



ARE INDIAN SCHOOL CHILDREN SLEEP - DEPRIVED? AN INVESTIGATION INTO SLEEP PATTERNS OF CHILDREN FROM TWO SCHOOLS IN MUMBAI CITY

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ABSTRACT

Introduction: In the 21st century the leading health problem in India is sleep deprivation which weakens immunity, growth and cognitive delay. A descriptive study was conducted to assess the sleep status of school going children in the age group of 10-16 years in selected schools of Mumbai. **Methodology:** A total of 1967 children aged 10-16 years were selected through purposive sampling technique from two different socioeconomic background school. Data was collected using a pretested questionnaire (Pittsburgh Sleep Quality Questionnaire) that was finalized in consultation with teachers from the schools, the school counselor, PTA representative and school physician. Descriptive and inferential statistics were employed to interpret the data. **Results:** At least half of the secondary school children slept for less than seven hours per night on weekdays, and that the percentage increases as the children go to higher classes. Students slept longer on weekends, the additional time was approximately two hours more. About one-third of children in both schools slept between 11 pm and 12 am and 13.9% from the IS and 16.9% from the GAS school slept after 12 am whereas, time to wake up was between 6 and 7 am in 59.6% of the IS students and 58.3% of the GAS students. The percentage of students who reported daytime sleepiness in the IS school was 13.9%, whereas in the GAS, the percentage varied from 4.7 to 6.9%. **Conclusion:** Children aged 10-16 years are likely to have a sleep deficit and the additional sleep during the weekend will not compensate for this. Therefore, children and their parents need to be made aware about importance of sleep and healthy sleeping practices.

KEYWORDS :

INTRODUCTION

Sleep is a fundamental physiological need, essential for good health, good quality of life and productivity. It is critically involved in numerous functions that include metabolism, immunity and hormonal function, cognitive functions, and ability to cope with stress.¹ For school children and adolescents, in addition to mental and physical health, adequate quantity of sleep is necessary for improved attention, behavior, learning and memory. The National Foundation has recommended that for optimal health, school age children between 6 and 13 years of age should sleep regularly for 9 to 11 hours and teenagers aged 14 to 17 years for 8 to 10 hours in a day.^{2,3} The Foundation also recommends that the sleep should be of high quality with children falling asleep quickly, sleeping throughout the night, having high sleep efficiency and taking fewer naps during the day.

It is widely reported that children and adolescents in the Western world are sleeping less than the recommended number of hours and that as children grow older, the duration of sleep is less.^{4,5} However, sleep duration may vary in different countries and there could be ethnic as well as interindividual variations in the need for sleep and sleep duration.⁶ Asian children have been found to sleep about one to two hours less than European children and approximately 40 to 60 minutes

less than children from the US.⁷ These differences may be partly genetically determined but the socio-cultural milieu in which the children grow, the climate and geographical location, timings of sunrise and sunset as well as their academic programme timings and demands, may all be important factors that influence children's sleep timings and duration. It was reported that with age, the percentage of young people in the UK, who slept for at least eight and a half hours decreased from 93% of 11 year olds, to approximately 73% of children at 13 years, to only 48% boys and 46% girls at 15 years.⁸ About one-fifth to one-fourth of the young people reported that they did not get enough sleep, to feel awake and concentrate on their school work. This percentage increased from 11 to 13 percent at 11 years to 19% boys and 25% girls at 13 years and further to 29% and 43% of boys and girls respectively, at 15 years. Such excessive daytime fatigue and sleepiness is not only associated with risk of weight gain, metabolic risk and diabetes but also increased risk of accidents.⁹

India has a great resource in terms of young people in the age group of 10-24 years. However, it has been reported that anywhere from one-tenth to about one-third of young people's lifestyles and behaviours put them at risk of poor health.¹⁰ One of the lifestyle behaviors that is likely to influence health of this age group and their risk of non-

communicable disease is their sleep pattern and duration of sleep. In a study on 768 young women, it was observed that more than half slept for less than 7 hours per night and one-third reported that their sleep quality was not good.¹¹ In a very recent study in Kerala, it was reported that 9 percent of the urban children whom they studied had inadequate sleep duration (<6hours/day) and that almost two-thirds slept for less than 8 eight hours in a day.¹² Reports on children in Delhi¹³ and from Pune,¹⁴ indicate that the sleep health of Indian children is of concern.

