major grouping are as follows:

- 1) Dyssomnias
- 2) Parasomnias
- 3) Sleep disorder associated with medical, neurological or psychiatry illness
- 4) Proposed sleep disorder

1.6.2.1 Dyssomnias

The dyssomnias refer to a group of disorders affecting normal sleep and wakefulness. The affected children will have difficulty getting off to sleep or remaining asleep or excessive sleepiness during the day. They can be further divided into :

- a) intrinsic sleep disorders (i.e. originating from within the body) such as obstructive sleep syndrome (OSAS), central sleep apnoea syndrome, narcolepsy, periodic limb movements, restless leg syndrome etc.

Periodic limb movements in children is very rare. It is more commonly seen in adults. They were 2 reported cases involving female children less than 7 years old with this type of disorder. Both of them manifested severe neuropsychological disorders and learning failure (Bestue-Cardiel et al., 2002).

Narcolepsy is a fairly common disorder, with estimated 1:1000 cases in USA. It is said to be a life long disorder. The presentation includes increased daytime sleepiness, cataplexy (loss of muscle tone), sleep paralysis, hypnagogic hallucinations and disturbed night time sleep. The disorder may affect lifestyle, interpersonal relationship, school performance, job opportunity and family life (Cohen, 1988).

b) extrinsic sleep disorders; caused by external factors including an inappropriate sleeping environment and parenting factors.

Eg. inadequate sleep hygiene, environmental sleep disorder, sleep-onset association disorder.

Sleep onset association are most commonly observed in infants, toddlers and preschoolers. It occurs when a child is used to fall asleep under a prescribed set of conditions that often involve the presence of parents. If the conditions are absent, the child does not go to sleep. If the child awakens after sleep onset, he or she cannot return to sleep unless the initial conditions are again met. Subsequent adjustment with inconsistent rule setting and failure to follow through with discipline will result in chronic sleep disorder. This later on results in excessive daytime sleepiness in children due to insufficient sleep. This type of disorder respond well to education and support.

c) circadian sleep-wake rhythm disorders i.e. inappropriate timing or organization of the sleep phase

eg. time zone change (jet lag) syndrome, shift work sleep disorder

1.6.2.2 Parasomnias

The parasomnias are abnormal behavior or physiologic events that occur in association with sleep stages or the transition between sleeping and waking. Typically there is a family history of these disorders. The occurrence is usually linked to a developmental stage. Night terrors may appear in the second year itself while sleepwalking and sleep talking more commonly develop in the preschool and school aged children. Confusional arousals can occur at any age. Most parasomnias resolve by adolescence. Regular recurrence of the parasomnias with awakenings can result in daytime sleepiness.

- A. Arousal disorders - sleepwalking, sleep terrors
- B. Sleep-wake transition disorder – rhythmic movement disorder, sleep talking,
nocturnal leg cramps
- C. Parasomnias associated with REM sleep – nightmares, sleep paralysis
- D. Other parasomnias – sleep bruxism, sleep enuresis

1.6.2.3 Sleep disorders associated with mental, neurological or medical disorders

- 1) Associated with mental disorders – psychosis, mood / anxiety disorders
ADHD, panic disorder
- 2) Associated with neurological disorders – dementia, sleep related epilepsy
sleep related headache
- 3) Associated with medical disorders – asthma, gastro-oesophageal reflux
peptic ulcer disease

There has been many articles written about strong associations between sleep disorders and children with Attention Deficit and Hyperactive Disorders (ADHD). The common sleep disorders affecting these children are sleep-onset delay / maintaining and sleep-breathing disorder and daytime somnolence. It was suggested that children undergoing evaluation for ADHD should be screened for sleep disorders and treatment should be advocated appropriately as it may improve the general outcome of these children (Owens et al., 2000). Sleep disorder in ADHD could also contribute to their low I.Q.

In a study conducted by Andreou et al in 2003, children with ADHD were documented to have poor quality of night sleep characterized by polysomnography findings in the form of apnoea, desaturation, snoring, awakenings and limb movements. He also demonstrated that these children showed low verbal I.Q which was 20 points lower than the controls.

1.6.2.4 Proposed sleep disorder

These are the disorders for which insufficient information is available to confirm their acceptance as definitive sleep disorder.

Eg. short sleeper, long sleeper, sleep hyperhydrosis

1.7 Sleep Disorder Questionnaire

1.7.1 History

Epidemiological surveys using questionnaires has been started since 1980s by many researchers. The questionnaire was not only to assess the frequency distribution of sleep disturbances but also to evaluate the quantitative aspects of sleep behavior (Salzarulo and Chevalier, 1983), (Dollinger, 1985). This is achieved by formulating a 'score' that gives the clinician a global evaluation from the questionnaires of sleep disorders for the single subject. Since that year onwards, several questionnaires on sleep behavior had been produced. Unfortunately, the early batches of these questionnaires were found to be incomparable with each other because the questions asked or the grading of the responses were different and lack specific sensitivity (Simonds and Parraga, 1982); (Kahn et al., 1989); (Cook and Burd, 1990).

The subsequent studies carried out to attempt a standardization of the questionnaires were also of no significance since the questions were not formulated to give an index of sleep disturbances. The only two studies reported assessing sleep disorders from a statistical point of view were the factor analytic study of the Children Sleep Behavior Scale (CSBS) (Fisher et al., 1989) and Dollinger (1982) study. However, both of them failed to demonstrate relationships between questions and the categories of children's sleep disorders as proposed by Association of Sleep Disorders Centers. This were mainly due to incorrect interpretation of the wording of items in the questionnaire and also due to inadequate exactness in the parental report. Pollock (1994) demonstrated that parental reports of disturbed sleep and objective measurements of sleep generally agree.