

## Sleep Patterns of Urban School-going Adolescents

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### ABSTRACT

**Objective:** To analyze the variance in sleep habits of adolescents of different high school Grades in urban India. **Design:** Cross-sectional questionnaire-based study. **Setting:** Community based school survey in an urban setting. **Subjects:** School going adolescents from 9th to 12th Grades. **Methods:** A total of 1920 adolescents aged 12-18 years were included. The questionnaire contained questions related to sleep habits. Each question was explained to the participants and their responses were noted. Outcome parameters were total sleep time in a day, time to go to bed and wake up-time, sleep latency, nocturnal awakenings (duration, frequency per night and nights per week), wake-time after sleep onset, wake time after sleep offset, sleep efficiency, quality of sleep, daytime napping (duration and frequency), and sleepiness during the day. **Results:** Mean age of the adolescents included in this study was 15.1 years and mean total sleep time was 7.8 hr/day. Adolescents of higher Grades had lesser total sleep time (9th=8 hours; 10th=7.7 hours; 11th=7.9 hours; 12th=7.6 hours;  $P=0.001$ ), and more frequent nocturnal awakenings (9th=35.9%; 10th=44.7%; 11th=40.3% ; 12th=28.3%;  $P=0.001$ ). Daytime leg pain ( 9th=14.4%; 10th=18.4%; 11th=6.1%; 12th= 21.8%;  $P=0.01$ ), daytime napping (9th=47.6%; 10th=50.4%; 11th=61.8%; 12th=69.8%;  $P=0.001$ ), and daytime sleepiness (9th=37.2%; 10th=39.1%; 11th=39.7%; 12th=54.2%;  $P=0.001$ ) increased progressively among higher Grades. Adolescents in higher Grades were more prone to not follow their weekly schedule on week-ends ( $P= 0.001$ ). Sleep debt of approximately one hour per day was seen in all adolescents, and progressed with higher Grades. **Conclusion:** Adolescents of higher Grades had lesser sleep time, and frequent awakenings; suffered daytime leg pain, and felt sleepy during the day. These factors suggest increasing sleep deprivation among higher Graders.

**Key words:** Adolescents, Sleep debt, Sleep patterns.

### INTRODUCTION

Sleep affects physical growth, behavior and emotional development besides determining cognitive functioning, learning and attention(1). Apart from physiological, psychological and environmental factors, socio-cultural factors also play a major role in determining sleep pattern of a person(1-4). Most of the studies regarding sleep habits in adolescents are from the West; however, a few Asian studies(1-3) are available and these

studies emphasize the effect of culture. Sleep habits of one community can not be generalized; moreover, sleep pattern is linked with the academic performance starting in adolescents. Wolfson and Carskadon(5) described that main correlates of poor academic performance are self-reported erratic sleep wake schedule, short total sleep time, phase delay, and poor quality sleep.

Hence, it is important to study the sleep patterns in adolescents. To the best of our knowledge, there is

no published data from India on this important yet ignored field. Therefore, this study was planned with the objective of assessing the sleep habits of urban school-going adolescents.

## METHODS

### Children

School-going adolescents from Grade ninth to twelfth of 3 schools situated in Delhi were included in the study, after taking requisite permission from the school administration. All participating adolescents were day-boarders. Parents' consent was not taken as it was not specified by the school authorities and also as we were only conducting a survey which did not require any intervention.

### Sampling

All the adolescents studying in the three schools in grades ninth to twelfth were contacted for the study ( $n=2011$ ). Adolescents with physical illnesses *e.g.*, asthma, recurrent abdominal pain, sinusitis, chronic rhinitis etc. that could have affected sleep parameters were excluded from the study ( $n=38$ ). Such information was gathered from the adolescents and corroborated from the school's medical record. Finally, 1973 school going adolescents from all the four Grades studying in the three schools were included. Of these, 53 did not provide the required information, but complete information was collected from 1920 adolescents.

### Procedure

The participating adolescents were explained the rationale for the study by trained psychiatrists and their oral consent was taken prior to administration of a questionnaire aimed at gathering information regarding sleep habits that they followed "most of the time on school days/nights" (excluding holidays and weekends) in last six months. Individual items of the questionnaire were explained sequentially and adolescents were asked to respond to each question immediately after it was explained to them. Moreover, if any of the adolescents raised any query, it was resolved immediately. They were clearly instructed not to fill the responses of which they were not sure of.