Besides duration of sleep, mistimed sleep, sleep quality and continuity are also of concern. Our clinical experience with several young Indian women and children indicated that severe sleep deprivation is not uncommon, with some individuals having short-term insufficiency related to academic pressures and examinations. In this context and given that sleep health of school children and adolescents, an important aspect affecting health needs attention, we undertook a study on secondary school children in Mumbai city in 2017-18, wherein we compared an international school with a government-aided school. Our aim was to examine sleep patterns in children with reference to sleep duration, timing of sleep and sleep quality. Besides comparing the schools, we also compared students by age group in order to determine whether older children who have more academic burdens and pressure differ in their sleep patterns from that of their younger peers.

Materials and Methods:

Two schools (one private International school [IS] and one Government – aided school [GS]) were purposively selected because the children enrolled in these schools were from different socio-economic backgrounds. For both schools, permission to conduct the study was obtained from their respective Managements and Principals.

Participants: A total of 1967 children were studied, with 1080 children belonging to the GS and the remaining 887 were from the IS.

Data collection: Data was collected using a pretested questionnaire that was finalized in consultation with teachers from the schools, the school counselor, PTA representative and school physician.

Questions included in the questionnaire were based on the Pittsburgh Sleep Quality Questionnaire.¹⁵ Time of going to bed and time at which each participant woke up on weekdays and weekends was recorded, from which duration of sleep was calculated. Also, students were asked whether they felt sleepy during school hours. Students were asked whether they wake up feeling fresh or with a headache and how frequent this was. Also, they were asked to rate their quality of sleep as good or poor.

Forms were filled by the students in the presence of their class teachers and the investigators. If they had any difficulty, the question was explained to enable them to answer the question. In the GS, students were provided forms and allowed to answer the questions, as per their medium for instruction (English/Marathi/Gujrati). All forms were collected, checked for omissions and/or irrelevant answers. On a separate day, investigators worked with individual students to fill up the missing information or to obtain relevant answers to questions which had been given irrelevant answers. Verification and filling up of missing information was required for 60 students.

Data Analysis: Data was coded using Microsoft Excel. Data analysis was done using SPSS Version 20. Tests applied included Pearson's Chi-square test, Analysis of variance, and Pearson's correlation coefficient. Descriptive statistics included mean and standard deviation, median, coefficient of variation and 95 percent confidence intervals.

Ethics Approval: Permission for publication of the study data was given by the Inter Systems Biomedica Ethics Committee.

Results:

Duration of Sleep: On weekdays, children from both schools slept for approximately seven hours per day and on weekends for approximately nine hours per day, with no significant difference between children in the international and government-aided school during weekdays. However, children from GAS slept for more number of hours compared to IS children during the weekends and the difference was significant.

TABLE 1: MEAN HOURS OF SLEEP ON WEEKDAYS AND

WEEKENDS IN INTERNATIONAL SCHOOL AND GOVERNMENT AIDED SCHOOL

Age group (years)	International School			Government Aided School			t	p
	Mean ±sd	Median	95% CI	Mean ±sd	Median	95% CI		
Weekdays								
10-11.99	7.31±1.17(152)	7.00	7.12-7.50	7.31±1.21(192)	7.00	7.14-7.48	0.015	0.988
12-12.99	7.29±1.01(198)	7.00	7.14-7.42	7.20±1.19(245)	7.00	7.05-7.35	0.780	0.436
13-13.99	7.40±1.01(178)	8.00	7.25-7.55	7.07±1.20(223)	7.00	6.92-7.23	2.929	0.004
14-14.99	7.07±1.21(169)	7.00	6.89-7.25	7.07±1.14(215)	7.00	6.91-7.22	0.049	0.961
≥15	7.07±1.09(190)	7.00	6.91-7.22	7.18±1.36(205)	7.00	6.99-7.37	-0.899	0.369
All children	7.23±1.10(887)	7.00	7.15-7.30	7.16±1.22(1080)	7.00	7.09-7.24	1.166	0.244
Weekends								
10-11.99	9.07±1.26	9.00	8.87-9.27	9.03±1.75	9.00	8.78-9.28	0.275	0.784
12-12.99	8.75±1.43	9.00	8.55-8.95	9.02±1.51	9.00	8.83-9.21	-1.933	0.054
13-13.99	9.05±1.25	9.00	8.87-9.23	9.07±1.67	9.00	8.85-9.29	-0.111	0.921
14-14.99	8.85±1.24	9.00	8.66-9.03	9.10±1.71	9.00	8.87-9.33	-1.607	0.109
≥15	8.66±1.37	9.00	8.47-8.86	9.00±1.56	9.00	8.78-9.21	-2.240	0.026
All children	8.86±1.32	9.00	8.78-8.95	9.04±1.64	9.00	8.94-9.14	-2.628	0.009

