Sleep Patterns and its influence on Sleep Problems among Children in India: A Systematic Review & Meta-Analysis

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Abstract

Sleep is equally important to the food we eat, the liquids we drink, or the safety of the children. Each living being needs sleep. It is the essential activity of the mind during each stage of development. Whereas inadequate sleep can lead to the development of various health issues. Although a generous group of literature has explored the relationship between sleep patterns and problems, comprehensive reviews and far-reaching conclusions are lacking. This systematic review was conducted to describe the sleep pattern or habits present in Children and also to identify its influence on the onset of various sleep problems among 3 to 18 years. Electronic databases were searched for articles published up to August 2019 and no limits for study designs were kept. The articles for review were obtained from databases like MEDLINE, PubMed, Cochrane, and Google Scholar along with a handful of references of experts using Boolean operators' search criteria. The guidelines adopted were Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The nighttime sleep duration was the most common sleep measure or variable in 73% of the articles. The average sleep duration (night time) is 9.811 hours (3 to 5 years), 9.082 hours (6 to12 years) and 7.944 hours (12 to 18 years). The result from this review suggested that sleep patterns tend to delay as the age increases leading to insufficient sleep and irregular bedtime schedules leading to the onset of some of the sleep problems like snoring, nightmare, bedwetting, etc. A few reviews suggested that it was difficult to define the sleep problem effectively as families vary greatly in their tolerance of their children's sleeping habits.

Keywords: *Sleep, Sleep Pattern, Sleep Problems, Children's Sleep*

Introduction and Background of the Study

Each living being needs sleep. It is the essential activity of the mind during each stage of development. Sleep is equally important to the food we eat, the liquids we drink, or the safety of the children. Circadian rhythms or the sleep-wake cycle begin to develop at about six weeks, and by three to a half year, most infants have a regular sleep-wake cycle. By the age of two, most of the children have spent more energy and time in sleep than being alert. Hence, a child is spending 40% of his or her childhood asleep. There are two states of sleep in the sleep-wake cycle. They are: Non-Rapid Eye Movement (NREM) or "quiet" sleep and Rapid Eye Movement (REM) or "active" sleep.

Neonates spend 50 percent of their time in each of these states and the sleep cycle is about 50 minutes. But when the child is at about six months of age, REM sleep comprises about 30 percent of sleep. At the preschool age, the duration of the sleep cycle increases and is about every 90 minutes. Children should get sound and enough sleep according to their age so that they can play, and develop cognitive skills during the day time.

The children of India suffer from various sleep disorders due to lack of adequate sleep. Many studies have proved that Asian countries are more sleepless as compared to Western countries. The most common sleep disorders seen in children are daytime sleepiness, restless sleep, difficulty falling asleep, and sleepwalking are a few. It is very much important to early detect sleep disorders and identifies sleep deprivation as it is associated with conditions like cardiovascular morbidities, ADHD, and obesity. As far as we are aware, no systematic review was conducted in the age group

3 – 18 years of age in India. Unlike adults, the children cannot complain about sleep problems or they could get the treatment for it. Hence it is necessary to identify the sleep pattern of Indian children and to identify the common sleep disorders they are affected with through an extensive systematic review. This systematic review was conducted to describe the sleep pattern or habits present in Children and also to identify its influence on the onset of various sleep problems among 3 to 18 years. The benefit of collating a systematic review is to measure abnormal sleep patterns which in turn can be helpful to frame policies and strategies for the resolution of the sleep problems.

Purpose

This systematic review aims to review the pattern of sleep among children age between 3 to 18 years and its influence on sleep problems.

Methods:

The designing of protocol and data extraction was conducted according to the 2009 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Literature Review Strategy

A search strategy was developed to identify studies related to sleep patterns and sleep problems from 3 to 18 years of age. Electronic databases were searched for articles published from 2005 to August 2019 and no limits for study designs were kept. The articles for review were obtained from databases like MEDLINE, PubMed, Cochrane, and Google Scholar along with a handful of references of experts using Boolean operators' search criteria. The search was limited to the articles in the English language only. An extensive literature search was done whose title, abstract or keywords included references to sleep, sleep pattern, sleep problem, child (age between 3 to 18 years). The articles extracted from the database were examined to extract potentially relevant articles, which was examined later in more depth to meet the inclusion or exclusion criteria set by the authors. The guidelines adopted were Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