The survey questionnaire was designed from the standard sleep medicine textbooks(6,7) and earlier studies. It was aimed at capturing all the basic parameters related to sleep(6-9). It contained questions related to both demographic data and sleep parameters. The study assessed sleep habits on different parameters *e.g.*, total duration of sleep in a day, time to bed, sleep latency, nocturnal awakenings (weekly and daily frequency, duration, reasons), wake up time, time to leave bed (Wake time After Sleep Offset (WASF), feelings of refreshing sleep in the day, daytime napping, duration of naps, effect of avoiding naps (on the daytime activity as well as on nighttime sleep), early morning headache (EMHA), and daytime leg pain.

Various outcomes were calculated as follows:

- Total Sleep Time (TST)=Total time spent in bed minus (sleep latency+time spent in awakenings +time taken to leave bed)
- Wake time after sleep offset (WASF)=Time to leave bed minus wake up time
- Sleep efficiency=Total sleep time in the night/ total time spent in bed in night $\times 100$
- Sleep debt=Recommended duration of sleep for the age minus TST

### Statistical analysis

SPSS 10.0 for Windows was used for the statistical analysis. Descriptive statistics was calculated for all continuous variables and results are shown as mean $\pm$ SD. For categorical variables, Chi-Square Test with Category Collapse and the Fisher's Exact Test (wherever applicable) were run. To find out the differences in numerical variables among Grades, one way ANOVA with post hoc Tukey test (only where the statistical significance was reached) was done. Univariate regression analysis was run to analyze the effect of gender on sleep parameters among Grades and both the variables were entered together in the equation for this in the 'interaction' mode. To test the strength of correlation between different sleep parameters two-tailed Pearson's Correlation (between numerical variables) or the two-tailed Spearman's correlation (between categorical versus categorical or numerical variables) were applied.

**RESULTS**

Out of 1920 respondents included in this study, 27.4% adolescents were in ninth, 28.6% in tenth and 19.8% in eleventh Grade, respectively and rest (*i.e.*, 24.1%) were in twelfth Grade. As instructed, adolescents did not respond to the questions of which they were not sure, resulting in missed responses. But frequency of missing response did not exceed beyond 2-3% for any of the variables under study. Missing values were replaced by most common responses in categorical variables and by series means in continuous variables.

Average age of the sample was 15.1 years and total sleep time was 7.8 hours per day. Most of the adolescents went to bed by 11.00 pm (41.5%), took 23.6 ( $\pm 22.9$ ) minutes to fall asleep and had wake up time between 5.00 am to 6.00 am (42.6%), requiring 9.4 ( $\pm 10.2$ ) minutes to leave the bed after waking up. Most of the adolescents were not following this schedule on an average of 1.4 ( $\pm 0.8$ ) days a week (mostly on weekends). Though the sleep efficiency of the sample was 92.6% ( $\pm 7.4$ ), refreshing sleep was reported by less than half of the sample only. **Figure 1** compares the total sleep time of adolescents of different grades.

Nocturnal awakenings were reported by approximately 37% adolescents, average 3.3 ( $\pm 1.2$ ) hours after getting the sleep. Awakenings were reported to be present since 2 ( $\pm 1.9$ ) years with the frequency of 3.4 ( $\pm 1.9$ ) days a week, 1.6 ( $\pm 0.8$ ) times in a single night besides spending 17.00 ( $\pm 21.45$ ) minutes per night being awake in bed. **Figure 2** depicts the reasons for awakenings among different Grades. Grade-wise distribution of other objective and categorical sleep parameters is depicted in **Tables I** and **II**, respectively.

Wake up time was significantly different among groups, as school-going adolescents from tenth and twelfth Grades were the early risers (data not shown in table). Interestingly, missing a daytime nap did not significantly affect the daytime functioning or the nighttime sleep in adolescents habituated to daytime napping. Family history of sleep disorders was not significantly different among groups. On regression analysis, gender was not found to influence the sleep parameters among different Grades.