About half of the children from the international school and two-thirds of the children from the government-aided school slept for less than 7 hours/day. A higher percentage of older children slept for less than 7 hours compared to the younger children, although this difference between age groups was not statistically significant. (Figures 1a and 1b).

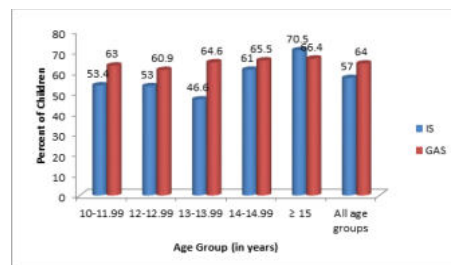


FIGURE 1: PERCENT STUDENTS FROM INTERNATIONAL SCHOOL (IS) AND GOVERNMENT AIDED SCHOOL (GAS) SLEEPING LESS THAN SEVEN HOURS ON WEEK NIGHTS

Timings for going to sleep and waking up: Both schools commenced classes at 7.30 am. Only about 2% of IS children and 5% of the GAS children, slept before 9 pm and about 9-12% slept between 9 and 10 pm on weekdays (Table 2). About two-fifths of children in the IS went to bed between 10 and 11 pm (40.4%), compared to a slightly lower percentage in the GAS (31.8%). About one-third of children in both schools slept between 11 pm and 12 am and 13.9% from the IS and 16.9% from the GAS school slept after 12 am. In the GAS 52.8% slept after 11 pm compared to a slightly smaller percentage of IS children (49.9%) who slept at the same time. The percentage of older children from both schools who slept late was slightly but not significantly higher compared to the younger age group.

TABLE 2: DISTRIBUTION OF CHILDREN ACCORDING TO TIME OF GOING TO SLEEP

Age group(yrs) /	< 7 pm	7-8 pm	8-9 pm	9-10 pm	10-11 pm	11-12pm	>12 am	χ ²	p
International School									
10-11.99 (152)	0(0)	0(0)	0.7(1)	11.2(17)	42.1(64)	32.2(49)	13.8(21)	58.398	0.000

12-12.99 (198)	0(0)	0(0)	0 (0)	11.6(23)	34.3(68)	45.5(90)	8.6(17)		
13-13.99 (178)	0(0)	0(0)	1.1 (2)	13.5(24)	50.6(90)	26.4(47)	8.4(15)		
14-14.99 (169)	0(0)	0(0)	0.6(1)	5.9(10)	45.6(77)	28.4(48)	19.5(33)		
≥15 (190)	0(0)	0(0)	0(0)	5.3(10)	31.1(59)	43.7(83)	20.0(38)		
All students (887)	0(0)	0(0)	2.2(4)	9.5(84)	40.4(58)	35.7(317)	13.9(124)		
Government Aided School									
10-11.99 (192)	0(0)	0.5(1)	1.6(3)	18.2(35)	26.0(50)	38.5(74)	15.1(29)	45.584	0.005
12-12.99 (245)	0(0)	0.4(1)	1.6(4)	16.3(40)	33.5(82)	33.5(82)	18.7(36)		
13-13.99 (223)	0(0)	0(0)	3.1(7)	13.0(29)	33.2(74)	34.1(76)	16.6(37)		
14-14.99 (215)	0(0)	0.5(1)	0.5(1)	6.9(15)	34.4(74)	38.6(83)	19.1(41)		
≥15 (205)	1.5(3)	2.0(4)	1.5(3)	9.8(20)	30.7(63)	35.1(72)	19.5(40)		
All students (1080)	0.3(3)	0.6(7)	1.7(18)	12.9(139)	31.8(43)	35.8(87)	16.9(183)		

Majority of the IS and GAS children woke up before 7 am. In the GAS, 32.1% children woke up before 6 am whereas a much smaller percentage of the IS children did so (22.1%). A higher percentage of children woke up between 6 and 7 am in IS (72.7) compared to 58.1% in GAS (Table 3).