Inclusion and exclusion criteria

The inclusion criteria used in the current systematic review are given below:

- Original article
- Non-clinical studies
- The age group of the participants between 03 to 18 years
- Studies in which samples are well described as the number of subjects, gender, etc.
- Studies with one or more of the variables like sleep pattern or duration, various sleep problems or disorders mentioned like sleepwalking, daytime sleeps, etc.
- Data were presented numerically

The exclusion criteria followed in the study are:

- If the study was published at more than one place then only the first published study will be included.
- Clinical studies.
- Studies published before the year 2005

Scientific literature quality assessment

The quality of the studies selected and used in the systematic review was assessed and evaluated by the Quality Assessment Checklist for observational studies by Hoy et al. The checklist consists of 09 items. The highest possible score was 09 and the minimum score was 0. The two investigators scored the articles independently and discrepancies were resolved through discussions.

Data extraction

The mean and standard deviation (SD) data from variables like duration of nighttime sleep and day time nap was extracted from the articles regarding sleep pattern. Further, the variables selected for sleep problems were categorized into three headings namely, sleep latency, hypersomnia (irresistible urge to fall asleep during the day, narcolepsy) and parasomnias (sleep talking, teeth grinding, sleepwalking, night terrors, nightmares). When the studies included weekend and weekday data, the average was extracted to align the majority of studies to represent the routine sleep pattern. When data for gender was separately available, the data were combined.

Meta-analysis and reference values

Meta-analysis was conducted for sleep measures in three age-bands identified by the investigators such as Pre-schooler (3 to 5 Years), Schooler (6 to 12 Years) and Adolescents/Teenagers (12 to 18 Years) The analysis was performed with the Open-Meta (Analyst) statistical software using the mean and standard deviation (SD) for each study to produce the pooled estimate mean and the 95% confidence intervals (CIs) in sleep pattern (duration of nighttime sleep) of the children. Additionally, the variables selected for analysis of the sleep problems were analyzed using the prevalence rate (number of each event occurred) and the 95% confidence intervals (CIs) for the estimation of pooled prevalence rate according to the identified age-bands.

Results

Database searches

The search criteria from all databases (with duplicates eliminated) rendered 44 articles. Of those, 31 found to be potentially relevant papers based on title and abstract and were used for the application of inclusion and exclusion criteria. 15 articles were excluded, leaving 16 articles for review. During data extraction, a further 05 were excluded because age ranges were too wide or articles contain limited data for meta-analysis. Data were captured from 11 cross-sectional designs (among these 02 studies were not included for quantitative analysis). The detailed search criterion is represented in Figure 1.

Articles Reviewed

Table 2 summarizes the important aspects of the 11 articles included in this review. All studies recruited both boys and girls; some did not supply a breakdown of gender. The review included studies from 09 different states in India. 02 articles were considered good quality based on the criteria, with 08 of moderate quality and 1 of poor quality. But no study was neglected for data accuracy.