**DISCUSSION**

Total sleep time (TST) decreased with the higher grades and the sleep duration of ninth Grade was

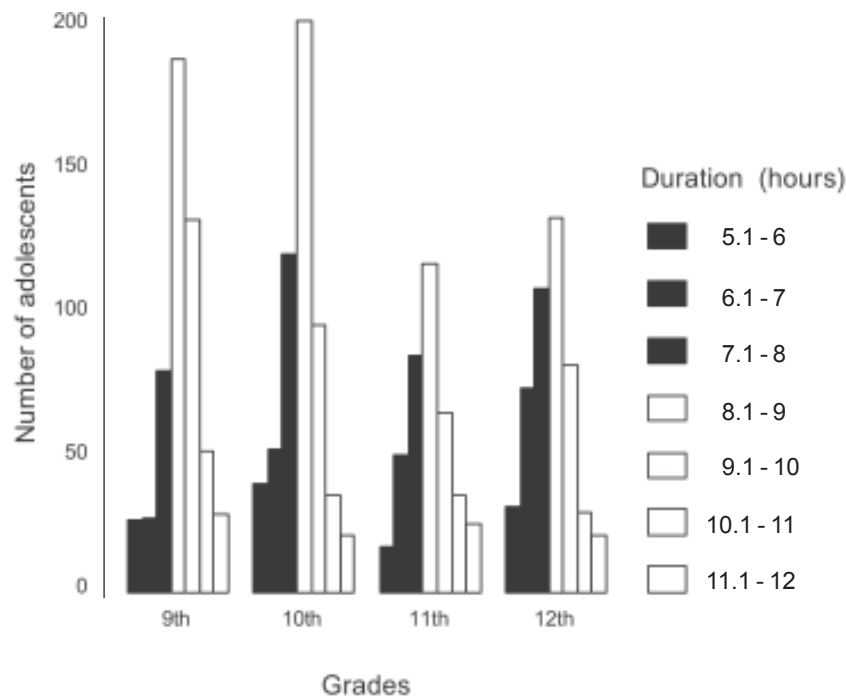


FIG. 1. Total sleep time of adolescents in different grades.

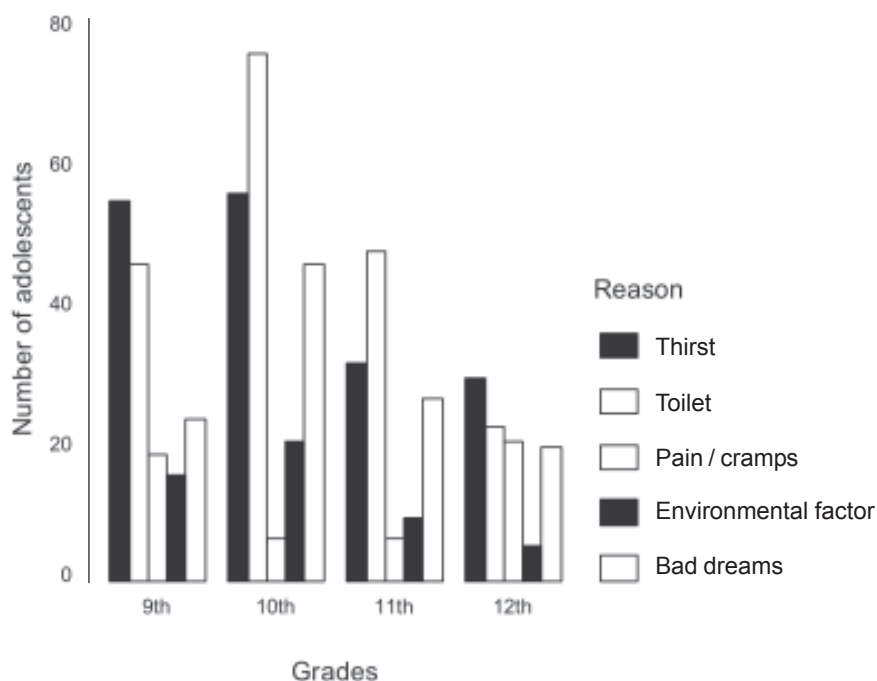


FIG. 2. Reasons for nocturnal awakenings among different grades.