TABLE 3: DISTRIBUTION OF CHILDREN ACCORDING TO TIME TO WAKE UP

Age group(yrs) / Number	< 5 am	5-6 am	6-7 am	7-8 am	8-9 am	>9am	χ ²	p
International								
10-11.99 (152)	2.6(4)	17.8(27)	77(117)	0(0)	0(0)	2.6(4)	40.089	0.005
12-12.99 (198)	0(0)	24.7(49)	68.2(35)	0(0)	2.5(5)	4.5(9)		
13-13.99 (178)	1.7(3)	16.3(29)	79.2(41)	2.2(4)	0(0)	0.6(1)		
14-14.99 (169)	3.6(6)	20.1(34)	71.0(20)	2.4(4)	0(0)	3.0(5)		
≥15 (190)	2.1(4)	22.6(43)	69.5(32)	0.5(1)	2.1(4)	3.2(6)		
All students (887)	1.9(17)	20.5(182)	72.7(645)	1.0(9)	1.0(9)	2.8(25)		
Government Aided School								
10-11.99 (192)	5.2(10)	27.6(53)	54.7(105)	7.8(15)	2.6(5)	2.6(5)	36.012	0.015
12-12.99 (245)	4.1(10)	27.3(67)	63.3(155)	1.6(4)	1.6(4)	1.6(4)		
13-13.99 (223)	3.6(8)	29.1(65)	61(136)	2.7(6)	2.7(6)	1.8(4)		
14-14.99 (215)	3.3(7)	28.4(61)	59.5(128)	2.3(5)	2.3(5)	1.9(4)		
≥15 (205)	2.9(6)	29.3(60)	50.7(104)	6.8(14)	6.8(14)	3.9(8)		
All students (1080)	3.8(41)	28.3(306)	58.1(628)	4.1(44)	4.1(44)	2.3(25)		

Daytime sleepiness: A significantly higher percentage of students from the IS than from the GAS reported that they felt sleepy in the daytime. The percentage of students who reported that they usually felt sleepy did not differ by age group in either school. The percentage of students who reported daytime sleepiness in the IS school was 13.9%, with the percentage in the 10-11.99 and ≥ 15 year age groups being highest (17.8%) compared to the other age groups (11.2-13.9%). In the GAS, the percentage varied from 4.7 to 6.9%, with not much difference between age groups (Table 4).

TABLE 4: PERCENT CHILDREN WHO EXPERIENCE DAYTIME SLEEPINESS

Age group	Never	Rarely	Sometimes	Usually	χ ²	P
10-11.99 years						
IS	15.8(24)	24.3	42.1(64)	17.8(27)	93.329	0.000
GAS	67.7(130)	11.5	11.7(27)	6.8(13)		

12-12.99 years						
IS	14.1(28)	18.7(37)	53.5(106)	13.6(27)	123.471	0.000
GAS	63.7(156)	15.1(37)	15.2(35)	6.9(17)		
13-13.99 years						
IS	16.3(29)	32.0(57)	38.8(69)	12.9(23)	81.348	0.000
GAS	60.1(134)	11.7(26)	22.2(51)	5.4(12)		
14-14.99 years						
IS	11.8(20)	37.3(63)	39.6(67)	11.2(19)	58.959	0.000
GAS	47.4(102)	18.1(39)	29.8(64)	4.7(4.7)		
≥ 15 years						
IS	11.6(22)	27.4(52)	46.3(88)	14.7(28)	46.906	0.000
GAS	40.5(83)	25.9(53)	25.9(53)	7.8(16)		
All Children						
IS	13.9(124)	27.7(247)	44.4(396)	13.9(124)	374.073	0.000
GAS	56.0(606)	16.4(178)	21.3(231)	6.3(68)		

Sleep Quality:

Seventy five to eighty percent of students reported that they slept well and their sleep quality was good, 20 % rated it as average but a small percentage rated it as poor. In the GS, percent students reporting poor quality increased with age (1.6% for the 10-12.99 year olds, 2.7% among 13-13.99 year age group, 3.6% among 14-14.99 year age group and 5.9% for those who were 15 years and above). In the IS, 5.9 % and 4% of the 10-11.99 and 12-12.99, ≥ 15 years age groups rated their sleep quality as poor. The percentage of 13-13.99 year olds and 14-14.99 year olds was 2.2% and 3.6%, respectively.