Table 1: Articles included in this review with Quality Index Score

First Author	Year	Population/Region/ Area of study	Study numbers	M:F	Age	Instument/ Measure	Design	Variables	Quality Index Score
C. Barathy	November, 2017	Pediatric Out Patient Department (OPD), Indira Gandhi Medical College and Research Institute, Puducherry	650		1-12 years	Semi-structured questionnaire (for pattern & Reporting by parents or self (for problems))	Cross-sectional observational study	Bedtime, wake-up time, night awakening, day nap, weekend sleep schedule and sleep problems	3
Ravi Gupta	April - June, 2017	Primary schools of the semi - urban areas of Dehradun, Uttarakhand	435	0.65	4 – 9 years	Pediatric Sleep questionnaire (Hindi translated)	Cross-sectional observational study	Various sleep problems like sleep latency, hypersomnia & parasomnia	5
J. C. Suri	January, 2008	School-going children residing in Delhi	2475		5 - 18 Years	Pediatric Sleep Questionnaire	Cross-sectional observational study	Various sleep problems like sleep related breathing disorders, snoring etc.	4
Munish Kumar Kakkar	May-August, 2016	School-going adolescents in urban and rural Rajasthan	565	1.03	10 – 18 years	Questionnaire-based study	Cross-sectional Study	Various sleep patterns	6
Modi Sarita	March, 2016	Under graduate students of Sri Aurobindo college of medical sciences and technology, Indore (M. P.)	1056	1.12	17 and 25 years	Questionnaire based study	Cross-sectional observational study	Sleep pattern and problems	6
Dr. Cyril Ignatius Rozario	May, 2017	Primary school going children visiting OPD of MCH Vandanam, Alappuzha, Kerala	400	1.44	6 – 12 years	Questionnaire based study	A preliminary questionnaire survey	Sleep pattern and problems	5
Dr. Bhavneet Bharti	January, 2006	School going children visiting Advanced Pediatric Center, PGI, Chandigarh	103	1.71	3-10 years	Questionnaire based study	Cross-sectional prospective study	Sleep pattern and problems	6
Apurva Mishra	October, 2017	Boys and girls attending regular government elementary schools in Lucknow, Uttar Pradesh	1050	1.73	4 -15 years	Self structured questionnaire	Cross sectional study	Pre sleep habits, duration and pattern of sleep	7
Ravi Gupta	July, 2016	School going children from four each schools from the rural and urban areas of Dehradun, Uttarakhand	831	1.04	9 - 14 years	Childhood-Sleep-Habit-Questionnaire (CSHQ, Hindi version)	Cross-sectional observational study	Sleep schedule, pre-sleep behavior, co-sleeping and parent's perception of sleep	5
Gowtham Murugesan	2018	School-going adolescents from 8 schools in 3 districts of Thiruvallur, Thiruppur and Namakkal, Tamil Nadu	538	0.99	10 - 17 years	Modified questionnaire of Adolescent Sleep Hygiene Scale	Cross-sectional survey	Sleep patterns, hygiene and daytime sleepiness	3
Ravi Gupta	November, 2007	School-going adolescents from Grade 9th to 12th of 3 schools situated in Delhi	1920	1.56	12 - 18 years	Questionnaire-based study	Cross-sectional Study	Sleep pattern and sleep problems	5

Sleep duration:

The nighttime sleep duration was the most common sleep measure or variable in 73% of the articles. Meta-analyses were conducted within age-bands for 3 - 5 years (Pre-school), 6 – 12 years (School going), and 12 – 18 years (Adolescent). The results of which appeared are illustrated in Table 3. The meta-analysis to produce these values or pooled mean and ranges are given in Figure 2, Figure 3 and Figure 4 (sleep duration at 3-5, 6 – 12 and 12-18 years of age). The reference value (or pooled mean estimate) is 9.811, 9.082 and 7.944 hours respectively for the mentioned ages and pooled estimated lower and upper 95% CIs as mentioned in the forest plot.

Table 2: Summary data for nighttime sleep duration (hours) across the age category.

Age-band or category	Study Reference serial number	Mean	Lower limit	Upper limit	I^2
Pre – school 3 – 5 years	1, 8	9.811	9.046	10.575	98.26%
Schooler 6 – 12 years	1, 4, 6, 7, 8, 9	9.082	8.789	9.374	98.42%
Adolescents 12 – 18 years	4, 5, 8, 10, 11	7.944	6.844	9.044	99.82%

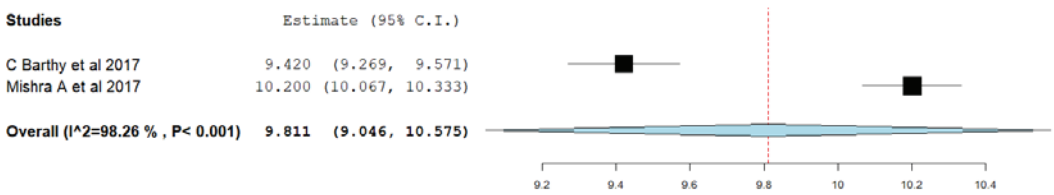

Figure 1: A forest plot example of the meta-analysis to calculate the pooled mean estimate for sleep duration at 03 – 05 years of age.