TABLE I DISTRIBUTION OF SLEEP PARAMETERS ACCORDING TO GRADES

S. No.	Variable	Grade 9th (N=527)	Grade 10th (N=550)	Grade 11th (N= 380)	Grade 12th (N=463)	P
1.	Age (years)	13.8 ± 0.7	14.7 ± 0.5	15.7 ± 0.6	16.4 ± 0.6	0.001 <sup>a</sup>
2.	Duration of sleep (h)	8.0 ± 1.3	7.7 ± 1.4	7.8 ± 1.5	7.6 ± 1.5	0.001 <sup>b</sup>
3.	Sleep latency (min)	23.9 ± 26.6	23.1 ± 21.9	25.2 ± 20.9	22.6 ± 21.0	0.39
4.	Wake time after sleep offset (min)	9.5 ± 11.8	8.8 ± 9.4	9.0 ± 9.0	10.05 ± 9.9	0.27
5.	Not follow schedule (d/wk)	1.4 ± 0.9	1.4 ± 0.9	1.3 ± 0.8	1.5 ± 0.9	0.001 <sup>c</sup>
6.	Nocturnal awakenings					
	Duration (years)	1.6 ± 1.9	2.2 ± 1.9	1.9 ± 1.6	2.0 ± 1.7	0.23
	Frequency (nights/wk)	3.2 ± 2.0	3.4 ± 2.0	3.3 ± 1.8	3.8 ± 2.0	0.14
	Frequency/night	1.5 ± 0.8	1.4 ± 0.8	1.6 ± 0.8	1.8 ± 1.0	0.001 <sup>d</sup>
7.	Sleep efficiency (%)	93.1 ± 7.7	92.8 ± 7.1	92.5 ± 6.0	91.9 ± 8.2	0.05
8.	Duration of daytime sleep (h)	1.7 ± 0.9	1.7 ± 0.8	1.8 ± 0.8	1.9 ± 1.0	0.06

Post hoc Tukey; <sup>a</sup>Significant difference between all four groups; <sup>b</sup>9th was significantly different from 10th ( $P < 0.001$ ), from 11th ( $P = 0.03$ ), and from 12th ( $P < 0.001$ ); <sup>c</sup>Between 9th and 12th ( $P < 0.01$ ); Between 11th and 12th ( $P < 0.001$ ); <sup>d</sup>Between 9th and 12th ( $P = 0.02$ ); Between 10th and 12th ( $P < 0.001$ )

significantly higher from other three groups, suggesting that tenth grade could be the transition point for change in TST. In the past, Carskadon, *et al.*(10) and Yang, *et al.*(4) reported decrease in TST with advancing school Grades; transition point being the tenth class. They attributed it to the

academic demands of higher grades. As already explained, school going adolescents in India also face the academic challenges from ninth grade onwards, and tenth grade is probably the time of stress not witnessed in lower Grades. TST of eleventh and twelfth graders' in this study is

**TABLE II** PROPORTION OF ADOLESCENTS HAVING SLEEP RELATED PROBLEMS

Variable	Grades				<i>P</i> <sup>a</sup>
	9th ( <i>N</i> =527) <i>n</i> (%)	10th ( <i>N</i> =550) <i>n</i> (%)	11th ( <i>N</i> =380) <i>n</i> (%)	12th ( <i>N</i> =463) <i>n</i> (%)	
Gender					
Male	331 (62.7)	349 (63.5)	233 (61.3)	258 (55.7)	0.06
Female	196 (37.3)	201 (36.5)	147 (38.7)	205 (44.3)	
Nocturnal awakening	189 (35.9)	245 (44.7)	153 (40.3)	131 (28.3)	0.001
Leg pain	75 (14.4)	101 (18.4)	61 (16.1)	101 (21.8)	0.01
Daytime napping	251 (47.6)	277 (50.4)	235 (61.8)	323 (69.8)	0.001
Daytime sleepiness	196 (37.2)	215 (39.1)	151 (39.7)	251 (54.2)	0.001
Urge to sleep	123 (23.5)	141 (25.6)	123 (32.4)	125 (27.0)	0.02

<sup>a</sup>*Chi square test*

comparable with that reported in other studies(1,4, 11-13).

It is suggested that adolescents need at least as much sleep as do pre-pubertal children(14) and at least 8-9 hours of nighttime sleep is required to maintain optimal daytime alertness(14-16), Discrepancy between the ideal sleep time and TST increased with the advancing grades in this study; in other words, sleep debt increased with higher grade, a result similar to findings previously reported(4,10). This resulted in higher prevalence of daytime sleepiness in corresponding groups.