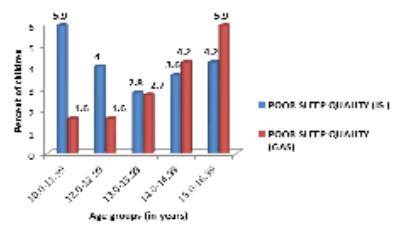


FIGURE 2: QUALITY OF SLEEP IN STUDENTS FROM INTERNATIONAL SCHOOL (IS) AND GOVERNMENT AIDED SCHOOL (GAS)

Discussion

The findings of the present study indicate that a substantial percentage, at least half of the secondary school children slept for less than seven hours per night on weekdays, and that the percentage increases as the children go to higher classes; although the mean value duration of sleep, indicated that they sleep for about 7-8 hours on week nights. Almost one-third of the students in both schools slept for less than 6 hours per night. Students slept longer on weekends, the additional time was approximately two hours more. These findings suggest that children in this age group are likely to have a sleep deficit and the additional sleep during the weekend will not compensate for this.

These findings are in line with reports in the literature about sleep patterns of school children and adolescents. ¹⁶ In one of the studies it was observed that the mean bedtime of students from Delhi, aged 9 to 17 years was 10.49 ± 1.14 hours on school days and 11.10 ± 1.37 hours on weekends. ¹⁷ Also, they noted that students woke up later on weekends compared to school days. A recent study reported that children sleep later at weekends. ¹⁸ This is likely because the weekdays/school day schedules are likely to have very little flexibility in terms of adjusting wake up hours as compared to weekend. School day schedules are likely to be rigid in terms of time at waking up because of the academic demand. This was particularly so in the school children we studied as their school started in the early morning hours. Academic pressure was an important factor contributing to shorter sleep duration among Japanese ¹⁹ and Korean teenagers. ²⁰ This is very likely to be a factor contributing to shorter sleep duration for the older children in our study as well.

Young people i.e. adolescents and senior high school students which was the typical age group included in this study, are late chronotypes. Their school timings clash with their delayed sleep-wake rhythms, leading to discrepancies between their sleep-wake behavior and associated physiological rhythms. This leads to a strong weekly structure in sleep-wake behavior characterized by short sleep during the school week and long and late recovery sleep on weekends, termed

'social jetlag'. It is possible that senior high school students go to school in their 'biological night'.

In order to cope with the rigid school timetables and intense academic and other demands, it is very likely that children curtail the amount of sleep, by sleeping late at night. Such demands are likely to be more in the higher classes. Thus, sleep may worsen for adolescents as compared to their younger aged peers. This was evident in our study because children older than 12-13 years of age slept for shorter durations as compared to the younger children. A meta-analysis of 41 studies conducted worldwide on sleep by age and region and reported that delay in sleeping at night increased with age, that led to restricting school-night sleep and that Asians had later bed times than did North American and European children.²¹

Further, in metropolises like Mumbai, schools often have two shifts with secondary schools operating in the morning shift and primary schools in the second/afternoon shift. Both schools involved in the present study commenced secondary school classes at 7.30 am. Thus, in order to get sufficient sleep i.e. at least 7 to 8 hours, the children would need to sleep by 10 pm or latest 11 pm and arise at 5 am or 6 am. However, it was observed from the wake up time that most of the children in both schools got about 6 to 7 hours of sleep. There was a small percentage of students who woke up before 5 am although they slept late, indicating that for them, duration of sleep was likely to be less than 5 hours per night. Similar observations have been reported for S.East Asian children that about 20 percent went to bed after midnight on school days and about 10% needed to wake up before 6 am. Japanese high school students in the 10th to 12th grades slept for an average of 6.33 hours, Korean children in the 9th and 10th grades sleep for about 5.4 hours whereas those in the 11th and 12th grades sleep for about 6.6 hours. In Hong Kong, the average sleep duration is 7.17 hours; whereas high school students in the US sleep for an average of 7.3 hours on school nights, those in mainland China for 7.6 hours, in Greece for 7 hours and in New Zealand and Canada, the average durations are 8.7 and 7.8 hours, respectively. This data suggest that children in industrialized countries or in regions where days are shorter and the sun sets earlier, may sleep for longer hours.²²