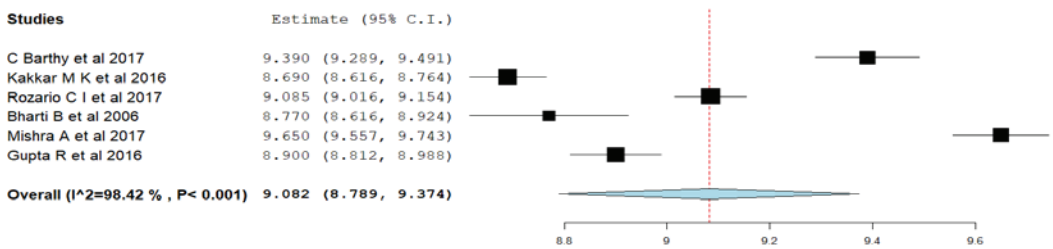

Figure 2: A forest plot example of the meta-analysis to calculate the pooled mean estimate for sleep duration at 6 – 12 years of age.

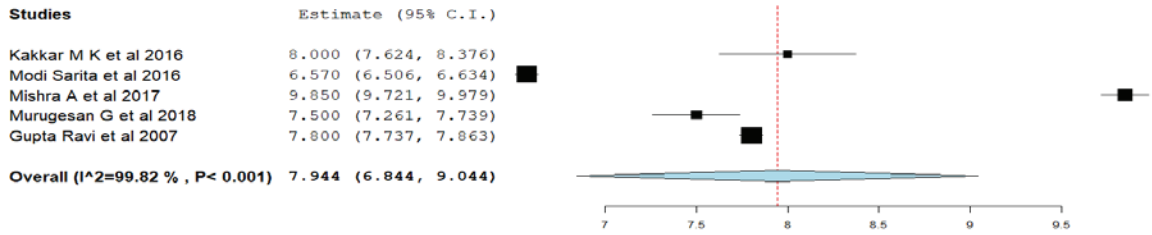

Figure 3: A forest plot example of the meta-analysis to calculate the pooled mean estimate for sleep duration at 12 – 18 years of age.

In India, the number of studies conducted is very few regarding the sleep pattern of children. Hence the paucity of data is evident in the results. The analysis also showed significant heterogeneity among the selected studies at P<0.001. The above-mentioned table shows that the night time sleep duration is declining as the age advances.

Sleep latency:

In pre-school age band 12.3% (47/375) had pooled prevalence of sleep latency (CIs: 95%, 6% to 23.6% with I^2 = 83.7%, P = 0.013). The summarized prevalence rate for 6 – 12 years is 9.4% (CIs: 95%, 2% to 35.4% with I^2 = 98.44%, P < 0.001) and for 12 – 18 years is 43.3% (CIs: 95%, 36.5% to 50.3% with I^2 = 89.85%, P < 0.001).

Hypersomnia:

These data were confined to the School going (3 studies contributed) and adolescent (2 studies contributed) age group. A total of 1179 samples were analyzed out of 95 were identified with the hypersomnia with a pooled prevalence rate of 2.7%. In adolescents, 1436 out of 2458 subjects were detected with hypersomnia and the pooled prevalence rate was estimated at 60.7%.

Parasomnia:

No data was extracted from 3 – 5 years of age. At 6 – 12 years age 43.6% pooled prevalence was identified with CIs: 95% (Range: 32% to 55.8%). In the age band, 12 – 18 years 20.6% prevalence rate pointed out with a range of 7.4% to 45.8%.

Discussion

Since the meta-analysis combined data from different states of India and cultures (South India and North India), the reference values should be considered as norms for entire India, rather than based on cultural norms. But the paucity of data and the number of studies conducted in the country limit the generalization of the findings across the country. The results, we believe, will be useful to assess the normal range of sleep at various age groups.

In majority of the studies, sleep measures were assessed at a one-time point and the study variable used in most articles was on sleep duration. A very few studies have been found with other variables like duration of day time naps, lifestyle, bedtime routines, etc. Disappointingly, many research articles collected sleep duration data but were excluded because the values were not reported numerically. For example, sleep duration was often subdivided categorically and some articles were rejected because they reported data by education grade rather than age.

The importance of measuring sleep patterns and identifying sleep problems at the earliest is reflected in almost all literature. Many cross-sectional studies show that the lack of required amount of sleep can result in various negative impacts like difficulty in falling asleep, lip biting, etc, and also can lead to poor academic performances. The sleep duration in our selected studies shows that the children in India are not getting the recommended sleep duration of various age bands by the experts of the National Sleep Foundation. Further, it is also noticed that the night time sleep duration is

declining from pre-school to adolescents. This may be influenced by the school days and later bedtimes. The mean reference values for sleep duration we have analyzed are given in Table 02.