Age was also significantly different among the groups in this study, and as expected, it advanced with the higher Grades. Effect of age on sleep has been reported previously(17); sleep time decreased by forty-five minutes on an average from fourteen years to eighteen years of age. However, to us it seemed very improbable that age alone accounted for such a large variation in sleep parameters. Therefore, we examined the correlation of sleep parameters (only those that attained statistical significance on one way ANOVA or Chi-Square test) with the age and Grades. It was found that age and the grade alone contributed much less in determining the sleep parameters in this group, and thus other environmental factors that were not included in the study imparted effect.

In the present study, the wake up time was significantly different and it receded with the advancing Grades. Available literature has reported that adolescents with advancing Grades tend to go to bed later and wake up early in the morning(1,4). It has been found that presence of media (television/ internet) in the child's bedroom delays the bedtime and wake-up time, such children spend less time in bed and are more tired during the day, as compared to their peers with no such access in their bedrooms(18). Although we did not directly inquire for the same in this study, we can't rule out such possibilities in our urban sample and it requires further investigation.

Daytime napping and daytime sleepiness were prevalent in this study sample and their incidence increased with higher Grades. Daytime napping is not only culturally accepted in Asian culture(1) but it also lessens the sleep debt, while daytime sleepiness is the most direct effect of insufficient nighttime sleep(19,20). Symptoms of daytime sleepiness among adolescents seem to be nearly universal(2,12) and previous studies have reported excessive daytime sleepiness and falling asleep in the classroom during adolescence with higher incidence in higher Grades(2,4). The available data suggests that most of the adolescents, especially the higher Graders, are chronically sleep deprived. Effect of such deprivation on their academic and subjective performance, particularly quantitative analysis, requires further research.



**WHAT IS ALREADY KNOWN?**

- Normative data of sleep for Western adolescents indicates that the higher Grades are associated with decreased total sleep time and less refreshing sleep.

**WHAT THIS STUDY ADDS?**

- The sleep debt increases in higher Grades in Indian school going adolescents and appears as increased prevalence of day-time napping and daytime sleepiness.
- Higher Grades are associated with lesser total sleep time and frequent awakenings in this study sample.

In this study, incidence of nocturnal awakenings increased progressively until eleventh Grade, but dropped down in twelfth Grade. Despite lower incidence, the frequency of nocturnal awakenings increased in higher Grades; and twelfth Grade adolescents had significantly higher number of awakenings compared to ninth and tenth Grades. Analysis of reasons for awakenings yielded that pain/cramp was the most common reason in ninth and twelfth Grade and 'bad dreams' was prevalent in tenth and eleventh Grades. A number of factors are responsible for nocturnal awakenings *e.g.*, physiological effects of age; environmental factors *viz.*, noise, light, uncomfortable mattress *etc.*; or it may be secondary to pathology *viz.*, sleep related breathing disorders, periodic leg movements, depression or stress. Increased awakenings in higher Grades have also been reported previously(4), but in absence of polysomnographic study, etiology for nocturnal-awakenings can not be delineated and supposedly multiple factors (as described above) acted together.

This study has some limitations. Firstly, this sample included only urban school going adolescents, hence it is not representative of all Indian adolescents. Therefore, findings can not be generalized. Moreover, it was not possible to examine other factors affecting sleep such as alertness-promoting behaviors such as caffeine and nicotine use, living conditions *e.g.* overcrowded homes, sharing the bed with other siblings, TV viewing, and perceived education stress. Inclusion of these factors could have resulted in a lengthy questionnaire that could have desisted people from filling all the details accurately due to boredom. Clearly, these are areas for further study, especially in Indian population. Moreover, information

gathered with the help of questionnaire is influenced by commitment of the subject, his understanding of the questions and absence of objective confirmation of the complaints. Though, we have tried to eliminate these factors to the extent possible, still we emphasize the need for replication of this study based on objective evidence.

*Contributors:* RG and MSB were involved in inception, designing, statistical analysis, interpretation of data, manuscript writing and critical analysis for intellectual content. VC, SS, DD, KS, RS and RSD were involved in data acquisition, statistical analysis, and manuscript preparation.

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