It was reported that chronotype assessed by sleep times becomes progressively later throughout puberty and adolescence.²³ These developmental changes in circadian timing in combination with early school start timing are not tuned in to the generally late chronotype of teenagers and is likely to lead to a peak of social jetlag at around the end of adolescence. As teenagers grow older, there is a progressive delay. This could be explained by decreased zeitgeber strength. This is of importance in cities like Mumbai where people including the children in the present study are likely to experience weaker zeitgeber strength because they are exposed to less light in the day time as they work indoors and are exposed to more light pollution at night time. During pubertal development, teenagers' circadian phases undergo significant delay.²⁴ This along with academic demand probably results in delayed bed time and shorter sleep duration. The human circadian system synchronizes and is entrained to the 24-hour day through light and darkness signals. However, there are individual differences in entrainment due to various exogenous factors like light exposure and phenotypic differences in endogenous characteristics, leading to different chronotypes. These differences are reflected in the sleep and wake patterns, with late chronotypes generally sleeping later and extending their sleep into the day.²⁵

Available limited literature suggests that Asian children may have shorter sleep durations. However, there are few studies on Indians within this country. Even in the studies conducted in other countries, Asians have been less represented in the samples. Thus there is a need to study Indian children in their own socio-cultural and economic contexts.

Ethnic differences in sleep duration may also need to be considered. In a review of 23 studies that investigated racial /ethnic sleep disparities in American school aged children and adolescents, they reported that more white youth tended to have sufficient sleep as compared to the minorities but they did not have conclusive evidence regarding Asians.²⁶ In spite of this, if the US National Sleep Foundation's recommendations are applied to our children, it is clear that the children in our study are sleep deprived during school/weekdays. These observations are of concern, because it indicates that a sizeable proportion of the students in the present investigation appeared to have short sleep duration. Sleep deprivation in adolescents has been

associated with poor academic performance. In Hong Kong, adolescents with excellent academic performance were found to have earlier bedtimes and longer sleep on week days and less severe daytime sleepiness than those with poor grades.²⁷ In the present study, only a small percentage of the students from the two schools reported experiencing daytime sleepiness, but the percentage who usually experienced this was much higher in the IS than in the government - aided school. Also, about half of the IS students said they usually have daytime sleepiness compared to about one-tenth to one-fifth of the GS students. Among the GS students, the percentage of students reporting 'usually feel sleepy in the daytime' increased with age. Also, a small percentage of students from both schools stated that they woke up with a headache, everyday.

Among Finnish adolescents, sleep problems were found to be strongly associated with weekly headaches and abdominal pain, with more girls than boys reporting these symptoms.²⁸ In terms of child health and growth, sleep induces the release of growth hormone and prolactin during the early night. Also, nocturnal sleep serves to prime the immune system to infectious challenge. Short sleep duration might increase susceptibility to infectious diseases eg viral pathogens.²⁹ Epidemiological evidence shows that when habitual sleep is reduced (<5 hours) or it is prolonged (>9 hours), it is correlated with increased risk of pneumonia.³⁰ Self -reported shorter duration of sleep and sleep fragmentation have been found to be associated with common cold.³¹

In summary, short sleep duration observed in these children could be due to biological processes i.e. evening -type circadian phase and delayed melatonin production as well as social obligations – specifically early school start time. In these children, it is also likely that media use could directly displace sleep, in addition to which there could be disruption of circadian rhythms by light. It is imperative that sleep health of children be addressed as a serious concern. Child sleep and family functioning are inextricably linked and it is important to view sleep from the family context.³² In both types of schools, it is possible that work timings and domestic chores of parents, in addition to their own academic pressures, makes it difficult for the students to sleep early especially because space is a constraint in most homes in Mumbai city. However, media use at night time can also displace sleep. In this context, parental behavior in terms of periodically checking on the child has been found to be associated with longer sleep duration.³² These authors recommended that establishment of a bedtime routine, development of a structured environment like having family meals at regular timings may help to improve sleep for young children and adolescents.

Despite the health impact of short sleep deprivation, and that it is likely to have an impact on public health, this aspect is not considered by schools, officials and policymakers who are the decision makers for children. There is a need to sensitize these groups to consider changes in school timings in the interest of child health.