Carskadon, et al., and Yang, et al., mentioned in their studies that a decrease in sleep time happens with advancing school grades and it may be due to academic demands of higher grades. This agrees with the pooled mean findings from our study.

Many literatures did not define sleep problems properly. Few had administered same tool to different population but obtained different pattern of data. This is because the perception of sleep problems varies from one person to another. Further, it was also observed that the differences in the instrument and the geographical location/cultural differences might have influenced the result of the studies selected to identify the pooled prevalence of common sleep problems like sleep latency, hypersomnia, and parasomnia. The scarcity of Indian literature on the selected topic also is a major factor in the determination of the prevalence of various sleep problems among children.

Conclusion

In conclusion, standardizing information over the childhood lifestyle is essential to realize what is outside of normal; to evaluate sleep problems, to manage sleep issues, or to give preventive advice. The information from the present study can set a benchmark and we reiterate that the reference values should be considered in planning, policy-making, and implementing the sleep pattern norms in adherence to the guidelines of the National Sleep Foundation. However, a nationwide study with proper randomized coverage of the population is essential to ensure the ethnic and cultural variations in the sleep pattern of India.

Ethical Clearance: For this Systematic Review we have taken the consideration of ethical issues. No significant ethical concerns were raised during the study. Ethical Clearance was obtained from SMVDPEC (Shri Mata Vaishno Devi Project Evaluation Committee)

Conflict of Interest: There are no conflicts of interest in this study as per the knowledge of the investigators.

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References

1. Barathy C, Prabha S, Shanthi AK, Devikittu. Study of sleep pattern in children aged 1-12 years attending OPD at tertiary care hospital, Puducherry, India. Int J Contemp Pediatr 2017; 4:1980-5.
2. Gupta R, Ali R, Verma S, Joshi K, Dhyani M, Bhasin K, et al. Study of sleep disorders among young children using Hindi translated and validated version of the pediatric sleep questionnaire. J Neurosci Rural Pract 2017; 8:165-9.
3. J. C. Suri, M. K. Sen, Tulsi Adhikari. Epidemiology of Sleep Disorders in School Children of Delhi: A Questionnaire Based Study. Indian J Sleep Med 2008; 3.2, 42-50.
4. Kakkar MK, Bohra D, Trivedi N, Gupta J, Saini Y. Sleep Patterns of Urban and Rural School going Adolescents. J Mahatma Gandhi Univ Med Sci Tech 2016; 1(1):20-23.
5. Modi Sarita, Bose Sukhwant. Study of sleep patterns and sleep problems of undergraduate students from different professional courses. Indian Journal of Basic and Applied Medical Research; March 2016: Vol.-5, Issue- 2, P. 16-28. www.ijbamr.com P ISSN: 2250-284X, E ISSN: 2250-2858.
6. Dr.Cyril Ignatius Rozario, Dr. O.Jose, Dr.Biju Thayyil. A clinical study on sleep patterns and sleep problems in school-going children. GJRA - Global Journal for Research Analysis. Volume 6; Issue 5, May 2017: 73-75.
7. Bhavneet Bharti, Prahbhjot Malhi, and Sapna Kashyap Indian Pediatrics, 2006, 43; 33-38.
8. Mishra A, Pandey RK, Minz A, Arora V. Sleeping habits among school children and their effects on sleep pattern. J Caring Sci 2017; 6 (4): 315-23. DOI:10.15171/jcs.2016.030.
9. Gupta R, et al. Sleep-patterns, co-sleeping, and parent's perception of sleep among schoolchildren: Comparison of domicile and gender. Sleep Science (2016), http://dx.doi.org/10.1016/j.slsci.2016.07.003i.
10. Gowtham Murugesan, Logamani Karthigeyan, Praveen Kumar Selvagandhi, Vijayaprasad Gopichandran. Sleep patterns, hygiene, and daytime sleepiness among adolescent school-goers in three districts of Tamil Nadu: A descriptive study. The

National Medical Journal Of India VOL. 31, NO. 4, 2018. 196 – 200.

11. Gupta et al. Sleep Patterns of Urban School-going Adolescents. Indian Pediatrics. Volume 45; March 17, 2008. 183 – 189.
12. PRISMA statement; 2010. Available from: http://www.prisma-statement.org/.