Acknowledgement:

REFERENCES

- Zielinski MR, McKenna JT, McCarley RW. Functions and Mechanisms of Sleep. *AIMS Neurosci.* 2016;3(1):67-104. doi:10.3934/Neuroscience.2016.1.67
- Paruthi S, Brooks LJ, D'Ambrosio C, Hall WA, Kotagal S, Lloyd RM, Malow BA, Masti K, Nichols S, Quan SF, Rosen CL, Troester MM, Wise MS. (2016) Recommended amount of sleep for pediatric populations: a consensus statement of the American Academy of Sleep Medicine. *J Clin Sleep Med* 12(6):785-786. *Sleep Health* 2015 1(1): 40-43
- Hirshkowitz M, Whiton K, Albert SM, Alessi C, Bruni O, Carlos LD, Hazen N, Herman J, Katz ES, Kheirandish-Gozal L, Neubauer DN, O'Donnell AE, Ohayon M, Peever J, Rawding R, Sachdeva RC, Satters B, Vitiello MV, Ware JC, Hillard PJA. (2015). National Sleep Foundation's sleep time duration recommendations: methodology and results summary. *Sleep Health* 1(1): 40-43.
- Williams JA, Zimmerman FJ, Bell, JF. (2013) Norms and trends of sleep time among US children and adolescents. *JAMA Pediatr* 167(1):55-60.
- Yip T, Cheon YM, Wang Y, Deng WQ, Seligson A. (2020) Sociodemographic and environmental factors associated with childhood sleep duration. *Sleep health.* <https://doi.org/10.1016/j.sleh.2020.05.007>. Accessed on 16/9/2020
- Matriciani L, Blunden S, Rigney G, Williams MT, Olds TS. (2013) Children's Sleep Needs: Is There Sufficient Evidence to Recommend Optimal Sleep for Children? *Sleep* 36(4):527-534.
- Guglielmo D, Gazmararian JA, Chung J, Rogers AE, Hale L. Racial/ethnic sleep disparities in US school-aged children and adolescents: a review of the literature. *Sleep Health.* 2018;4(1):68-80. doi:10.1016/j.sleh.2017.09.005
- Brooks FM, Magnusson J, Klemena F, Chester M. (2015) HSBC England National Report. Health Behaviour in School-aged Children (HSBC): World Health Organization Collaborative Cross National Study. Findings from the 2014 HSBC Study for England. pg 38.
- Luyster FS, Strollo PJ, Zee PC, Walsh JK. (2012) Sleep: A Health Imperative. *Sleep* 35(6):727-734.
- Singh S, Gururaj G. (2014) Health behavior and problems among young people in India: Cause for concern and call for action. *Ind J Med Res* 140(2):185-208.
- Ghugre PS, Pandya A, Shobha G, Pathak M, Gadit S, Udipi SA (2018) Physical activity,

- sleep and anthropometric profile of young adult females from Mumbai city. *Int J Hlth Sci Res* 8(1):194-202.
12. Mathew G, Varghese AD, Benjamin AI. A comparative study assessing sleep duration and associated factors among adolescents studying in different types of schools in an urban area of Kerala, India. *Indian J Community Med* 2019;44, Suppl S1:10-3
 13. Dubey M, Nongkynrih B, Gupta SK, Kalaivani M, Goswami AK, Salve HR. Sleep quality assessment of adolescents residing in an urban resettlement colony, New Delhi, India. *Indian J Community Med* 2019;44:271-6
 14. Bapat, Radhika & Geel, Mitch & Vedder, Paul. (2017). Socio-Economic Status, Time Spending, and Sleep Duration in Indian Children and Adolescents. *Journal of Child and Family Studies*. 26. 10.1007/s10826-016-0557-8.
 15. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res*. 1989 May;28(2):193-213.
 16. Heejung Park a,* , Jessica J. Chiang b , Michael R. Irwin c, d, Julie E. Bower c, d, e, f , Heather McCreath g , Andrew J. Fuligni. Developmental trends in sleep during adolescents' transition to young adulthood. *Sleep Medicine* 60(2019) 202e210
 17. Arora M, Datta K, Singh SP, Sreedhar K, Mallick H. Sleep Loss in School Children : Fact or Myth . *Indian Journal of Physiology and Pharmacology*, 2019; 63(2).
 18. Mathew G, Varghese AD, Benjamin AI. A comparative study assessing sleep duration and associated factors among adolescents studying in different types of schools in an urban area of Kerala, India. *Indian J Community Med* 2019;44, Suppl S1:10-3
 19. Tagaya, Hirokuni & Uchiyama, Makoto & Ohida, Takashi & KAMEI, Yuichi & SHIBUI, Kayo & Ozaki, Akiko & TAN, Xin & Suzuki, Hiroyuki & Aritake, Sayaka & LI, Lan & TAKAHASHI, Kiyohisa. (2004). Sleep habits and factors associated with short sleep duration among Japanese high school students: A community study. *Sleep and Biological Rhythms*. 2. 57 - 64. 10.1111/j.1479-8425.2003.00079.x.
 20. Yang CK, Kim JK, Patel SR, Lee JH. Age-Related Changes in Sleep/Wake Patterns Among Korean Teenagers. *Pediatrics*, 2005, 115 (1) 250-256.
 21. Gradisar M, Gardner G, Dohnt H. Recent worldwide sleep patterns and problems during adolescence: a review and meta-analysis of age, region, and sleep. *Sleep Med*. 2011 Feb;12(2):110-8. doi: 10.1016/j.sleep.2010.11.008. Epub 2011 Jan 22. PMID: 21257344.
 22. Chung KF, Cheung MM. Sleep-wake patterns and sleep disturbance among Hong Kong Chinese adolescents. *Sleep*. 2008 Feb;31(2):185-94. doi: 10.1093/sleep/31.2.185. PMID: 18274265; PMCID: PMC2225574.
 23. Roenneberg T, Allebrandt KV, Merrow M, Vetter C. Social jetlag and obesity. *Curr Biol*. 2012 May 22;22(10):939-43. doi: 10.1016/j.cub.2012.03.038. Epub 2012 May 10. Erratum in: *Curr Biol*. 2013 Apr 22;23(8):737. PMID: 22578422.
 24. Carskadon MA, Acebo C, Jenni OG. Regulation of adolescent sleep: implications for behavior. *Ann N Y Acad Sci*. 2004 Jun;1021:276-91. doi: 10.1196/annals.1308.032. PMID: 15251897.
 25. Fischer D, Lombardi DA, Marucci-Wellman H, Roenneberg T. Chronotypes in the US - Influence of age and sex. *PLoS One*. 2017;12(6):e0178782. Published 2017 Jun 21. doi:10.1371/journal.pone.0178782
 26. Guglielmo D, Gazmararian JA, Chung J, Rogers AE, Hale L. Racial/ethnic sleep disparities in US school-aged children and adolescents: a review of the literature. *Sleep Health*. 2018 Feb;4(1):68-80. doi: 10.1016/j.sleh.2017.09.005. Epub 2017 Oct 15. PMID: 29332684; PMCID: PMC5771439.
 27. Mak, Kwok-Kei & Lee, So-Lun & Ho, Sai-Yin & Lo, Wing-Sze & Lam, Tai-Hing. (2012). Sleep and Academic Performance in Hong Kong Adolescents. *The Journal of school health*. 82. 522-527. 10.1111/j.1746-1561.2012.00732.x.
 28. Medic G, Wille M, Hemels ME. Short- and long-term health consequences of sleep disruption. *Nat Sci Sleep*. 2017;9:151-161. Published 2017 May 19. doi:10.2147/NSS.S134864
 29. A. N. Vgontzas, MD and A. Kales, MD. Sleep and Its Disorders Annual Review of Medicine 1999 50:1, 387-400
 30. Besedovsky L, Lange T, Haack M. The Sleep-Immune Crosstalk in Health and Disease. *Physiol Rev*. 2019;99(3):1325-1380. doi:10.1152/physrev.00010.2018
 31. Aric A. Prather, PhD, Denise Janicki-Deverts, PhD, Martica H. Hall, PhD, Sheldon Cohen, PhD, Behaviorally Assessed Sleep and Susceptibility to the Common Cold, *Sleep*, Volume 38, Issue 9, September 2015, Pages 1353–1359
 32. Pyper, E., Harrington, D. & Manson, H. Do parents' support behaviours predict whether or not their children get sufficient sleep? A cross-sectional study. *BMC Public Health* 17, 432 (2017)